Complete Gardening in India

BY

K. S. GOPALASWAMIENGAR, B.A., B.L., F.R.H.S.

Author of "Cultivation of Bulbous Plants in India"

and "Gardening Notes" in the Hindu

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FOREWORD

It is a rare occasion that one comes across an exhaustive book on Horticulture written by an amateur and I gladly write this short note to introduce the author to readers of the book.

Mr. Gopalasamy Iyengar, by taking full advantage of the facilities for study and practical demonstration afforded by the various sections in the Lalbagh, has become a successful raiser and grower of plants, and he has further enlarged his experience by his active connection with the work of the Mysore Horticultural Society.

There are a number of technical books on Horticulture but not always suited to problems confronting the Amateur Gardeners, and this book, written by an amateur for the amateurs, should help to clear most of those practical difficulties. In India, with the exception of the Government Institutions, there are few gardens under technical management; the garden-owner has to depend largely on his malls. The effective lay-out and up-keep of the garden, therefore, depends almost entirely on the interest, personal supervision and knowledge the owner can devote to it. The book will be of great assistance to him.

The various operations are described in popular language; hints on seasonal work and plant sanitation are exhaustive and the descriptive lists of plants should make it easy for the amateur gardeners to select suitable plants to grow.

The book will also be very useful to students of Horticultural Schools and Vocational Classes, School Gardens &c., and I wish it every success.

G. H. KRUMBIEGEL,
F. R. H. S.,
Director of Horticulture in Mysore (Retd.).
PREFACE

For over six years, I have been contributing Notes on Gardening to the Hindu, Madras, and it has been suggested to me both by its Editor and numerous readers that a publication of the Notes with incidental alterations, etc., in book form with illustrations, would meet the much felt need of a large number of amateur gardeners. Nearly 25 years ago, my interest in gardening was first awakened by a clever and enthusiastic mali and my ardour for the hobby has all along been on the increase and in spite of my professional and other engagements, I have been able to devote a good part of my leisure to gardening. As an amateur, myself, I have experienced several doubts and difficulties in practical gardening, which I have had to solve myself, or get my gardening friends to solve for me, as there are very few exhaustive books on practical gardening applicable to the conditions in India. As an active member of the Mysore Horticultural Society and as an exhibitor of plants and flowers in the several Shows held under its auspices, I have had the acquaintance of a number of gardening experts, with whom I have discussed and exchanged ideas. As a resident of Bangalore which can claim to possess one of the best Public Botanic Gardens in India, my opportunities for close observation and study of plants have been almost unlimited. I have had also the advantage of the use of the library in the Lalbagh as also of the numerous excellent colour drawings, plates, and photographs there to which I have had free access. I have tried to embody in this book, all the results of my study, observation, and personal experience as a practical horticulturist for over twenty years, and I am placing it before the public, in the language of an amateur, though I have had to use here and there technical words and phrases and quotations from several authors, whom I have consulted, for better and more precise expression of ideas. A bibliography of books consulted is appended.
The book is divided into two parts, the First Part dealing with the principles adopted in laying out gardens, the components of a modern garden and how they are formed, and several garden operations, such as the preparation of the soil and its enrichment with manures, propagation of plants, remedial and preventive measures to keep them free from pests and diseases—in fact, all the common tasks in the garden. The Second Part contains descriptive lists of select plants that are commonly grown in our gardens or are worth growing. Fuller lists are not given as the amateur may find it difficult to make a selection from very long lists. The more attractive species and varieties have been marked with asterisks. Comprehensive instructions are given in the introductory notes to the several lists in the Second Part and special points with reference to particular plants are emphasized under their respective names. The names in each list are arranged in the alphabetical order to facilitate reference. The Natural Order to which a plant belongs is given against its name and the species are arranged under the respective genera, to help the reader to have an idea of the common characteristics of the plants belonging to the same order, genus, or species.

The cultural directions given for the enumerated plants are those that are followed in Bangalore, about 3,000 feet above the sea level. They are, however generally suited to all places in India with such variations as may be necessary for the varying altitudes, distances from the sea, amount of rainfall, climatic conditions, etc. The terms low, medium, and high elevations are used in the book with reference to places situated from the sea level to about 2,000 feet, from about 2,000 to 4,000 feet, and from about 4,000 to 7,000 feet above the sea, respectively.

Two chapters, one on The Kitchen Garden and the other on Select Fruit Trees have been added to make the volume a complete treatise on Home Gardening, as it is intended to be.

I am deeply indebted to the Editor and the Proprietors of the Hindu for the help rendered by them, but for which the publication of this book now would have been impossible. I am grateful to Mr. G. H. Krumbiegel, F.R.H.S., Director of Horticulture and Consulting Architect to the Government of
His Highness the Maharajah of Mysore (now retired) for the encouragement he has been giving and the kindly interest he has been taking in all my efforts in writing and publishing this book. From Mr. Thomas Royer, the very capable Propagator in the Government Botanical Gardens, Lalbagh, Bangalore, I have received invaluable assistance and useful information in the preparation of this book. Mr. M. K. Sitharam Chetty, L.Ag., Officiating Superintendent of the Government Botanic Gardens in Mysore, as also Mr. L. Narayana Rao, M.Sc., Assistant Professor of Botany in the Central College, Bangalore, have given me valuable help and my thanks are due to all of them. I must also thank Mr. H. C. Javaraya, L.Ag., F.R.H.S., till lately the Superintendent of the Government Botanic Gardens in Mysore and now Senior Marketing Officer in the Government of India for permitting me the use of the photos in Lalbagh for making some half-tones for this book and Mr. T. S. Dandapani Iyer, B.A., B.L., Art Editor, Hindu Office, Madras, for his help in the preparation of all the blocks for illustrations.

I should be failing in my duty if I fail to express my sincere thanks to my friend, Mr. A. Nagaraja Rao, B.A. B.L., for assisting me in correcting the proofs and to the Printers, Messrs. The Huxley Press, Madras, who have shown the utmost patience and courtesy in incorporating the several alterations and corrections through the several stages of proofs.

Bangalore

K. S. Gopalswamiengar.
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Ghatki, 12th May 1934.

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PART I
GARDEN AND GARDEN OPERATIONS
CHAPTER I

GARDENING

Few avocations afford so much pleasure as gardening, whether taken as a hobby or as a business. "Gardening" is, as Lord Bacon tells us, "the purest of human pleasures, the greatest refreshment to the spirit of man." Dean Hove, a great cleric, scholar and enthusiast in horticulture, in his A Book About the garden, asks himself the question, which, of all the amusements and recreations of life, brings the longest and the largest happiness. He discusses the relative merits of several of them as shooting, hunting, fishing, boating, racing, cricket, billiards, tennis, and concludes "All English sports and games I have loved and love and they satisfied not my present need." And, of gardening, he says, it gives "something more continuous than these—something which may occupy the thoughts and employ the actions of my leisure, not in summer only, as in cricket, not in winter only, as the chase, but alike in every season of the year; and more than this, through all the different phases of my life—youth, manhood, and old age." He continues thus:—"Every day brings to a gardener its special interests. There is always something worthy of his care and admiration, some new development of beauty, some fresh design to execute, some lesson to learn, some genial work to do........ And not only is the gardener's happiness in its duration sure, but it is in its peculiar essence, of a very sweet and gracious quality. It ministers health to the body. It ministers health to the mind. It brings pure air to the lungs and pure reverent thoughts to the heart. It makes us love our home, content and satisfied with those pleasures which neither sting nor pall; and yet when we leave our home, it follows us wheresoever we go. As

'All places which the eye of Heaven visits
Are to a wise man ports and havens,'
so in all gardens, and in all gardeners, we find a home and brothers. There is always a welcome, always a sympathy ...."

Gardening happens to be one of those luxuries that is not restricted to the upper classes. The wealthy may spend fortunes on conservatories, extensive lawns and costly adornments and rare specimens, while the poor may have about their houses only a few plants. But still, the enjoyment that each derives may be the same. The garden makes the home dear to each of them, and helps them to be content by satisfaction ever new.

Some persons maintain a garden, just because they think it is a fashion to do so, and leave everything to the mali, taking no personal interest themselves. There are others however, who maintain a garden, because of their true love of plants and of the beautiful; they tend, water, train the plants, protect them from inclemencies of weather and carefully watch them grow. It is the latter class of persons who enjoy the happiness of a garden and not those who keep a garden just because their neighbours also maintain gardens.

As things are at present, many a house-owner does not have a garden and if he has one, he often does not know when and how to sow a seed or how to plant a tree, and he is entirely at the mercy of the mali. This is to a great extent due to the fact that no earnest endeavour is made in our schools to encourage in children artistic taste and love of nature. Horticultural instruction in our schools would largely add to the comforts of society as a whole, because children of to-day will some day have gardens of their own.

Horticultural societies should be formed with branches working in each town and village. They would promote and stimulate gardening interest and afford opportunities for appreciating the beauty of things pleasant to the eye and the utility of things good for food, by arranging shows and garden competitions. Tangible results could be obtained by issuing bulletins written in simple language explaining and expounding the science of gardening in an easily understandable manner to laymen and women. In collaboration with educational authorities, the societies might arrange for lantern lectures on various subjects and hold demonstrations for the benefit of the younger
generation and thus try to kindle that spark of love for the beautiful which is latent in every child. In places which are fortunate in possessing public gardens, children might be taken round, every now and then, so that they may watch and observe Nature's beauties. If only gardens are laid out in the premises of our educational institutions and the young men and women are taught and allowed to work in them and reap their own harvests, we will have, in the course of a single generation, 'very few idlers who won't have gardens and very few ignorant men and women who won't know, how to use them?'
UNIT OF LIFE, THE CELL

Plants, like all living organisms, are made up of units called cells. These cells are very minute in size and are, as in the body of animals, in plants grouped into tissues. A typical plant cell essentially consists of a cell wall, a mass of protoplasm and nucleus. The cell sap contains among other things, certain salts, starch, sugar and certain other organic products, made by the protoplasm or that go to make it. Protoplasm is generally viscid and granular, and in it, is found embedded the nucleus, of a darker body, usually somewhere about the centre. In the cells of leaves and other tender parts of plants are found green granular bodies, which are called chloroplasts, which give the green colour to them.

Cells reproduce themselves and form new cells. The nucleus plays the greatest part in the reproductive process of cells. A detailed study of this belongs to the province of cytology. It is enough to mention here that the cell has all the complements of life, and that it functions as a living being. Certain low organisms are still a puzzle to scientists, offering difficulty in fixing them either as plants or animals.

TISSUES

The simplest plants consist of only one cell. Algae, fungi, lichens and mosses—all examples of low forms of vegetable life—are plants of a simple type. In the more developed and complex higher forms of plant life, cells are found varying in size, form and structure and united together forming tissues of various types, each of which has its definite function to perform in the economy of the whole organism. The common types of tissues are:— (1) The epidermal tissue, which
forms an external covering for all plant parts and occurs in various modifications. (2) Vascular tissue which is the conducting tissue and which consists of (a) the wood tissue which conducts the water and also supports the plant and (b) the phloem or what is called xylem which conducts the manufactured food material. (3) Parenchymatous tissue which occurs in varying forms and which forms the ground material, as it were, of the plant and (4) Sclerenchymatous tissue which gives the requisite strength to the plant. These tissues are arranged in a variety of ways varying with the plants and their parts. Roots, stems and leaves have each a characteristic arrangement of these tissues.

Parts of an ordinary plant.—The ordinary plant with which we are all familiar consists of four parts, viz., roots, stems, leaves and flowers. The first three constitute the vegetative parts, and the flowers with the seeds constitute the reproductive part. Modifications of these different parts give rise to that diversity of plant life which so delight the horticulturist. Each of these parts has its own specific function to perform in the general scheme of plant life.

Root and its functions.—Roots penetrate the soil and they are usually, though not always, under the ground. The main or primary root of a plant is really a development of the radicle which first emerges from the embryo of the seed. It divides itself as the plant grows and with its branches it serves to fix the plant in the soil. From the walls of the cells of the roots and their branches, as they grow, emerge fragile, minute,
invisible tubular structures called root-hairs which are the feeding organs of the plant. Into the thin walls of these minute tubes pass from the soil, water containing dissolved food and this is transmitted to the stem and leaves through the bigger channels in the roots and its branches. This explains the need for keeping the soil moist by supplying it with water and for the careful handling of seedlings during transplanting lest their root-hairs be injured. As the root and its branches push through the soil, root-hairs die on their older portions and are replaced by new ones on their newer parts. Thus, new areas are being explored for food. It is thus clear that the area which furnishes food and water for the plant is not exactly right under the stem but is away from it. This explains why big trees and shrubs are watered over an area away from the stem, as they can then only be benefitted by the water supplied. In bulbous plants, the stem is underground and it is easily mistaken for the root or roots. Roots are usually brownish in colour although in some cases as in Orchids, they are green.

There are several variations in the structure of the root. In some plants, adventitious roots are produced without any definite order from leaves, stem and roots and these are useful in different ways. They are aerial, as in Orchids and Aroids, and are useful for taking in moisture directly from the atmosphere; they are clinging, as in the Ivy, and serve to fasten the plants to supports; they are parasitic and penetrate the host plants robbing them of their food, as in Loranthes and fungi; they are modified into thickened portions under or above the

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**Fig. 4**

A. Fibrous root system in grass.
B. Root-system of a tree or shrub.
TR=Taproot.
LR=Lateral or secondary root.
soil as in the Dahlia, serving as a store house of reserve material for production of flowers and seeds the next season or year.

Stem and its functions.—The stem is an essential part of the plant, which originates from the plumule, the other side of the seed germ. It grows outward from the ground and bears the branches and the leaves holding the latter up to light. The stem and its ramifications, the branches, connect the leaves, the flowers and the fruits with the roots. The stem varies in form and size considerably. Usually, it is green and soft in tender plants and tender parts of plants; it grows woody, brown, and sturdy in matured parts where it develops a bark. Sometimes, as in the Cactus, the stem is green and fleshy and has the appearance of a leaf, performing functions similar to those of the leaf.

In some other plants, the stem is underground, as in bulbous plants like the Lily, Arum, and the Onion and it then acts as a receptacle of reserve material and sends up aerial shoots bearing leaves and flowers. But all the morphological variations of the stem need not be noticed here as they belong entirely to the province of botany and do not come within the scope of this book. It may, in passing, however be mentioned, that it has an infinite variety of form ranging from the sturdy Ficus to a slender Grass and from the tuberous Potato to the leaflike Cactus.

Structure of stem.—The ground tissue of the stem is variously modified according to the circumstances. Usually, the stem of a dicotyledonous tree consists of four general regions as will be seen by an examination of its cross-section:— (1) In the centre is the soft ground tissue called the pith which is of small size. (2) Around the pith is the wood formed of strands of vascular tissue which gives rigidity to the plant and which is arranged in groups or bundles appearing in the form of rings in grown-up stems, each ring corresponding to one year’s growth. (3) Surrounding the wood is a zone of delicate tissue of thin walled cells, usually colourless, called the bast or the phloem. (4) The outermost layer, the bark, is a composite structure, the thick epidermis (outer skin) of which protects all the inner parts. The cambium, which is situated between the wood and the phloem rings is the most active or live portion of the stem, where growth takes place every year. It produces two sets of
cells one thickening the interior wood portion and the other set thickening the exterior phloem of the stem as well. As a

result of this, the stem grows in thickness which naturally leads to the rupture of the epidermis. In order to protect the plant under these conditions from the ravaging effects of other micro-organisms, cork is produced just below the surfaces of the epidermis by an active tissue called the cork cambium, not unlike the cambium referred to above. In budding and grafting operations, the cambiums of the stock and the scion (not the cork cambiums) are brought in contact with each other, so that the stock and the scion may unite, the cambium being the only active portion bringing about unification. In the stem of monocotyledonous plants, such as grasses and palms, there is no pith, there is no cambium, and the vascular bundles are not arranged in the form of a hollow cylinder but they are distributed in the growing tissue. As there is no cambium, there is no growth in the stem after the cells, fibres, and vessels of which it is composed, have once reached their full size.
Leaf and its functions.—The leaves are usually flat and have a unilateral symmetry and their modifications are endless. They may be very simple in shape or very elaborate and ornately cut. Usually, the blade, which is the essential part of the leaf, is attached to the stem by a leaf-stalk, which is called the petiole. The leaves are normally green in colour owing to the presence of green plastid, known as the chloroplast. In the case of highly coloured leaves, such as those of Crotons, Coleus, etc., other colouring matters present in their cells mask the colour of the chlorophyl. Morphologically, there are various modifications of leaves according to the functions they perform in different plants. In the Cactus for instance, the leaves are modified into thorns which protect them from being eaten by animals, while the stem is green and fleshy and itself performs the normal work of leaves. In carnivorous plants, such as the Drosera and Nephenthes, the leaves serve as traps for insects upon which the plants feed.

Structure of leaf.—The leaf is covered by a thin epidermis made up of a layer of cells. Situated on the epidermis, more especially on the underside of the leaf, are the stomata, acting
as the air passages to the interior of the leaf, putting the internal cells of the leaf into communication with the air outside. Between the upper and the lower layers of epidermal cells of the leaf is a mass of green tissue known as the _mesophyl_, which has the chloroplasts in it and makes up the body of the leaf. The lower layers of the mesophyl are spongy and the cells therein are irregular in form and loosely arranged to form air spaces between them. These spaces communicate with each other forming a labyrinthine system of air chambers throughout the spongy mesophyl. It is into this system of air chambers that the stomata open. The function of the stomata is to allow moisture to escape from the leaf in the process of transpiration and to allow air in, and carbon-dioxide out, during respiration. The veins and veinlets of the leaf are embedded in the mesophyl and they form the supporting framework of the leaf and conduct material to and from the green working cells.

**Flower and its parts.**—The flower, from the horticulturist’s point of view, is the most attractive part in most plants. It is produced in the axil of a leaf or terminally at the end of a shoot. Botanically essential parts of the flower are the reproductive cells. The ornamental parts of the flower such as the petals, are intended solely for the protection and assistance of the generative cells. There are several modifications in the construction of the flower in different plants. An ordinary complete flower consists of four sets of leaves or organs, called the _calyx_, the _corolla_, the _stamens_ and the _pistil_, respectively arranged in whorls one inside the other. The outermost leaves of a flower forming the calyx are usually of a strong structure and of a green or brown colour. In some flowers however, the calyx is as highly coloured and showy as the petals. The calyx may be composed of separate leaves, called _sepals_ or be united into a tube. The next circle of floral leaves forms the _corolla_. It serves to attract
insects that help fertilization and to protect the inner essential organs, viz., the stamens and the pistil which contain the reproductive male and female cells respectively. The corolla may consist of separate leaves, called petals, or be united. There are endless modifications of the calyx and corolla, bearing an intimate relation to the method of fertilization. The number of stamens vary from one to many in a flower. A stamen is usually made up of a stalk, which is called the filament, and a little lump at its top, which is called the anther. The anther consists of powdery looking pollen grains carrying the male element that fertilizes the egg cell in the pistil, which occupies the centre of the flower. The pistil consists of a lower inflated portion called the ovary, a long stalk continuous with the latter known as the style and a knob on its apex known as the stigma. When the ovary is cut across, it is found to be divided into compartments filled with ovules or unfertilized seeds, containing female cells. Each ovule consists of a nucleus and is surrounded by one or two coats and the placenta which connects it to the wall of the ovary.

**Fertilization.**—The process by which the pollen is carried by an insect, wind, or any other agency from the stamen and deposited on the stigma is known as pollination. Self-pollination takes place when the pollen of a flower finds entrance to the stigma of the same flower. Cross-pollination takes place when the pollen of one flower finds entrance to the stigma of another flower. The pollen coming into contact with the stigma feeds on the sugary substance on its surface and sends down a long tube through the style entering the cavity of the ovary. Through this tube the male germ is brought into contact with one or two ovules. One of two nuclei of the male germ unites with one of the egg cells and the result-
ing product of this fertilization is a mass of protoplasm which contains the characteristics of both the parents and develops into the primary part of the new plant or embryo. The other male nucleus unites with the sister cell to the egg and gives rise to the greater part of the store or the reserve material of the seed. It is this reserve material in the seed which keeps the seedling alive, feeding it until it fixes its roots in the soil and is able to take its own food therefrom. The seed is the final stage of one generation of plant and is the initial stage of the next generation, composed as it is of the fundamental vegetative organs, a root, a stem and the first leaves in miniature.

**Cross-fertilization; Hybridization.**—When the pollen is taken from the flower of a particular variety of one species and placed on the stigma of another flower of a different variety belonging to the same species, plants raised from seeds so obtained, are the result of cross-fertilization; they inherit the characteristics of both the parent plants and they are, generally more vigorous than plants which are the result of self-pollination. A hybrid is produced by pollinating the flower of one species with the pollen from a flower of a different species. The processes by which new varieties and species are thus created are termed cross-fertilization and hybridization.

**Seed and its parts.**—The seed, as seen above, is the result of the changes taking place in an ovule after fertilization. The seed may have only one or two coats. The body of the seed within the seed-coat consists of an embryo, which is the young plant contained in the seed, and a substance called the albumin or endosperm. The embryo is embedded in the albumin. There are seeds however which have no albumin or endosperm. On examination of embryos of seeds which have begun to sprout, it is observed that a seed consists of (a) one or two cotyledons, the first seed-leaf or leaves of the embryo, (b) the radicle, which is the lower or the root-end of the embryo and (c) the plumule, which is the first bud, the upper end of the embryo. Monocotyledonous embryo has only one cotyledon; dicotyledonous embryo has two cotyledons.

**Germination of seed.**—The awakening of the organs of life and the beginning of growth in the seed is called germination.
Seeds germinate when placed under suitable conditions, the essentials for germination being air, a certain degree of moisture and warmth or suitable temperature. If sufficiently warm—the amount of the warmth required varies with the seeds of different kinds of plants—moisture is absorbed by the seed, which causes it to swell up and burst the seed-coats. Oxygen is also absorbed from the air. Certain chemical changes accompanied by liberation of carbon-di-oxide take place in the embryo, which result in the solid substances which the seeds contain in the cotyledon and the endosperm being made available for the use of the growing plant. The radicle is always the first to come out, curving down towards the earth, whatever may be its position; it forms by its direct prolongation the primary root of the plant. The plumule shortly afterward disengages itself, ascends and develops into the stem, bearing foliage and flowers. (Refer to Fig. 2 on page 5.) It is thus seen, that the food stored up in the seed, supplies not only the necessary energy to the embryo to wake up and start life as a tiny plant but it also sustains this little plant till it develops and is able, by itself, to get its food from the soil and to assimilate carbon from the carbonic acid gas in the air.

Plant physiology.—Plant physiology is the science which deals with the functions of the parts of plants above described. In dealing with plants, we must realise, that we are dealing with living objects. Plants, like animals, breathe, take food, excrete, move and react, to external stimuli. For their continued existence, they require food, air and water, and if any of these is wanting, plants cease to live. Again, like animals, they try to propagate their species, as is evident from their efforts to flower and produce seed. It has already been observed what the functions of roots, stem and leaves are and how they divide the labour of sustaining the plant and reproducing the species. The slightest injury to any part reacts on the entire plant just as a whitlow or even a scratch on the little finger causes pain. The merciless amputation or the wounding of the branches or the stem or roots, etc., has likewise a bad effect upon the tree as a whole. Hence, it might be interesting and profitable to have some knowledge of plant physiology and
to study several important garden operations in relation to this subject.

Assimilation through roots.—Plants prepare organic food from inorganic elements and ultimately all the food thus formed becomes available to animals. The roots which permeate the soil absorb from it food materials consisting of mineral salts in a state of solution in water by a process called *Osmosis*, by virtue of which liquids of different densities have a tendency to mix; the thinner liquid consisting of water containing the nourishing salts enters the cell at a more rapid rate than the thicker plant-sap which moves downward to form more roots and secrete what is not wanted by the plant. It is to facilitate this intake of raw materials through roots, that plants are regularly manured and watered. Root-hairs absorb dissolved food from the soil and transmit it from cell to cell of the root until it reaches the vascular tissue, along which it passes to the various parts of the plant. The energy required for this is obtained by the oxidation of the tissues of the roots. The oxygen for this purpose is derived from the air present in the interstices of the particles of soil. If the soil is waterlogged, the interstices are all filled with water and the roots die for want of proper aeration.

Efficient digging and hoeing operations are intended to loosen the soil and promote aeration of the roots. Waterlogged soil is drained for the same purpose. As the number or density of root-hairs is in direct proportion to the abundance of, and suitability of the food absorbed by them, the care taken by the gardener to promote fibrous roots, by transplanting processes, to secure their fullest development, and to prevent them from injury, during transplanting, digging and hoeing operations, is fully justified. As roots can take in food only in a soluble form, the immediate stimulating effect of liquid manures is accounted for.

Carbon-assimilation through leaves.—Leaves play the most important role in the physiology of plants. They are the laboratories of the plant. Light, photo-chemically acts on the green colouring matter, the chlorophyll of the leaves and tender parts of the plant, causing it to manufacture the complex substances
known as carbohydrates, such as sugar and starch. The process is rapid and is very complicated. These organic substances are made from the carbon-dioxide of the atmosphere, taken in by the leaves directly through their pores in conjunction with the nutritive salts derived through the roots. This process of food formation has been named "photosynthesis" and it can only go on in sunlight, when carbon-dioxide and water are available, and only through the agency of the chlorophyll. By the work of the leaves, carbon-dioxide is taken out of the air, which is made richer in oxygen by that liberated from leaves after the fixation of the carbon. Consequently, air is purified and made fit for animals to breathe.

Result of overcrowding.—When plants are planted too near each other, after they have made some growth, they cut off some light to each other, only the top shoots getting adequate supply of it. When the sun-light is thus cut off from the lower parts, leaves and the plant, carbon or food assimilation process is very much reduced, which means they cannot manufacture the necessary food for their own growth. Hence they grow, slender and weak. As there is a competition among the plants for getting the maximum sun-light, they all grow tall and thin without making corresponding side growths, exhaust themselves, topple ultimately one above the other, as observed in the case of seedlings damping off when sowing is thick.

Parasitic and saprophytic plants.—Plants, which have no chlorophyll in them, cannot make their own food and necessarily have to get it from other living beings, dead or alive. Plants thriving on dead organic matter are called saprophytes. The common Mushroom is a saprophyte. Plants which derive their food from other living plants by robbing them of a certain amount of their ready-made food are called parasites. The Mildew fungus is an instance of a tiny parasitic plant and the Loranthus of a large parasitic plant usually seen on Mango trees.

Necessity for water.—Water which is obtained by plants through their roots from the soil is very essential for their existence. It passes up the plant continuously to its remotest ends, to the broad surfaces of its leaves from whose pores it is given off or transpired. And a sort of a current, called the transpira-
tion current, is kept up. The water which comes up from the roots serves the useful purpose of bringing to the leaves the minerals which they need for helping to make the living substance and other complex chemical compounds. Water is not only necessary as a medium for conveying food to plants but it is also essential to keep the protoplasm alive.

**Respiration in plants.**—All the living parts of plants carry on respiration just like animals both day and night. Respiration is distinct from and the converse of photosynthesis. It is a triple process consisting of the taking in of oxygen to the living cells, the uniting of this oxygen with some of the foods or else with the living substance itself present in the cells, and the liberation of carbon-dioxide as a waste product. Oxygen supplies the necessary energy to cells to perform their work. Although plants have no lungs as animals have, they nevertheless have a very efficient system for taking in air and for distributing it. A connected network of air spaces ramifies the plant-body, so that every living cell of the plant gets its supply of air.

**Composition of plants.**—Plants, when split up by chemical processes, are found to be composed largely of carbon, which forms the bulk of the plant, hydrogen and oxygen in lesser quantity, and still less of nitrogen, sulphur, phosphorus, potassium, calcium, magnesium, iron, sodium, chlorine and silica. As explained already, plants acquire raw materials either by absorption through the roots or by photosynthesis. It has been seen how plants get carbon from the atmospheric air. They get hydrogen from water and from ammonium salts in the soil. Oxygen, they take up in a free state from the air and also in a state of combination in water and mineral salts. Plants cannot make use of the free atmospheric nitrogen. It must be presented to them in a combined state, as soluble nitrates for example, from the soil. Members of the Bean family (Leguminous plants) obtain some of their nitrogen in a different way. There are found tubercles or nodules on their roots, in which certain bacteria live, which take free nitrogen from the air present in the soil and build up the nitrogen so taken into compounds (nitrates) which are passed on to the plant. How plants obtain
nitrogen has been elaborately dealt with in Chapter III. The other necessary elements are taken by plants from the soil in which they are present as ammonium, potassium, calcium and sodium sulphates, phosphates and chlorides. Iron helps formation of chlorophyll. The elements which are usually used up for growth and have consequently to be added to the soil are nitrogen, potassium and phosphorus. They are supplied in the form of organic manures and commercial fertilizers, which are rich in these elements.

Heliotropism.—Plants respond to external stimuli such as heat and light. Stems and leaves have a tendency to grow towards light, as any window plant will demonstrate by its turning to the source of light. This reaction to light is known as heliotropism. It is on account of this characteristic movement that plants in the fernery and house or window plants have to be turned in their places every now and then to keep them growing symmetrically.

Geotropism is the name given to the reaction of a plant to the force of gravity. Various parts of the plant react to this stimulus in different ways. The cells alter themselves according as the plant is growing in the direction of gravity or against it, or at an angle to it. The roots growing into the earth and the stem vertically upwards are mainly due to the influence of this stimulus.

Optimum temperature and light.—Temperature is also a factor that largely influences the growth of plants. Excessive heat or excessive cold kills all activity in the plant. There is always a certain temperature known as the optimum temperature, which varies with every plant, at which it thrives best. There is similarly an optimum intensity of light for each plant. This explains why some plants require more shade than others.

Influence of climatic conditions.—The size and form of plants are much affected by the conditions under which they are grown, as the protoplasm is sensitive to the various agents acting upon it. It reacts or responds to them by altering its behaviour in some way. Thus, climate is an important factor controlling the growth of plants. Light varies daily as also from season to season, in direction and intensity, in different
parts of the world. There is, further, diurnal and seasonal variation in temperature. Humidity of air fluctuates in different places and at different seasons. Water contents of the soil occasioned by drought and heavy rainfall and the soluble materials in the soil also vary. Differences in these and other factors such as altitude, account for the differences in the growths of the same species or varieties of plants in different localities and also explain why certain plants thrive in some places better than in others. It should, however, be observed, in passing, that a plant is a self-adjusting organism, which tries to adapt itself to its environments. It seldom dies without a struggle.

Life history of plants.—All the changes which a plant undergoes from its birth to death constitute different stages of its life history. Plants of comparatively small size, usually with soft and succulent stems, which die down every year are called herbs. If they die completely root and all, in the first year or season of their origin, they are called annuals. The life history of an annual consists in the germination of the seed, the production of the seedling, its growth to maturity, when it flowers and produces the reproductive elements, which unite to form seeds, which again contain fresh embryos, which preserve the race, though the plant itself dies. If the crown or root-stock of the herb survives the following year, the plant is a biennial but if it survives and produces year after year a fresh plant or plants, it is called a herbaceous perennial. Shrubs are mostly perennial plants with branching woody stems and not attaining to the dignity of trees. Trees are characterised mostly by a distinct primary stem or trunk. There is no cut and dry dividing line between these classes of plants; herbs may pass into shrubs and shrubs into trees by endless gradations.

Classification of plants.—One method of botanical classification of plants is based on the natural resemblances and differences in the structure of their vegetative and reproductive organs. To the practical horticulturist, some knowledge of this classification will be useful, as similar plants often call for similar treatment. The whole plant kingdom can be divided under four heads:—(1) Thallophytes—Algae and Fungi; (2) Bryo-
phytes—Liverworts and Mosses; (3) Pteridophytes—Ferns; and (4) Spermatophytes, including all seed-bearing plants. Spermatophytes are sub-divided into (a) Gymnosperms, in which seeds are exposed as in Cycas, and Pine and (b) Angiosperms, in which seeds are enclosed in a seed capsule. Angiosperms are sub-divided into Monocots and Dicots. The subclasses are divided into still smaller classes or families. Each of the sub-classes into which Monocotyledons and Dicotyledons are divided includes a number of natural orders. Each of these consists of a number of familiar plants which are closely related. But, each natural order is built up of a number of genera, possessing distinct characteristics. In classifying the genera and arranging them into families, attention is only paid to the floral organs. Plants are classified according to the number and position of the parts that make their flowers, cones, or spore-bearing organs. The genus, in its turn, includes several plants, resembling each other in one or more respects. In the genus itself, however, the different species are often distinguished by such characteristics as the hairiness or shape of the leaves or the habit of the stems. The narrowest systematic conception is the species, which includes plants so closely related that they must have descended from a common ancestor. Sometimes, individuals composing a species vary in very minor details as the shading in colour of the flower, etc., when they are called varieties of the same species.

Naming of plants.—Plants are named by a binomial system of nomenclature. Each plant receives two scientific names; the first indicating the genus, the second the species. In other words, every species has a generic name and a specific name in the form of an adjective, either in Latin or Latinised language. The first letter of the generic name is in capital and the specific name begins with a small letter unless it is a proper noun. Thus for instance, Allamonda grandiflora and Allamonda violacea and Allamonda Aubletii (Aublet's) are three species of the genus Allamonda.
CHAPTER III.

SOIL AND SOIL MANAGEMENT

Soil.—Soil is the upper layer of the earth’s crust, upon which plants grow and depend for their nourishment. It must therefore receive the gardener’s first and primary attention. To every plant-grower is essential a knowledge of the science of the soil, as his success largely depends upon the choice he makes of the soil which would be best suited for growing his plants, and upon the manner in which he improves and works it. For, different plants have different soil requirements; as for instance, some thrive in sandy soil; some in heavy soil; and some in soil rich in lime or peat and so on. Again, different kinds of soil need to be treated differently.

Origin of soil.—Soil originates from disintegration and decomposition of rocks due to the action of several natural agencies such as frost, heat, cold, wind, air, rivers and streams, rain, etc. How soils are formed is a study which belongs to the province of geology. It is enough to note here that all soils are composed of mineral products, particles of rocks, and organic remains of plants and animals, accumulating in the earth from time immemorial.

Variations in soil.—Soils of different places vary in texture, chemical composition and colour, as they are derived from different kinds of rocks, which have been broken up into particles of different sizes and have different quantities of humus (organic matter) combined with them. Thus, though all soils are ultimately made up of only mineral products and humus, their properties are determined only by their chemical composition and their physical texture. If the particles of rock are large fairly, we have sand or gravel; if they are fine, we have heavy or clayey soil; if the soil is rich in iron, we have red earth. The methods adopted to improve soils of different places are based upon altering or manipulating their texture.

Types of soil.—It is no easy task to devise an arrangement of soils at once comprehensive and distinct; but, for practical
purposes, soils may be classed under certain leading types as sand, clay, loam, gravel, peat and alluvial soil. It is important to note the characteristics of each of these.

**Clay and improvement of clayey soil.**—Clay is largely composed of almost dustlike particles of rock and the fineness of these particles gives clay its close texture and makes it more tenacious than any other kind of earth. The particles are so small that they are soft and greasy to the touch and are light and float in water making it muddy. Clay is plastic and adhesive while wet, which makes it difficult to work in that condition. In the dry state too, it is extremely difficult to work as it is very hard. Percolation of moisture through clay is well nigh impossible and the nitrifying bacteria are least active in it for want of air. Roots of plants cannot spread through heavy (clayey) soil easily, and in times of drought, it contracts giving rise to fissures through which much of the soil moisture is lost and the roots are thereby injured and ill-fed. Clay has a great degree of water-holding capacity, almost to the point of decided disadvantage. Hence all clayey soils should be drained to remove excess of water stagnating in them. Clayey soil, though it is the worst kind of soil that the plant-grower may come across, may be gradually improved and brought into workable condition by efficient draining, deep trenching, and incorporating into it plenty of organic manure, preferably horse manure, leaf mould and lime. Lime has a wonderful effect upon clayey soils. It separates the particles of soil which stick together making it porous and it also promotes nitrification. Clay is at once improved by a suitable admixture of sand. But this method of improving clayey soil may be prohibitively costly.

**Sand and improvement of sandy soil.**—In sand, the rock particles are much larger than in clay and they can be individually seen and felt. Sand has consequently a loose texture and possesses properties the reverse of clay. It is easily saturated with moisture and readily allows water to pass through. Water that passes through sand, carries away its nutrient elements along with it rendering it poor and “hungry”. Sandy soils therefore require to be frequently supplied with a heavy manure like cow-dung which is lasting in action. Their chief demerit is that they give up readily their food and
water contents. This is rectified by improving their texture, by
making them more close by digging in heavy loam or clay, or
by digging in plenty of organic manure, such as leaf-mould and
dung and by treating them with lime or chalk occasionally.
Lime has a cementing action upon particles of sand.

*Loam, horticulturist's ideal soil.*—Loam contains clay and
sand in approximately equal proportions. It contains a large
quantity of humus also—much more than what is contained in
sand or clay. It is the ideal gardening soil. It combines the
merits of sand and clay, as it has a texture which is neither too
course nor too fine. It has a fair degree of water-retaining
capacity, is sufficiently porous and is aerated properly. It is
also rich in all the elements necessary for plant life. To im-
prove loam, only cultivation and addition of manure when the
food contents in it are exhausted are necessary.

*Gravelly soil.*—Gravelly soil contains larger particles of
rock than sand. It is improved by addition of clay and by dig-
ging in plenty of cow manure and by plentiful irrigation. Lime
also should be added if the soil lacks it.

*Alluvial soil.*—Alluvial soils are formed by accumulation of
sand, earth and loose stones brought down by rivers and
streams. They are rich in humus too. Crops after crops may
be raised in such soils for some time with only a little cultiva-
tion and addition of manure.

*Peaty soil.*—One does not ordinarily come across peaty
soil. Peat consists mainly of decayed vegetable matter in a
state of greater or less decomposition, accumulated in the course
of centuries on the margins of lakes and in marshy land. Peat
is used in composts for growing Orchids and such plants of the
fernery as Dieffenbachia, Anthurium, etc.

*Value of humus in soil.*—Humus or organic matter in the
soil is useful in more ways than one. The addition to the soil
of the right quantity of humus in the shape of animal refuse or
leaf mould improves its texture enabling it to absorb and retain
moisture. Humus lightens heavy soils by making them porous
and consolidates loose sandy soils. It raises the temperature of
cold soils and maintains it in an equable condition. Soil bacteria
which convert organic matter into nutritive salts are fed and
activated by humus. If however, it is not in a thoroughly de-
composed state, it has a tendency to make the soil sour by an excess of humus acid, which is detrimental to the growth of useful bacteria and hence to the growth of plants.

Improvement of soil.—All that is necessary in tackling the soil in many gardens is a slight manipulation of its texture by cultivation and addition of required ingredients as lime and manure. The gardener has indeed a difficult task ahead when he is confronted with light sandy soil or very heavy clay. In gardens of small size, the difficulty is overcome by making pits or excavating trenches to the required depth and filling them up with suitable mixtures.

Functions of soil.—Soil fulfils three essential purposes. First, it fixes plants in position by affording anchorage to their roots. Many a giant tree is prevented from toppling over during high winds on account of the firm hold the roots have in the soil. Secondly, soil supplies the moisture necessary to the roots of plants. Thirdly, it supplies to the plants through the roots, all the elements, with the exception of carbon, which are necessary for their life and continued growth.

Advantages of cultivation.—To enable soil to function properly, the land should be well cultivated. Cultivation consists in loosening the soil and pulverising the clumps of earth. Cultivation is effected by ploughing, digging, trenching and ridging the ground. The object of cultivation is to help the roots to penetrate the soil in search of moisture and nourishment. They spread with greater ease in loose than in compact soil. By cultivation, the soil is aerated suitably to the needs of the growing plant. Soil is better able to absorb moisture or rain water and to retain it, if worked well. Not only is any excess of soil moisture removed by working the soil deep, but it is also made warmer and more conducive to increased activity of beneficial soil microbes.

The depth to which soil needs cultivation depends upon its nature and that of the sub-soil (the soil below the surface layer, 6 to 12 inches below the surface is called sub-soil) and on the nature of the plant intended to be grown. Deep rooting plants require deeper cultivation than shallow rooted kinds. In clayey soil, deep cultivation is necessary. Such soil should be trench-ed deep.
There are three well recognised methods of working the soil. They are, ploughing, digging and trenching. Ploughing is the usual method of preparing land in agricultural operations, only the surface soil to a depth of about six inches being stirred in the operation.

Simple digging.—Digging is done with the fork, or the spade, or the 'kudali', the favourite instrument of the malis. The fork is useful for digging heavy soil. With the spade, it is easier than the fork to transfer the earth from one position to another. These instruments properly handled are more efficient than the Indian instrument, the kudali.

Simple digging consists in driving the instrument to the full length of its blade, about eight inches, into the soil, thus loosening it, and then turning it over. Digging is commenced by opening a small pit, say a foot wide and a spit (the length of the blade of the instrument) deep and transferring the earth so moved to the finishing end of the ground. Another trench is made in front of this opening and the soil is turned over to fill the first opening, at the same time removing weeds and grass roots and breaking large clods of earth. This process is carried on till at the finishing end, the last hole made is filled with the soil moved from the first opening. It would be wrong to begin digging without first opening a trench, as it would result in the soil becoming higher at one end than at the other.

Manuring during digging is best done by spreading a layer of it on the land, so that a portion of it goes to the bottom of the trench with each turning over.

Double digging.—Double digging or bastard trenching as the same operation is called by some, consists in working the soil two spits deep, that is, to a depth of about sixteen inches. The operation is commenced by opening out a trench about a foot wide and a spit deep and carrying the earth so disturbed to the finishing end of the plot. This trench is again worked a spit deep and the soil left in position. The top spit of the next trench is turned over to fill the first trench and the bottom layer of the second trench is worked a spit deep and the soil left in situ as before. The operation is thus carried forwards till the entire plot is dug.
Method of digging.—It is always best to proceed on a system in digging a plot of ground. For convenience, the ground is marked into strips ACEF, say 4 feet wide, as shown in the figure. By dividing each strip into sections by a line DB drawn along the middle, much labour and shifting of soil is saved. Proceeding from AB, a trench is made a spade deep and the soil is removed to the end of the adjacent section BF. The bottom layer of this trench is worked and left in its position. Some garden refuse or manure may be put over the soil thus worked, to improve the lower layer of soil. Another trench is then made before it and its top spit of soil is turned over to fill the first trench; the bottom layer of the second trench is then worked and left in position; and so on, the operation is carried forward, in the direction of the arrow mark in the figure. The earth removed from the first trench is used to fill the last trench made. Double digging fulfils all the ordinary requirements in flower gardening.

Trenching.—Trenching is deeper cultivation than double digging and is much more expensive. During trenching, the ground is marked out into strips, 2—3 feet wide as in digging. The soil in the strip is removed to a depth of 2—3 feet and carried to the finishing end of the plot. Into the first trench so made, a layer of garden refuse or coarse manure is placed to enrich the sub-soil. The soil from the next strip is turned over to this trench, layer by layer, until it is filled, the lower layer of soil now being on top of the first trench and a fresh trench is formed alongside. Whenever plenty of manure and refuse are available, it would be advisable to introduce it between the layers of soil, as they are turned over, using the good manure for placing on the top just beneath the surface of the soil. In this kind of trenching, the several layers of soil get mixed up. Unless the soil is uniformly good to a depth of at least three feet, there is always the danger of bringing to the surface inferior and comparatively unproductive sub-soil. "Dig deep to find the gold," is without doubt a golden maxim but it is
limited in its application to soils which are uniformly good to a good depth.

Plan for trenching.—The following plan carried on in much the same way as in double digging would involve less risk of top soil getting mixed up with sub-soil in trenching operations. As shown in the figure, the entire length of the plot to be trenched is marked out into strips I, II, III, IV, V, etc., about a foot wide and 2—3 feet long as may be necessary. The top spit of soil (No. 1) from strip I is moved to the other end of the plot of land to be trenched and placed in a long row equal to the width of the land to be trenched, leaving similar space above for placing the second spit (No. 2) from strip No. I. Then, the second spit (No. 2) is removed and placed accordingly. The bottom layer of soil in strip I (No. 3) is dug up again a spit deep and is left in its place. Thus, in trench or strip No. I, the soil is worked three spits deep. Again, the top spit of soil from strip No. II (No. 4) is removed and placed below the 2nd spit from strip I. The second spit from strip II (No. 5) is turned over to trench I to occupy the place of its second spit (No. 2) and the bottom of the second trench so made is worked a spit deep. Then, the top spit of soil from the strip III is turned on to fill the trench in the first trench, and the second spit of soil in strip III goes and fills the space of the second spit (No. 5) of strip II. This process is continued till the three heaps of soil occupy their respective positions in the last three strips. If the soil calls for trenching deeper than
two feet, it is worked in the same manner treating it as if it were made of more than three spits.

**Conservation of soil moisture.**—The soil should contain sufficient quantity of moisture to be made available for plants. Moisture is lost from the soil by natural evaporation taking place from its surface and by transpiration from leaves of plants and weeds growing in it. The gardener's aim should be to conserve the moisture in the soil by making it absorb as much rain water as possible and helping it retain moisture. This is effected by good cultivation and weeding.

Much of the rain water that falls on hard ground flows away and only a small quantity soaks through it. **If the ground is loose and well cultivated, it would absorb a large quantity of water.** A portion of this absorbed water is held fast by the soil particles round them as a film of vapour due to surface tension and the rest freely passes down ultimately reaching the water table, where the water stands underground.

Apart from the downward movement of water mentioned above, there is an upward movement of water in the soil from the water table to the soil surface due to capillary force. One can easily imagine millions of fine capillary tubes originating from the level of underground water, rising through the inter-spaces of soil particles to the surface of the soil and conveying water to it, just in the same way that oil rises through the wick of a lamp or water through the bore of a capillary tube. As rapidly as water reaches the surface of the soil, it is lost by natural evaporation, thus giving rise to a continuous current of water rising through the soil. The loss by capillary force is greater in the case of compact than in loose soils. Cultivation of soil, it is thus clear, reduces the loss of water by natural evaporation from the surface of the soil.

**Mulching and hoeing operations.**—There are two familiar garden operations, known as mulching and hoeing, which serve to conserve soil moisture by minimising its loss by evaporation from the surface of the soil and loss through weeds. Mulching consists in spreading a layer of partially decomposed manure, leaves, straw or any other material as coconaut fibre over the surface of the ground. This is done to greatest advantage in times of drought. The material so spread not only minimises
loss of water by natural evaporation but also protects the surface roots of plants from the scorching heat of the sun. Further, when rain falls, the food elements of the mulch are washed into the soil, increasing its fertility. Hoeing consists in stirring or loosening the surface layer of the soil to a depth of one to three inches with a hoe or scarifier. The loosened earth acts as a "dust mulch". In addition to providing the soil with a mulch, hoeing promotes aeration of soil, destroys the hiding places of ground vermin and exposes them to be preyed upon by birds, and discourages growth of weeds.

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Dangers of water logging in the soil.—Air, that is intermixed with soil, from its surface to the level of ground water, is continually being discharged into the atmosphere owing to its displacement by rainfall. In porous soil, the rain water rapidly finds its way down to the sub-soil water level as the obstruction to its passage is very little; thereby, it may raise the level of the sub-soil water. If the rainfall is excessive or if the soil is so very impervious that it resists the passage of water, the soil becomes surcharged with moisture. In other words, the interstices between the particles of soil, originally occupied by air, become completely filled with water. In this condition, the soil is said to be waterlogged. In waterlogged soil, plants die as their roots cannot respire for want of air; noxious pans of iron and aluminium silicates are formed; beneficial soil microbes die, also due to want of air and due to the soil turning sour. It is therefore necessary to drain off excess of moisture in the soil to make it agreeable for vegetative life to flourish. Efficient drainage is one of the most important points in connection with the cultivation of garden crops. It consists in drawing out of the soil only so much of "free" moisture which is not required by plants and which occupies the spaces between the particles of soil, impeding aeration. The quantity of moisture which is held by the soil particles as
a film encircling them due to surface tension is enough to satisfy the needs of the plant and that, cannot be drained away. Drainage keeps the land in the best condition for the development of plants; it alters the texture of heavy soil by conducting away water and filling the space originally occupied by water with air; it enriches the soil in its feeding capacity by facilitating the decomposition of organic manures. It increases the temperature of cold soils and it furthers the activity of soil microbes.

**Test for need for draining soil.**—Soil drainage is a difficult problem in India in places where rainfall is excessive and almost continuous during certain periods of the year. Unfortunately, little attention is paid to draining soil as it involves some expenditure. A low-lying piece of land would need to be drained to get the maximum benefit out of it. An apparently high or sloping land may need drainage too. It should be ascertained if it is only the surface water that has to be conducted away; in which case, surface drains have to be constructed. If water accumulates in the sub-soil, sub-soil drainage has to be effected. If the land is porous, that is, if it is light on the surface and has a porous sub-soil, water generally passes through naturally without need for drains. But, if the soil is heavy, with a sub-soil of clay or marl, which will not allow the passage of water through it, sub-soil drainage has to be effected. If the land holds the water in puddles for a day or two following the Rains, want of drainage is indicated. To make sure if draining is necessary, a few trial holes about three feet deep are made and left open for ten or fifteen days; if water accumulates in the holes within two feet of the surface, sub-soil drainage is necessary.

**Surface drainage.**—Surface water can be conducted away through channels, 6 to 12 inches deep, made in suitable places and connected with ditches, tanks or public gutters. If the surface of the ground is on a dead level, with the result that the water falling on it cannot clear away, the ground should be worked and sloped in one direction. The slope should however be gradual to prevent erosion during the rains.

**Sub-soil drainage with drain pipes.**—Sub-soil drainage is effected usually with drains constructed with agricultural drain pipes which are made of hard baked clay. They are in various
sizes. Usually they are made without sockets, in 12-inch lengths of a diameter of 3 or 4 inches. Closely inserted one inside the other and placed end to end, they form straight earthen piping, through which water can be conducted away unobstructed. Study the contour of the land to determine the direction of the drains to be fixed. Run the main drains along the valley lines ab shown in the figure, in the lowest part of the land, and the subsidiary lines or feeders at right angles or obliquely to the main drains according to the formation of the land. The main drains should be large enough to conduct water from all the feeders along its course and it may be about 4 inches in diameter. Run the main drain from the highest point to a reservoir or a water channel in the lowest part of the land to be drained, with an equal gradient throughout. The distance between the feeders should generally be in inverse proportion to the rainfall. In fixing the distances between the drains, take into consideration the texture of the soil and the relative rapidity with which the water has to be drained off. Have the drains 20 to 24 feet apart and 3 to 4 feet below the surface in clayey soil. In loamy soil, set the drains 30" to 35 feet apart. Whenever possible, lay drains in true straight lines, with an inspection chamber or eye at every change in direction. For laying drains, open V shaped trenches, 2 feet wide, at the top and 1 foot wide at the bottom and 3—4 feet deep, according to heaviness of the soil. Grade the bottom with a slope of 1 in 100 to 1 in 300 feet. Connect the feeders with the main pipe by sockets and cement the joints. The drains so laid are too deep to disturb ordinary operations. Lay the pipes along the bottom and fill the trenches to a depth of not less than 12 inches with broken stones or similar rough material. Use large
stuff for packing in the bottom layers. Use material which does not readily disintegrate. Fill the rest of the trenches with smaller stones and rubble in the lower layers finishing off with garden refuse and loose earth.

**Sub-soil drainage with rubble drains.**—If there are trees near by, their roots get into the openings of the pipes and clog them. In such places, unless the trees are cut down, it is not practicable to have pipe drains. In their place, rubble or stone drains can be made. For making these, dig trenches as recommended above, grading the bottom also as described above. Place semi-circular roofing tiles or stones in the lower twelve inches and cover with layers of smaller stones or rubble, finally filling up with sods or garden sweepings and loose earth. Such drains, though absolutely necessary at the time of the formation of the garden, may become dry in course of time, being filled up with the roots of trees, which take up the work of the drains, by utilising the moisture for their growth.

**Work of soil microbes.**—Nitrogen is a colourless, tasteless, odourless inert gas. It constitutes four-fifths of the atmosphere but still, plants cannot make use of it as they do the carbon and oxygen from the carbonic acid gas and oxygen in air. Nitrogen is present in a combined form in all organic matter, whether of animal or vegetable origin. The value of farm yard manure, which has been recognised from very ancient times, is due to the formation of nitrates (nitrates are compounds of nitrogen, a basic element such as sodium or potassium and oxygen) from it when mixed with soil. The discoveries of Pasteur, Schloessing and Muntz, and Winogradsky in the latter half of the nine-
The nineteenth century have proved the existence of micro-organisms in the soil and made it clear that the presence and formation of nitrates in the soil is due to the activity of several distinct sets of these organisms on decaying matter. There are several kinds of bacteria at work in the soil. One kind causes organic matter to generate heat, decay, and release nitrogen, chiefly as ammonia gas (a simple compound of nitrogen and hydrogen). Another kind converts the ammonia so liberated into nitrates by uniting it with basic elements in the soil. Still another kind converts the nitrates to nitrates, in which form plants get their nitrogen through the roots in a state of solution in water.

As nitrates in the soil are used up by plants for their growth, it is obvious that the nitrogen content in the soil (nitrates) should be maintained for their continued growth. This is effected in a natural way by the action of at least three sets of microbes in the soil, though additions of organic manures and artificially prepared salts such as ammonium sulphate and sodium nitrate also increase the nitrogen content of the soil. The microbes have the wonderful capacity of taking free nitrogen from the air and building it up in their bodies making complex compounds of nitrogen, which are preserved in the soil for future use by plants. There is one particular set of micro-organisms living in the roots of Leguminous plants (Bean Family). These organisms take nitrogen direct from air and build it up into nitrogen compounds, useful both for themselves and for plants. It is seen thus, that atmospheric nitrogen is "fixed" in the soil in the form of compounds of nitrogen which are later converted to nitrates by the activity of different kinds of soil bacteria, a feat which is accomplished by scientists only by the use of prodigious electric power, very high temperature, very great pressure and catalytic agents. The energy which the microbes require for doing this tremendous work in their quiet and unostentatious manner is supplied by the oxidation of carbon compounds such as sugar, starch, straw, etc. As long as these substances are in the soil, oxidation goes on and bacteria do their work.

In addition to the abovementioned beneficial microbes there are some harmful ones in the soil, which cause "denitrification" in the soil under certain conditions. When the soil is
waterlogged, these microbes get the oxygen they require for their existence by decomposing the nitrates in the soil and setting free nitrogen, which is lost.

Keeping in mind the foregoing facts, the problem of the plant-grower is how best to encourage the work of the beneficial soil microbes. They need a certain amount of moisture, air, and warmth in the soil to thrive. Good cultivation aerates the soil. So also effective drainage. These operations enable the microbes to live by supplying them the requisite quantity of air. Straw, leaves, etc., dug into the soil periodically will help to supply the energy for carrying their work of fixation of nitrogen. When organic manure such as dung and green manures rich in complex compounds of nitrogen are mixed in soil, nitrates are formed as mentioned above, if microbes are in a thriving condition in the soil. The microbes thrive best, it is well-known, not in waterlogged and sour soils, but in well aerated soils which are sweet and prevented from turning sour by addition of lime to them.
CHAPTER IV

MANURES AND THEIR USE

Manures are substances which are added to the soil for encouraging and sustaining plant growth. They may increase soil fertility directly by supplying what is requisite, or indirectly, by their action on other substances that might be present already in the soil but not in a suitable state for being absorbed. Manures may have powerful constituents in them combined in a natural or artificial manner as in dung and commercial fertilizers respectively. The strength of manures and their suitability to certain crops and soils should receive due attention from the gardener. While application of manures to plants at an improper time or in an improper manner produces direct harm or possibly death to the plants, the same application in a suitable manner and in proper season is attended with beneficial results. In the application of manure, the object should be to make it afford as much soluble matter as possible to the roots of plants and that in a slow and gradual manner so that it might be entirely consumed in forming their soft and organised parts. It is evident that organic matter, whether of vegetable or animal origin, should undergo a process of decomposition before they can be utilised for the nourishment of plants. The decomposition may take place partly prior to its application to the soil or in some cases, it may be entirely effected afterwards.

Manures are usually divided into two classes, (1) organic and (2) inorganic manures. Organic or natural manures, as they are also called, include excreta of animals, animal matter, such as blood, bones, flesh, wool, horn, etc., and decomposed vegetation. They are more or less complete manures, in the sense that they contain and supply in greater or less degree, all the essential nutritive elements. Inorganic or artificial or chemical manures or fertilizers, as they are variously called, are of mineral origin. They are either specially manufactured or are found in nature as such. They are phosphates, potash salts and salts containing nitrogen.
The three elements, which are indispensable for the building up of plants and which have to be supplied to the soil periodically, as they are being used up in much greater quantities than the other elements in the soil, are nitrogen, phosphorus and potassium. Nitrogen is essential for making the protoplasm for new cells and for their growth. It builds up the stem, leaf and green parts of plants. Phosphorus makes up the texture of the fruit and assists in the ripening of the tissues of plants, in the production of flowers and in the formation of seeds. Potassium enhances the flavour of fruits and vegetables and it is associated with the manufacture of starch and sugar in a mysterious way. It also enables plants to resist attacks from fungi. Calcium acts as food, besides improving the texture of the soil. Iron has a certain bearing on the chlorophyl. Magnesium is essential, it is not known why. With regard to the amount of manure to be applied to the soil, the quantity of the respective elements already present in it should be taken into consideration. And, this is determined by soil analysis.

From a practical point of view, manures are best classified under six heads, as suggested by Weathers in Commercial Gardening:

1. Complete manures, which as mentioned above, supply not only nitrogen, phosphorus and potash, but also other essential foods like sulphur, iron, sodium, magnesium, chlorine, etc. All organic manures are complete manures.

2. Nitrogenous manures, chiefly supplying nitrogen, as for instance, sodium nitrate, and ammonium sulphate.

3. Phosphatic manures, chiefly supplying phosphorus, as for instance, superphosphate of lime.

4. Potassic manures, chiefly supplying potash, as for instance, potassium sulphate, and wood ashes.

Organic manures. The more important organic manures used in our gardens are mentioned below:

Stable or horse manure is stored and made ready for use in the following manner:—Dung and stable refuse are thrown into a pit or heaped up in a shady corner. The material is moistened with water once or twice to hasten decomposition. Otherwise, too much heat is developed, which results in the escape of much of the valuable ammonia gas which is formed.
and is the chief source of nitrogen. The dung heap is covered with a layer of earth to absorb the ammonia gas which would otherwise be lost. To prevent nutritive substances from being washed away, the manure heap is protected from rain. The manure is ready for use in about six months, when it can be powdered with ease by gentle pressure without sticking to the hand. In this condition, horse manure enters into the compost used for growing all kinds of ornamental plants. Unless well decomposed, horse manure has a burning tendency on tender roots. It is lighter in texture, quicker in action, as it ferments more and is better suited for horticultural purposes than cow-dung. It is also comparatively free from Cockchafer grubs. Horse manure is a safe stimulant, and produces almost immediate effects. A top dressing; of this manure in a well decomposed state, mixed with half its quantity of loam, applied as often as may be necessary, stimulates plants to vigorous and strong growth and hastens flowering. Such top dressings of horse manure or the use of liquid manure prepared from horse or cow manure is safer to use than artificial manures, which involve risks to the health or the life of plants, if applied injudiciously. Horse manure is better suited to heavy than light soils. It accelerates warmth in the soil and renders it friable and light.

Cow or cattle manure is stored and prepared for use in much the same way as horse manure. But, it takes a longer time to decompose, taking nearly a year before it becomes usable. It is heavier than horse manure and acts more slowly and hence its value is more lasting. In this country, cattle manure is used only in connection with kitchen gardening and fruit trees. If freed from grubs and well decomposed, cow manure could however be used in place of horse manure for growing ornamental plants. As cow manure is more retentive of moisture, watering is to be done carefully. It is more suited to light than heavy soils.

Urine of cattle or horse is rich in nitrogen. It should be used after considerable dilution with water as it has a strong burning effect upon tender roots.

Sheep or goat dung is preferred to horse or cattle manure for fruit trees. Sheep dung is believed to expose trees to fun-
Sheep dung is best used in connection with light soils and it serves as a stimulating liquid manure productive of excellent results. Night soil is a powerful manure, rich in nitrogen. The chief objection to its use is based on sanitary and sentimental grounds, on account of its offensive odour when it is not sufficiently decomposed. But, if allowed to lie in a pit for a year or so, with alternate layers of soil and covered over ultimately with earth, night soil is deodourized. It could then be used with very good results. It is extensively used by market gardeners for growing vegetables. As it is a strong manure, regular watering should be done when it is used. A pound for a square yard would be a good dose for all kinds of soil.

Guano is a well-known manure, rich in nitrogen and phosphorus, containing about 18% of the former and 20% of the latter. It occurs, deposited in large quantities, principally off the islands of the coast of Peru and South America. It is the excrement of sea birds accumulating over several centuries. Pure guano is a powerful stimulant and it is safely used mixed with about six times its weight of soil. Four pounds may be used for an area of about 5 square yards. Guano may be applied as liquid manure for all pot plants. Fowl manure is similar in action to guano.

Bones are rich in phosphorus and nitrogen and contain about 45% of calcium phosphates and 4-5% of nitrogen. Bone is slow in action and it is used for growing flowers, fruits and vegetables. In a powdery form, known as bone-meal, bone is obviously more rapid in action. Bone-meal is very popular with gardeners, being usefully mixed with soil mixtures for pot plants. It may be spread on the surface of the soil at the rate of 4 ounces per square yard and forked in.

Blood (dried) is rich in nitrogen and induces strong growth. Two ounces per square yard may be used on all soils.

Oil-cakes are residues left after oil is extracted from seeds of groundnut, castor, rape, gingelly, pongamia, cotton, etc. Oil-cakes are stimulating manures, being rich in nitrogen. Pongamia cake is very largely in demand for manuring purposes. If applied in too large doses, it causes the “burning” of buds in
flowering plants. Oil-cakes are best applied for pot plants in the form of liquid manure. In a powdered form too, oil-cake is used mixed with other ingredients in composts.

Soot is very little used in this country, but it gives good results, as it is composed principally of charcoal which has fertilising properties due to the ammonia contained in it. It can be spread on the surface of the soil at the rate of six ounces per square yard. It can be hardly misapplied. Soot-water which is made by suspending a bag of soot in a tub of water is a valuable liquid manure, which brightens the colour of foliage. Soot also acts as a preventive against larvae of insects, snails and slugs.

Leaf-mould. Withered and dry leaves, and garden sweepings, which are free from disease, are thrown into a pit in a shady corner in the garden and covered over with earth and watered copiously once or twice in summer to assist decomposition. The leaves become reduced to a state of mould in the course of nine months to a year. When well decomposed, leaf-mould could be powdered and sifted through wire meshes. In irrigated pits, the mould is made in a shorter time. It is one of the most indispensable manures to the horticulturist. Although it can be made with ease in all gardens, it is purchased at a prohibitive price. Leaf-mould is rich in humus and is hence usefully applied to both sandy and clayey soils. It is very useful in the cultivation of delicate seedlings and delicate plants. It forms part of composts for palms, ferns, bulbous plants, delicate annuals and foliage plants and for striking soft-wooded cuttings. Addition of leaf-mould to flower beds at least once a year is attended with very good results. Leaf-mould when mixed with imperfectly decomposed horse manure is used in the making of hotbeds, as it prevents violent fermentation and helps to maintain a moderate degree of heat for a long time.

Wood ash is rich in potash and can be used as a top dressing at the rate of 8 ozs. per square yard, which would work out at an ounce of potash for a square yard.

Inorganic manures.—Inorganic manures are used for a specific purpose and usually supply one essential plant food and hence are called "relative manures". They supply either potas-
sium, nitrogen or phosphorus and the chemicals supplying these elements to the soils are known as potassic or nitrogenous or phosphatic manures. In this connection, it is necessary to sound a note of warning against the so-called proprietary fertilizers which are claimed to serve as complete manures for growing plants. Inorganic manures (potassic, nitrogenous or phosphatic manures) are best used separately at different stages of the plant’s growth according to its needs. Their use is also largely dependent upon the actual needs of the particular soil. As such, an indiscriminate use of special mixtures may do more harm than result in any good. Even when it is desired to mix two manures, it is best the grower does so himself, using the right quantities needed by his soil, as determined by soil analysis.

Inorganic manures should be used very guardedly, as they contain the essential elements in a highly concentrated form. It is safer to err on the side of applying too little of them than too much. They are used only to supplement and not to supplant organic manures. It would be cheaper to apply them along with the quantity of organic manure that might be available. Artificial manures used by themselves without an adequate quantity of humus in the soil are very harmful. They are absolutely lacking in humus, which has a well-known influence in altering the texture of the soil for the better and providing food for soil microbes. They act as stimulants, without lasting benefit to the soil, and require to be added every year to the soil. They are often caustic or acidic in reaction and if used too freely are apt to burn the tender roots of plants if watering is not freely done. They render the soil unfit for growing plants in course of time. Hence, it should be emphasised that artificial manures are productive of good results only when used in conjunction with organic manures.

The following are the more important chemical fertilizers with which the gardener may be familiar with:

Nitrate of soda (salt petre) and ammonium sulphate are two salts which are rich in nitrogen. The former is largely produced in Chili and contains about 15.6% of nitrogen. The latter is obtained from the liquor ammonia of gas-works and contains about 21% of nitrogen. Both are easily soluble in water and quick in action and both are powerful stimulants.
They are not to be applied when the soil is dry. They are not to be brought into contact with the foliage of plants. The soil is flooded after their application. The safe quantity to use may be an ounce of the salt for one square yard. This might be spread on the surface and forked in. The nitrate seems to be unsuited to our country where large tracts of saline deposits exist. On heavy soils, the nitrate destroys the filth and gets the surface into a sticky state. Ammonium sulphate is better suited to damp and heavy soils. As it is acidic, it is not safe to employ it for soils deficient in lime.

Superphosphate of lime, ammonium phosphate and basic slag are three fertilizers which are rich in phosphorus. The "super" is prepared from bone and it is rich in calcium and phosphorus, containing 20 to 35% of phosphate. It is an acidic manure and is best employed on lands rich in lime. It should be used with the same caution noted in connection with soda nitrate and ammonium sulphate. It is best applied when the plant is in a healthy growing condition and is about to flower, at the rate of two ounces per square yard.

A mixture of "super" and ammonium sulphate in the proportion of two of the former to one of the latter is generally used by several gardeners, as it serves both to build up the body of plants and to produce a good crop of flowers.

Ammonium phosphate is a salt which is both rich in nitrogen and phosphorus and can well replace the use of the mixture mentioned above. Used along with bone-meal, it is capable of giving excellent results in rose cultivation.

Basic slag is a by-product in the manufacture of steel. It contains a large quantity of phosphorus, which becomes available to plants only comparatively slowly. Basic slag is also rich in calcium. It is a valuable fertilizer for roses, lawns and fruit trees. It may be applied to heavy soil deficient in lime at the rate of three ounces per square yard.

Lime, when added to soil, plays an important role in improving its texture, in increasing the solvent action of soil-water, in acting chemically on manures added to soil and in preventing sourness in it. Lime has a magical effect on soils incapable of yielding good results; it renders clayey soil less sticky by disintegrating it; it cements sandy particles of poor light soils
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assisting them to retain moisture; it effects the decomposition of vegetable and organic matter producing ammonia, nitric and carbonic acids and renders them into soluble and consequently easily assimilable compounds. Heavily manured soils with too much humus in them and which have turned sour on account of excess of moisture are greatly improved and corrected by digging in lime. Lime also acts as a mild preventive against fungus and insect pests in the soil.

For the first one or two years of cultivation, Indian soils need no liming, as they generally contain some amount of lime. The following is an easy method of finding if soil needs liming. A handful of the soil to be tested is dried and placed in a glass saucer and a little dilute hydrochloric acid is poured on to it. If the soil effervesces unmistakably, enough of lime is indicated. If no effect is noticed as the acid soaks into the soil, it requires addition of lime. But, if there is only some fizzing with practically no effervescence, presence of only a small quantity but not enough lime, is indicated in the soil.

The best mode of liming the soil is to slake lime and spread it on the surface at the rate of two ounces per square yard. If the soil contains some lime already, addition of lime rubbish or old mortar will do. Liming need not be done more than once in four or five years. It has been found by experience that one or two spoonfuls of lime stirred into the soil in pots which has turned sour by overwatering, very much improves the condition of plants. Old mortar is sometimes added to the composts for Crotons and Dracaenas and such other coloured foliage plants with the belief that the colours of the foliage are better developed. If quick lime is not available, chalk can be used instead, with slower action.

Mixing of manures. — Certain manures should not be mixed with certain others, as they interact chemically, neutralising the principles of each other or liberating substances injurious to plant life. The following note on the mixing of manures taken from Dr. Anstead's pamphlet on Coffee Cultivation will be found useful: — "It must be carefully borne in mind that certain fertilizers must not be mixed together at all under any circumstances, such for instance as lime, or basic slag with sulphate of ammonia or manures containing nitrogen.
Others again may only be mixed just before they are applied as they have a tendency to cake and become hard; such for instance as super-phosphate with sulphate of potash. The diagram below shows at a glance what fertilizers may and what not be mixed. Materials joined by a heavy black line should not be mixed together under any circumstances, those joined by a double line should only be mixed if the manure is to be applied immediately, while those joined by a single line may be safely mixed together at all time.

Liquid manures and their use.—Manures are quicker in action and more effective, if they are applied dissolved in water, instead of waiting for them to dissolve in the moisture contained in the soil. Liquid manure is nothing more than manure dissolved in water. It may consist of artificial salts, such as ammonium sulphate, potassium sulphate or superphosphate or organic manures as cow-dung, horse-dung, sheep-dung, dissolved in water. For flower plants such as Roses, Dahlias, Chrysanthemums, various kinds of oil-cakes and especially "Honge" or Pongamia oil-cake is left in water to rot for a few days and the resulting liquid is diluted many times with water and used with excellent stimulating results. The urine of cattle or the horse, etc., which is too strong, can be used on plentiful dilution with water.

In horticultural work, the amateur finds liquid manure quite indispensable for his plants. But for it, he would be seriously handicapped in exhibition work. It is stimulating, beneficial, and productive of immediate results. It may be used both for plants in the ground and in pots. The right kind of
manure, nitrogenous, phosphatic or potassic, can be applied when required, by dissolving it in water.

In the application of liquid manures, 'weak and often' should be the rule. If the solution is strong, water passes from the cell-sap in the root-hairs through their membraneous walls and comes out to the soil, as a result of which the plant collapses. To prevent this "ex-osmosis", care should be taken that liquid manures are applied only in a state of great dilution.

Liquid manures are easily made. Cow-dung is the favourite stuff used, on account of its harmlessness. Fresh dung is tied up in a muslin bag and suspended in water in a tub. Water gradually dissolves the soluble parts of the dung, leaving the chaff. After three or four days, the dark liquid in the tub is diluted till it assumes the colour of light tea decoction. To get the full value from it, it is necessary to prepare liquid manure from fresh dung. All the suspended matter is to be strained away, as it would otherwise choke the air spaces in the soil necessitating stirring of the soil after application of the manure. Liquid manure is similarly made from horse or sheep dung. The latter is particularly rich and very stimulating in action. One peck of any kind of dung will make about 40 gallons of liquid manure. As fowl or poultry manure is very strong, about half a peck of it may be used for making a like quantity of manure.

One ounce of ammonium sulphate, or potassium sulphate, or ammonium phosphate or soda nitrate may be dissolved in two gallons of water. Two ounces of 'super' may be dissolved in like quantity of water. Artificials are often acidic and burn the tender roots of plants. Hence, they should be used only after wetting the soil through with water, and they should not be brought in contact with foliage.

The best time for application of liquid manures is when the plants are well established and are growing actively. Flower plants are supplied with them from the time flower buds are forming till they show colour. The manure is to be applied
in weak doses once a week or a fortnight. Fruit trees are sup­plied with liquid manures when the fruits are setting. Nitro­genous manures are applied for colourful foliage and vigorous growth. Phosphatic manure is used for flower formation at the time of blooming. Potassic manure is applied when the fruits are set and are growing for better quality, flavour and taste.

Liquid manures of all kinds, are best applied when the soil is wet. The drier, the soil, the weaker should be the solution. The liquid should not be spilt over shoots and foliage. The soil should be stirred after each application of manure.

In Western countries, soot is applied as a liquid manure, one peck making about 30 gallons of liquid manure. The ammonia and the soluble contents go into solution if a bag of soot is sus­pended in water for a day or two.

Summary of important points to be remembered in connec­tion with manures and manuring:

Choose the manure to suit the particular soil and the plant. Apply right kind of manure in proper time.

Animal manures require care and management in storing them to conserve their valuable properties. Never place them outdoors exposed to sun and rain. Cover them with a layer of earth to fix the escaping ammonia gas.

It is always safe to manure a little and often than much and seldom.

Never use undecomposed manure, as it has a burning effect on roots and destroys them.

Easily soluble manures, as for instance the concentrated chemical fertilizers, should not be applied just before the rainy season, as they are liable to be washed away. Organic manures may be dug into the soil with advantage before the rains.

Do not mix manures which interact with each other. Do not mix lime with manures rich in nitrogen and which part with it easily, as for instance lime with guano, horse or cowdung; do not mix soda nitrate with superphosphate.

Water plentifully when artificial manures are used. Do not bring them in contact with foliage.

Organic manures cannot be dispensed with when commer­cial fertilizers are used. The latter are only to supple­ment and not to supplant organic manures.
Do not freely manure newly planted plants and trees. Add manure to soil only after they have established themselves. Don't supply liquid manure to sickly plants.

Do not make the composts of pot plants very rich. Top dress the soil with mixture of manure and soil, when the plants establish and are growing.

The best time to apply liquid manures to flowering plants is when the buds are forming; to fruit trees after the fruits are set at intervals, until they begin to colour; to vegetables during their active growing period; and to pot plants when the pots are full of roots.

The wrong way to manure trees and shrubs would be to apply them very near the stem. As feeding roots are away from the stem, apply the manure, from half to four feet away from the stem to the extent of the entire spread of the branches, as roots generally travel to that extent under the ground. The bigger the tree or the shrub, the greater is the distance away from the stem, the manure is to be usefully applied.

Economic manuring.—With the gradual replacement of animal by motor transport, there has been an increasing difficulty in obtaining animal manure for field crops and garden flowers. The farmer and the gardener are both faced with the problem of having to find an alternative and comparatively...
cheaper source of organic matter for the soil. Application of artificial manures without organic matter in the soil is attended with serious consequences. The value of farm yard manure consists in its large humus content and its superiority over the commercial fertilizer is due to its double barrelled action on the soil in increasing its fertility by providing food for and stimulating the activity of soil microbes and in maintaining and improving its texture. As vegetable matter, such as straw, decayed leaves, etc., is also capable of adding to the humus content of the soil, it stands to reason that digging into the ground a quantity of vegetable matter, especially leaves of Leguminous plants and trees as Pongamia glabra ('Punga'; 'Honge'), would also enrich the soil when they decompose in it.

Use of green manures has been found very advantageous. Green manuring is an ancient practice which is well worth reviving. It consists in growing a crop of a quick nature and digging it in before its growth becomes unmanageable. Usually, the plants are dug in just before they flower or when they are with flowers. Members of the Bean family are obviously preferred to other plants for green manuring. Crotolaria juncea (Sunn hemp) and Tephrosia candida (Boga medellos) are two favoured green manuring plants. Horse-gram, Cow-pea, Groundnut, can also be thought of, if crops are also desired from plants used for green manures. In intensive farming, green manure crops are best grown as a part of a special rotation in which part of the year is given up to green manure. As the green manure plants also take up much nutrition from the soil, though they give back to the soil valuable food after they are dug in and decompose in the soil, it is prudent and even necessary to apply requisite quantities of commercial fertilizers to the soil, before the seeds of the regular crops themselves are sown. Ordinarily, an ounce of fertilizer consisting of 4 parts of super-phosphate, 1 part of ammonium sulphate and 1 part of potassium sulphate may be applied for each square yard of space and raked into a depth of 2—3 inches.

Preparation of poudrette or activated compost from garden sweepings:

By following the procedure indicated below, every large garden owner can prepare in a short time very good organic
manure for his plants by making use of garden refuse, as dried leaves from shrubs and trees and weeds.

In a secluded and shady part of the garden, away from the residence, collect all garden sweepings. Do not collect, however, diseased leaves affected with fungus and insect pests. Chop all bigger stuff, as stems of Cannas, etc., into small pieces to facilitate early decomposition. Make a mixture of cow-dung and water, using a basket of about 50 lbs. of fresh dung for every 24 gallons of water. Dip enough raw material into such a solution of cow-dung to make about a cart-load of manure, (smaller quantities also can be used) and stack the moistened raw material in a compact heap. A heap, 8' X 3' X 2' would form about a cart-load of manure.

Watch the temperature of the heap. It rises, after the second day and reaches a maximum in five or six days. The heap of fermenting organic material develops an abundance of organisms which possess the property of hastening the decomposition of fresh supplies of raw material. The day the temperature begins to fall is called the “Changing day” or the “Turning day”. A quantity of the heap now taken and mixed with fresh raw material starts decomposition on a quicker pace than before, being now rich in microbes which effect decomposition, and hence it is called the “starter” or the “activator”.

On the first turning over day, assuming this to be once a week, take a quarter part of the heap and put it by its side, making the beginning of a II heap. Make up the quantity of the I heap by adding fresh refuse, and turning over the whole heap after moistening it with dung solution as before. Repeat this every week, taking a quarter from the I heap and making up the II heap till it is completed at the end of 4 weeks and is of the same size as the I heap.

Now start the III heap by taking a quarter of the II heap and putting it by its side. The quarter portion taken from the II heap is made up by shifting a quarter from the I heap, which is made up again by adding requisite quantity of fresh material and turning over. The III heap is completed in 8 weeks. Then start the IV heap by taking out a quarter of the III heap and this would be completed in 12 weeks. The VI heap would be completed in 20 weeks. Remove the material of the VI heap
and store it in a cool place. It is sufficiently decomposed and is ready for use. It has an earthy smell and is quite free from unpleasant odour. Continuing this process, every week, of turning over the I heap with fresh quantities of drenched raw material and the II heap with quantities taken from the I heap and the III heap with quantities from the II heap and so on, it is clear that the VI heap would liberate a cart-load every month. It can be seen that all the heaps would be mixed up with a quarter of the next preceding heap on every turning day. Keep each of the heaps sufficiently moist by moistening them with fresh cow-dung solution.

The compost so prepared is rich in humus and plant food and is known to give excellent results with all kinds of plants.
CHAPTER V

GARDEN IMPLEMENTS AND ACCESSORIES

The 'mali' is satisfied if he is supplied with a small and a large 'kothali', a 'mamti', a pick-axe or a mattock, a 'varavari' or 'pilcheduki' and a 'kurpi' or 'kudugolu'. He manages to carry on his work with these implements. He is not accustomed to work with imported implements as the spade, the fork and the shovel. But he can be easily taught to handle these instruments and do his work quicker. Many are the kinds of tools and implements which are offered for sale and are convenient and useful in saving labour. They may be purchased as necessity arises. It would pay in the long run to secure only strong durable materials and keep them clean.

The instruments used for digging and trenching are the 'kothali', pick-axe, digging fork, spade and the 'mamti'. The 'kothali' is the familiar instrument in India with which all digging is done. The 'mamti' is not only used to dig loose soil but is also used to turn over loose soil while digging and trenching. The smaller sized 'kothali' is used to remove weeds and to stir the surface soil between plants as the Dutch hoe. Of hoes, which are imported tools, there are several types. They are used for cleaning and weeding purposes and for stirring the surface soil. The pick-axe is used for breaking hard soil. One of its ends is pointed and the other is flat like a chopper, its edge being on a line with the handle. The "pick" is serviceable to mend roads and paths. The mattock is similar to the "pick" and has one of its ends broader than the flat end of the "pick". The digging fork has prongs about 9 inches long; it is furnished with a handle and the
operator has to work it in an upright position as with the spade and the shovel. The fork is used for working stiff moist soils. Small hand forks are serviceable for transplanting small plants, for weeding and loosening surface soil. The spade has a broad blade of rectangular piece of iron, which is furnished with a handle. It is a very useful instrument for digging and trenching operations. The 'mamti' combines the work of the spade and the shovel. The shovel is an imported instrument which is used like the mamti for transferring soil, rubbish, etc., to baskets or turning them over from one position to another.

A trowel is a small instrument very useful for making holes for planting seedlings or small plants. A dibber is the instrument with which holes are made for planting or 'pricking' seedlings.

Any round piece of solid bamboo or dried stem with one end sharpened not to a point but ending bluntly, would serve...
the purpose. But, if the point is shod with iron, it would last longer, and enable the work to be carried out easier.

The 'pillu-cheduki' or 'varavari' consists of a triangular piece of iron, fixed to a handle. It is mainly used for cutting the edges of lawns and flower beds and for weeding. The edge of the instrument can be sharpened as it gets worn out. 

Edging iron is the instrument for trimming edges of lawns abutting walks and roads and for cutting the edges of flower beds in grass land. It consists of a crescent-shaped blade, with an iron socket in the centre, into which a long handle is inserted.

The rake is an instrument for levelling land and to bring it to some uniformity of fineness by removing unbroken clods and stones. It is also helpful for collecting weeds, rubbish, etc., together in a heap before they are removed. The rake consists of a number of nail-like projections from a bar, furnished with a handle.

A bed marker is easily made, as it consists of only a strip of wood into which are driven a number of strong nails at equal distances. This device is very handy when a large number of seedlings have to be planted out as it enables a large number of spaces to be marked out at one time. A drill-maker, consists of a board about 12 inches wide and 2½ feet long, or more or less, as needed actually and cut with triangular projections and attached to a block of wood carrying a handle. By drawing the handle on the surface of the ground, the projections of the instrument leave depressions in straight lines in which seeds are sown.

A good pruning knife is a necessity for every gardener. It should have a strong curved blade. For budding is used especially made budding knives, which have their cutting edge
rounded off the point and which are provided with handles made of flat smooth bone or ivory, reduced to a spatula-like termination enabling easy lifting of bark from stock in budding operations. These knives should not be used for sundry work, as cutting small twigs, thread, mending pencils, etc. Shears are used for trimming hedges and pruning border plants. No gardener should be without a pair of secateurs. Only those types which cut clean without pinching first should be purchased. For pruning decayed and dead branches of trees and shrubs, a pruning saw should be secured. Small saws of the Grecian pattern with slightly curved edges are useful for removing branches which are too large to be severed with ordinary pruners or secateurs. Tree pruners with long handles to match
are used to prune stray branches which cannot be reached ordi­
narily. Bushes like Bougainvilleas are best trimmed with them.
Baskets made of bamboo are for carrying rubbish, soil, 
manure, etc. Iron baskets or ' gumela ' are for the same use. A 
wheel-barrow may be very serviceable to carry larger quanti­
ties of material with greater ease.

The ' mali ' is to be provided with suitable vessels for con­
veying water from the source to the plants. Galvanised iron

pots are handy. A water-can fitted with a coarse rose is
almost a necessity for watering pot plants. A fine rose should
be fitted to it for watering very minute seedlings or pots in
which very fine seeds are sown. The same fine ' rose ' may be
adjusted in two ways, allowing the water to come out gently
in misty spray or with force.

For washing the dust off plants, one should possess a good
syringe or sprayer. Syringes or sprayers are furnished with
different sets of nozzles, which permit of water to be expelled
in a fine misty way or in forcible sprays. The Abol syringe is
one of the best syringes for all kinds of work in small gardens,
being used for spraying insecticides and fungicides, as well.
There are various forms of bucket and knapsack pumps useful
for spraying large number of plants.
Though the "kudugolu" and the scythe are useful for cutting grass, to avoid waste of time and to have the work done in an efficient manner, it is best to mow the grass on the lawn with a lawn mower. It should be carefully cleaned and oiled after use each time. The ground should have been properly levelled and all stones removed from the surface lest they should damage the blade. A roller should be owned if one is to have a good lawn. It would be useful for keeping the roads and paths in good condition.

Labels used for showing the names of plants should be neat, inconspicuous and durable. Zinc labels written with indelible ink are the commonest. Ivorine labels are costly but attractive. Deal-wood labels are cheap and handy. The portion which goes under the ground should be dipped in creosote, gas-tar, or any other preservative material. Indelible ink is made by dissolving 2 parts by weight of acetate of copper and 2 parts of ammonium chloride in 30 of water and adding 1 part of lamp-black.

In addition to those mentioned below, many other articles like the broom, thread, hose-pipe, ladder, crowbar, axe, hammer, grafting-wax, scissors, and others too numerous to mention are serviceable too, at one time or other.
CHAPTER VI

METHODS OF PROPAGATION OF PLANTS

Plant propagation—a fascinating pursuit.—The power of producing young or multiplying themselves is a characteristic of all living organisms. All subjects of the vegetable kingdom, from the hugest of trees to the lowest single celled plants, have some device or other for continuing their kind. The gardener, in order to enable himself to make new plants out of old, to replace the useless with the fresh and to increase his stock to meet the ever-increasing demands of a growing garden, should acquaint himself with the ways and means by which different kinds of plants can be increased. Plant propagation presents to him a fascinating aspect of gardening in addition to curtailing his expenses in purchasing plants and seeds. The pursuit becomes all absorbing, on account of new hopes and expectations raised, if the amateur gets a working knowledge of the elements of plant breeding and sets about creating new varieties.

Sexual and vegetative methods.—There are various methods by which plants are raised, one or more of them being better suited for particular plants than others. But, all the methods followed fall under two heads:—(1) The sexual method, by sowing seeds and spores in the case of flowering plants and ferns respectively. Spores and seeds are the result of the union of male and female cells in plants. (2) The asexual or vegetative methods, which include such methods as by division, cuttings, layering, offsets, grafting and budding, proliferous buds or bulbils, etc.

It may be generally observed that plants raised by the sexual method are more vigorous growing than those raised by vegetative means. Seedlings may not take after the parent plants; they may differ in the shape of the leaf, in the habit of growth, in the colour of the flower, or in some other characteristics from the parent. This is due to cross fertilization brought about by such natural agencies as wind, water, insects, birds, etc. But, all plants raised by vegetative methods do take after the parent
plant, unless it be that the particular leaf, or the shoot, or the
root from which the new plant is obtained is a "sport", having
some peculiar fixable characteristics different from others on the
same plant.

PROPAGATION OF PLANTS FROM SEED

Vigorous plants from seed.—Reproduction from seed is the
commonest method by which a majority of plants propagate.
Cross fertilization and hybridization are responsible for the off­
spring of a plant by its seed, not taking after the parent plant.
Reproduction from seed is advantageous as it encourages vigo­
routines growth, increasing the vitality of species, besides afford­
ing chances for obtaining new varieties. Constant reproduction
by vegetative means tends towards degeneration of the species.
But, it is the quickest mode of raising straight-away mature
plants capable of blooming within a season or two. For in­
stance, Orchids will take probably 8 to 12 years to bloom from
seeds; but, plants made by dividing old clumps or otherwise
bear blooms during the same or the next season.

Secure best seeds.—There is as great a difference in the
vitality among seeds of the same as well as different species and
varieties of plants as there is disparity in the strength and sus­
taining power of the individuals composing mankind. The laws
of heredity, such as the descent of healthy and strong children
from healthy and strong parents are equally true in relation to
plant life. The aim, therefore, should be to secure the very best
seeds, seeds which have been gathered only from mature or ripe
fruits from healthy and vigorous plants, which have been mark­
ed out for conspicuous merits as the richness of their colour,
the largeness of their blossoms, the luxuriance of their growth,
the profusion of leaf or the shapeliness of form, etc.

Conditions for germination.—Conditions essential for suc­
cessful germination of seeds are heat, moisture and air. By heat
is meant genial warmth, neither too cold, nor too hot for the
plant. Generally seeds germinate better in closed frames, espe­
cially those which are furnished with bottom heat. In them,
the soil is preserved uniformly moist and the hot bed furnishes
sufficient warmth for quickening the activity of the embryo in
the seed.
METHODS OF PROPAGATION OF PLANTS

Essential conditions for successful propagation.—For successful propagation from seed, four essential conditions have to be satisfied. They are:—(1) The seeds should have been gathered from ripe fruits in an undamaged condition. (2) They should be preserved with care and not exposed to atmospheric moisture. (3) They should be sown in the right season and (4) They should be sown in the right manner.

Seeds, how collected and stored.—Collection of mature seed presents some practical difficulties. Fruits which do not drop off before the seeds are ripe should be allowed to remain on the plant till they are perfectly ripe. Those kinds like Balsams, Crotons, etc., which burst their seed capsules scattering the seeds all over the ground, should be watched carefully and collected when they are about to burst, or better still, enclosed in paper bags. Others which have a tendency to drop off unnoticed, to all appearances looking green and unripe as in Calendula should be enclosed in thin muslin bags for collection. Pulpfey fruits like Tomato, Brinjal and Fuchsia, which ripen on the plant should be gathered when they fall off or show signs of over-ripeness, when they should be cut open and the pulp squeezed and washed with water separating the seeds which should be dried and mixed with charcoal powder. Seeds, with husks, should be gently rubbed in the hand and then sifted to separate the husk. Seeds which have been collected in the foregoing several ways should be cleaned and mixed with charcoal powder to prevent attacks from fungus and insects, dried in shade for two or three days and then in the sun for a couple of days and preserved in a cool dry place in sealed paper packets or in tin boxes with labels on. Before sowing, seeds are best exposed to the sun for a couple of hours.

Peculiarities in germination.—Different kinds of seeds have their own peculiarities regarding germination. The period of ability differs widely in different species. In most annuals, it is from 6—12 months. In some kinds of seeds, as for instance the Mango, it is only about two months. There are others however, which are known to be active even after several years. Melons and Cucumbers are best sown after two years. Even as regards the time taken for germination, there is much variance among different seeds. Old seeds take longer
time to germinate than fresh ones. Some seeds, as those of Pansies, sprout capriciously and irregularly. In some as Cineraria, Petunia, Primrose, etc., many of the choicest varieties do not germinate until long after the less attractive colours have produced strong seedlings; for this reason, the smaller seedlings are not to be rejected while pricking or transplanting. Seeds of some kinds do not germinate well in all seasons. Seeds of some kinds of annuals, it might be observed, falling in the beds in which the flowers were grown, get mixed with the soil and remain dormant in it to come up only in their season.

**Seed-sowing—how done.**—Several details have to be borne in mind in sowing seeds:

The soil for sowing seeds should be light and porous. A mixture made up of one part each of loam and sand, and two parts of fine sifted leaf-mould is the ideal soil for sowing seeds. Old soil removed from pots is useful for sowing hardy kinds of seeds after it is sterilized by exposing it to the sun for a few hours.

Seeds are sown in specially prepared nursery or seed beds or in seed-pans or seed-boxes. Seed beds are dug up to a depth of 18 inches. The soil is broken and made fine and even, and raised 2—3 inches above adjoining ground if necessary, for drainage or to prevent being flooded during rains. The top soil to a depth of 6—9 inches is well mixed with sand and sifted leaf-mould and levelled after picking out all stones, rubbish, etc. The surface is made fine and smooth, and then pressed down gently with the palm or better still, with a soil-leveller, which is nothing more than a plank attached to a handle, to get the full benefit of the capillary action of the soil particles, and watered some hours before sowing, in order that the soil may settle down. The seeds are sown in drills or broadcast thinly and evenly. Not only is much seed wasted by thick sowing, but also the growths crowd each other with the result that seedlings get lanky and spindly giving rise to inferior plants. The seeds are covered with fine soil to the necessary depth, this being usually the thickness of the seeds themselves. The
METHODS OF PROPAGATION OF PLANTS

The bed is then watered with the "rose" of a water-can, using a finer "rose" for small sized seeds which are covered only lightly. To minimise evaporation from and to preserve the moisture in the soil, it is covered with shade. Bamboo thaties may be put over the beds at a distance of about six inches from the surface. The soil is kept moist by supplies of water when needed. After germination, more and more sun is daily allowed to the young seedlings, which are thus gradually hardened. The shade is removed finally after a few days. If seedlings are close together, they are thinned by pulling out some. They can even be transplanted, if they are too valuable to be thrown away, in which case they require to be removed from the soil with great care, after wetting it sufficiently. Seedlings of several kinds are best transplanted ("pricked") to encourage growth of fibrous roots. If seeds are fairly large as those of Nasturtiums, Balsams, and Sunflowers, it would be economical to sow them in drills convenient distances apart, as the operation of thinning is then confined to one direction and reduced to a minimum. Seeds of hardy kinds, which are smaller than the above, such as those of Asters, Pinks, Phlox, etc., are best broadcast in seed beds. Very delicate kinds are best sown in seed pans or seed boxes as they can then only be managed easily.

Shallow pans or boxes 4 to 5 inches deep are used for sowing seeds. These have one to three holes in the bottom for drainage. Against each of the holes is placed a crock with its concave side down. Some pieces of crock are then put at the bottom of the pan, the larger pieces being put below and the smaller ones broken to the size of coffee seeds above, all together occupying a depth of about an inch or an inch and a half. Some coarse sand, two or three handfuls, is sprinkled on the crock pieces, to prevent the soil from clogging the drainage. The pan which is thus
provided with efficient drainage is filled to half an inch from the top with the soil mixture recommended above. After levelling it, it is lightly pressed down and watered with the "rose" of a watering can. When the water has drained away, the seeds are scattered on the soil, distributing them thinly and evenly over the entire area. They are covered, then, with fine soil to the required depth, which is generally the thickness of the seed. Again, watering is done with the rose, not disturbing the seeds and the covering soil. Very small seeds as those of Antirrhinum, Petunia, etc., are mixed with 8 to 10 times their bulk of fine sand to ensure even distribution while sowing. They have naturally to be covered lightly just hiding them from view. Seeds, much smaller than these, as for instance those of Gloxinia, Begonia and Fern spores, which are like particles of dust, are bulked as usual and dusted on the surface of the soil and, not covered at all. In the case of minute seeds, it is best to water the pan from below through

Fig. 31.

A = Seed pan covered with glass plate after sowing.
B = Shows manner of watering the soil from below.
C = A tiny seedling taken out of the soil and held in the fork ready for pricking.
D = Shows the depth up to which seedling is to be pricked.
E = A pan full of pricked seedlings.
the drain holes. For this, the pan is allowed to stand in a shallow basin of water, with the level of the water in the basin below the surface of the soil in the pan, till the water rises through the drain hole to the surface of the soil moistening it. After watering, the pan is covered with a sheet of glass to preserve the moisture inside, and removed to a shady situation. When the soil begins to get dry, it is watered carefully as before. Too much of water is harmful as it rots the seeds by excluding air. Any moisture collecting under the glass is wiped off every morning and evening.

**Care to be taken of seedlings.**—When seeds germinate and seedlings show themselves out of the soil, they are placed close to light lest they grow tall and lanky. They are watered with great care. If too liberally watered, they damp off. If the soil on the other hand is kept too dry, the young seedlings shrivel. Just enough moisture to keep the soil just moist and no more is needed. If in spite of the best care, seedlings do show a tendency to damp off as could be seen by some of them turning brownish near the junction of the stem with the soil and falling over, some sharp sand or preferably charcoal or sulphur dust sprinkled over the surface of the soil may prevent further loss.

The proper stage for "pricking" or for the first transplanting of seedlings differs with different kinds of plants, but in most cases, it is best done as soon as the first pair of true leaves are formed. With the help of a small piece of flat wood, seedlings are gently, without damaging their roots, levered up the soil, which is previously moistened; the clump of soil is gently broken by light pressure of the hand and the seedlings, if too close to each other, are taken out individually with care not injuring their roots, and planted again in slightly richer soil in seed pans or boxes, using a dibble for making holes in the soil for the reception of the seedlings. They are set \( \frac{1}{2} - 3 \) inches apart, seedlings of rapid growing plants being placed at greater distances than slow growing kinds. Seedlings, very minute in size, as those of Begonia and Gloxinia are best lifted with the help of a narrow thin flat piece of wood into which a small notch is cut in the middle for holding the delicate plants, which are otherwise too small to handle. Transplanting is done to increase the fibrous root system and make strong stocky plants.
Some kinds as Asters and Pinks are best transplanted twice before planting out. After each transplanting, the seedlings are removed to shade till they establish, and then admitted to more and more sun gradually; they are to be watered very carefully too. Seed-pan are to be watered only after some time after they are removed to the shade. A sure way of killing young seedlings would be to water them while out in the sun, when the soil round about them is hot. It is necessary that light should be evenly distributed over seedlings. If it reaches them only from one direction, they turn towards the light, elongate, topple one over the other, spindle and die.

**Special treatment in sowing certain seeds.**—The seed coat varies in its thickness and texture with different species. If it is thin, moisture soaks in and reaches the germ of the seed soon, stimulating it to germinate quickly. If it is thick and horny, moisture does not enter the seed for a long time, requiring some artificial aid to soften the shell to admit water inside. Hard coated seeds as Canna are best soaked in warm water and kept moist for three or four days before sowing; they are often left coated with a paste of cow-dung and water for the same purpose; they may be filed through, not injuring the embryo; the method chosen in each case depends upon the degree of hardness of the seed.

**Depth of sowing.**—The depth to which seeds are to be sown, varies with the species, the nature of the soil, the season, etc. As a general rule, seeds may be covered to the thickness of their own diameter. If buried too deep, they do not get enough oxygen to breathe, the soil gets contaminated with excess of carbonic acid gas collected, with the result that they decay; even if they sprout, they may not have vitality enough to push through the depth of the soil. Generally speaking, the bigger the seed, the deeper it is planted. Palm seeds, for instance, are sown at least an inch deep, so that they may have a certain amount of moisture always available to them.

**Beware of ants.**—Where ants abound, seed pans and seed beds should be protected from them. They either carry away the seeds or damage them. Boiling water is poured over the soil before sowing to drive them away. Seed pans are best placed on stands kept in water.
PROPAGATION FROM CUTTINGS

What is a cutting.—Next to seed-sowing, the commonest method of propagating plants is by cuttings. Any portion of a plant, a piece of stem, leaf or part of a leaf, a piece of root or root-stock, which has been removed from a plant with the object of inducing it to strike roots and thus begin an independent existence is called a cutting. Thus, there are stem cuttings, leaf cuttings and root cuttings. The sap accumulates at the cut end, forming a cellular thickening called the callus, from which roots emerge in course of time.

Multiplication by cuttings.—Multiplication by cuttings is a cheap and convenient method of raising several kinds of plants. It is resorted to when seeds are unobtainable and when it is desired to keep a stock true to type. While cuttings of some kinds of plants emit roots readily, even by mere contact with moist soil, there are others which do not root at all; again, there are others, which root with difficulty, requiring such aids as the propagating frame and the hot bed. Why plants differ so much in this respect is not known.

Kinds of cuttings.—The following table, taken with some modification from Bailey's Standard Cyclopedia of Horticulture will show at a glance different kinds of cuttings which are employed to propagate plants:
Cuttings.—

(a) Stem

Growing wood

Soft, e.g., Fuchsia, Coleus.

Hardened, e.g., Rose, Croton.

Ripened wood

Long, e.g., Poinsettia.

Short, e.g., Vine.

(b) Roots or root-stocks

Long.

Short, e.g., Bread Fruit Tree.

(c) Leaf

Divided, e.g., Begonia Rex.

Bulb scales, e.g., some Lilies.

Entire, e.g., Echeveria, Saint Paulia.

Choice of cuttings.—Cuttings have to be taken from only healthy plants. The nature of cutting that would successfully root varies in different kinds of plants. Very recent and tender growths, generally do not make good cuttings, as they wilt and die for want of enough reserve material in them, besides being easily susceptible to fungus attacks. On the other hand, too hard and firm tissue has cells, dormant and inactive for fresh root formation. Hence, cuttings of moderately firm texture have to be chosen in the generality of cases. When in doubt about the texture of the cutting which would give the best results in particular kinds, cuttings of varying degrees of firmness could be tried for future guidance. As a general rule, there is a greater chance of cuttings of soft wood taking root than of hard wood; in the case of rapidly growing plants of good vitality, the proper condition for a cutting of soft growing wood may be determined by its readiness to snap, not bend, when bent back. Hard wood can be used as cutting, as long as growth continues in it. Fuchsias are generally propagated by cuttings taken from the soft terminal portions of the growing shoots, with three or four nodes in them. The same is true of Salvia and Coleus.
Geranium cuttings, if too soft, are liable to rot away; they should be hard and at the same time sappy. Some hardy trees and shrubs like Ficus, Citharexylon, and the Milk Bush are propagated by long cuttings of ripened wood inserted in the open ground itself, whereas in the case of Poinsettia, Plumeria, Croton, etc., shorter cuttings of 6 to 12 inches may be used. Cuttings of Grape vine are best taken from ripe wood, in lengths of 6 to 9 inches, each piece possessing at least two buds.

The position of the cutting on the parent plant very often determines the flower-bearing capacity and the vigour of the resulting new plant. In the case of Carnations for instance, the cuttings from near the base of the plant are comparatively grassy producing more leaves than flowers in the plants raised from them; those taken from the top portion of the plant give rise to weak plants; those from the middle portions of the plant result in vigorous floriferous specimens. Cuttings from strong and sturdy stems with short internodes furnish in better class of plants than those taken from slender weak shoots with long internodes.

There is no fixed rule with regard to the length of the cuttings to be taken. It varies with different kinds of plants and with weather conditions; a longer piece is more liable to wilt than a short one. The average length of soft-wood cuttings is from 1 to 3 inches. The average length of hard-wood cuttings is from 6 to 9 inches, as in the Rose, Crotons, etc.
Season for propagation from cuttings.—While tender soft-wood plants can be generally propagated throughout the year by cuttings, it may be observed that some kinds strike root with greater ease at particular times of the year. Generally, the best time for propagation from cuttings is about the commencement of the growing season. In the greater part of India, this is from August and September.

Medium for rooting.—The best medium for cuttings to root in is fine pure river sand. In the case of hard wood cuttings, the addition of a little red earth or loam to the sand makes the soil firmer and more retentive of moisture. There is no need for any kind of manure in the soil for rooting cuttings. A large amount of decaying matter in the soil, in fact, retards root formation. The same soil should never be used over and over again. The soil should have an assured drainage.

Kinds of stem cuttings.—Stem cuttings are of three kinds, viz., terminal cuttings, cuttings with the heel, and node or joint cuttings. Terminal cuttings are taken from the top portions of shoots. Figures 32 and 33 illustrate terminal cuttings.—A clean slanting cut is made just under a node. The lower leaves of the cutting are snipped, not torn off, so that a bare stem is left for planting in the soil. The upper leaves, if too large, are reduced to half their length, to minimise transpiration.
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Cuttings of plants with milky juice, as Poinsettia, Plumeria, Oleander, etc., are washed before planting them; they have to be laid aside after preparation for an hour before insertion in the soil. Large succulent cuttings as those of Cactus, Cotyledon, Pine-apple, are allowed to lie on the soil for two or three days before insertion; or, they may be put in sand, which is not watered for two or three days; under these conditions, they form a callus at the base, which prevents decay. Cuttings with the heel are those lateral shoots which are pulled off the main stem. Very often, these are more successful than terminal cuttings. The oval surface at the bottom which is rough is smoothened with a sharp knife, trimming the rough wood and bark. As in the terminal cuttings, the lower leaves are removed and the upper leaves are reduced in size. Mallet cuttings with small bits of branch attached to them are similar to heel cuttings. Cuttings are best planted as soon as they are severed from the plant. The wood should on no account be allowed to shrivel. If there is likelihood of delay in planting cuttings, they may be kept in water or wrapped in moist cloth. Cuttings may be inserted in specially prepared beds or in pots. Distance from cutting to cutting may be from 1 to 3 inches. Cuttings root with greater ease if they are placed very near the crocks or by the edge of the pot. A dibble should always be used for making holes for inserting cuttings in the soil. The cuttings are placed in the holes and gently pressed down, taking care that their bases reach the bottom of the holes and rest firmly on the soil. The soil is well pressed round the cuttings. Firming the soil is a point which is ordinarily overlooked with resulting failures. The cuttings are then watered with the rose of a watering-can so that they are not disturbed. The soil is always kept moist and not allowed to run dry at any time. Overwatering is to be avoided, however. Dampening them overhead with water from a syringe once or twice a day is attended with good results.

The absorption of moisture by a cutting is very negligible compared with the quantity of water lost by transpiration from their leaves. Unless, therefore, means are employed to minimise evaporation from around the cuttings, so that the water
lost by the cutting may as nearly as possible correspond with
the gain by absorption, successful results cannot be expected.
Bell jars and propagating frames are helpful for this purpose
and serve to preserve uniform heat and moisture around the
cuttings. The inside of the frame or bell-jars, as the case may
be is wiped free of moisture every day. The cooler parts of
the year are preferred to hot season for striking cuttings.

Another aid for speedy formation of roots by cuttings is
"bottom heat." The temperature of the soil is kept higher than
the superincumbent air. This stimulates the flow of sap to the
bottom and the early formation of callus and roots. Bottom
heat is generated by a hot bed, described elsewhere.

**Node cuttings.**—Thick, short-jointed stems as in Dieffen­
bachia, Alocasia, Dracaena, Anthurium,
etc., are cut into short lengths, each
piece having a node and a bud, and
immersed in pure sand with the buds
facing upwards. If the sand is kept
just moist, roots are emitted in course
of time at the nodes. Buds develop into
young shoots which emerge out of the
soil.

(b) **ROOT CUTTINGS**

Some plants can be propagated from cuttings taken from
the root, as for instance the Bread Fruit Tree. One to three
inch pieces of lateral roots with one or more buds in them
may be laid horizontally and covered with sand and firmed;
they may be planted vertically too, if they are more than three
inches long. The soil to be used may consist of equal parts
of sifted leaf-mould and sand.

(c) **LEAF CUTTINGS**

Propagation from leaf-cuttings is most advantageously
practised with many plants as Peperomia, Rex Begonia, Saint
Paulia ionantha, Gesnera, Bryophyllum, Kalanchoe, etc. Only
mature leaves, which are neither too old nor too tender, are
used. Young leaves are unsuited as their energy will be em-
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ployed in making their own growth and not for forming roots; old leaves are likewise unsuited, as they would have already exhausted themselves in the performance of their functions.

A

Fig. 36.

A—Leaf of Rex-Begonia with its petiole stuck into soil and its blade resting on it with the cut veins weighted down with pinches of soil put above.

B—Shows how a Saint Paulia leaf emits roots and forms a young plant.

The entire leaf or only a part of it may be used as a cutting, the method varying with the kind of plant. Peperomia is propagated by cutting back the leaf stalk to about half an inch in length and inserting it in moist sand with the blade above. Bryophyllum leaves will develop plants all round their edges if laid underside downwards on moist material. Rex Begonias may be raised by immersion of leaf stalk in moist medium as Peperomia; but if entire leaves are laid on moist and with the junctions of the main veins notched or cut and pressed into the soil, young plants develop at the notches.

Potting rooted cuttings.—Cuttings of all kinds are allowed to remain in nursery beds or in pots, until they strike roots. As soon as growth commences, the rooted cuttings are potted separately, the size of the pot to be employed depending upon the quantity of roots on the cutting. It is always advisable to begin with smallest sized pots possible and to increase the size at each shifting or repotting. For the first potting, the soil should contain a large quantity of sand and leaf-mould and very little of manure, which should be in well decomposed state.

Propagating or cold frame.—The need for glass frames and hot beds for securing suitable conditions for propagation by cuttings has already been emphasised. A propagating
frame, in some cases with, and in some without the aid of a hot bed, is quite indispensable for raising several kinds of plants from cuttings which do not strike roots without some device for preserving a warm and humid atmosphere around them, while at the same time allowing sufficient light for growth. A frame is an absolute necessity in a garden of any pretensions to size, where a large number of various kinds of plants have to be continually raised. It is advisable to set apart a place in a remote corner of the garden for one or more frames. They have to be placed in a shady situation, where they get only morning sun for an hour or so in hot places and in a sunny situation in cold regions. The frame may be fixed or movable. The fixed type consists of masonry walls on the sides with a covering of one or more glass sashes. These should be light and of convenient size to be handled by one person. The size of a frame can conveniently be 6 feet long, 3 feet broad, and 2 feet high. The roofing may be lean-to or gabled, proper slope being given to the roof in either case to drain off all rain water. The sashes may be adjustable at different angles to admit air into the frame, whenever necessary, by allowing them to rest on detachable stays. Frames erected in sunny positions are to be provided with awnings or 'thatties' to screen off severe rays of sun. The ground on which the frame is put, should be trenched, well drained and filled to a depth of 1½ feet with silver sand. Portable frames do not differ much from the fixed types, except they have sides made of wooden planks, tightly jointed and resembling a box without a bottom.
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Hot-bed.—A hot bed is a mass of properly prepared manure placed outdoors with a glass frame placed on top of it. Fermenting manure generates heat, which is used to raise plants from seed, root cuttings and force the growth of plants. A hot bed is made and managed in the following way:—The staple material in the formation of a hot bed is fresh horse dung,—not more than twenty days old. To this is added an equal quantity of freshly fallen leaves, lawn mowings, etc. If any part of the dung is dry, it is watered; the whole heap is turned over every other or third day for ten or fifteen days, moistening the portions of manure which might have been rendered dry by excess of heat evolved during its decomposition. When the manure ceases to heat up much, it may be considered safe for making the bed. Excessive heat of decomposition is disastrous to tender roots. The addition of leaves has the effect of ensuring a moderate and lasting heat, which would not be possible if only horse manure is used. A suitable place, as dry as possible, is selected in a sheltered situation. A hole is dug in the ground about 1½ feet deep and 1 foot longer and wider than the frame. Into the hole is spread the fermenting material, layer after layer, beating down each layer firmly before another is put on top of it. The material is put evenly so that it may not settle down more in one place than in another. The frame is then put in position and more dung mixture is firmed as before, so as to occupy a depth of 6 inches above the ground. Very often, the total depth of material used is 3 feet. A 3-6 inch layer of sand, is spread on the manure and the frame is closed. A stick, about 2½ feet long may be stuck into the centre of the bed to serve as a guide for testing the heat. Much heat is developed and rank steam is evolved which is let off by opening the covering. In about a week’s time, the temperature falls, and is 10—20 degrees higher than the shade temperature outside, when the hot bed is in a usable condition. Each day, the stick can be withdrawn from the bed and tested by clasping near the bottom with the hand; if it is violently hot, the bed is not fit for use and needs cooling down yet, the bed is not considered safe for use till the stick can be held comfortably. Pots containing cuttings may now be immersed in the sand, in the frame. The soil
soon reaches the temperature of the hot bed. The frame is opened every day, both morning and evening, to allow fresh air; the sashes are wiped on the inside to remove moisture; the cuttings are watered, when needed. Seeds may also be sown or cuttings inserted in the soil direct. The hot bed will keep its heat for a couple of months. Rooted cuttings or seedlings, as the case may be, are taken out of the hot bed and placed in a cold frame or in shade for a few days and thereafter gradually hardened to open air conditions.

PROPAGATION BY LAYERING

In the words of Lindley, "Laying (Layering) is nothing but striking from cuttings that are still allowed to maintain their connection with the mother plant, by means of a portion, at least, of their stem." These plants, which are difficult to raise by cuttings, may be successfully propagated by layering. In layering, advantage is taken of the fact that the sap returning from the higher regions of a plant to its roots is capable of forming roots at any place of suitable texture in the stem, constituting a separate and independent plant, which may afterwards be detached from the parent. Though in some cases as in Verbena, roots are emitted from almost every node by covering the shoots with moist soil, it is generally necessary to interrupt the flow of sap downwards to induce formation of roots, by one of the methods detailed below, some one method being better suited than others in the case of particular plants:—

1. **By bending, twisting, and strangulation.** A healthy branch is bent into the form of an arc and pressed into the soil and held in that position by means of a small stone put on the bend or by means of a hook. Jasmine, Oleander, etc., are propagated this way. A little twist of the branch at the bend or strangulation of it effected by tightly passing a wire round the stem hastens root-formation by interrupting the flow of sap at the bend.

2. **By tongueing or heeling.**—The branch of well ripened wood that will bear being bent down to the ground or to the soil contained in a pot is cut half way through with a sharp knife just under a node, passing the knife upwards forming a
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slit, 1—1½ inches in length, the length of the slit varying in the case of different plants. Thus, a 'tongue' is formed and it is kept apart from the other part of the stem by inserting a piece of match-stick or crock or similar material into the slit. All leaves are removed from the portion which would go under the soil. A basin is made round the plant, and it is filled with a mixture of leaf-mould and sand. The branch is gently raised, slightly twisted and pressed down in such a way that the tongue enters the porous soil vertically to a depth of 1 to 2 inches. Care is to be taken that the branch does not break or get otherwise damaged in the operation. The layered portion of the plant is then covered with soil which is well pressed round it. The shoot itself is held in position by a hook firmly driven into the soil as shown in fig. 38 or by a small but heavy piece of stone, as shown in fig. 39. Callus forms at the tip of the tongue, from which roots are emitted.

Fig. 38.

Shows manner of layering a branch.

S is the branch, a portion of which 't', is layered into the soil in the pot 'p' by making a tongue as in inset 't' or by removing bark as in inset 'r', on the stem. 'n' is the place where the notch is to be made later on.
in course of time. The time taken to root differs in different kinds of plants. When the callus is formed, which generally takes 4 to 6 weeks, a small notch is made on the parent stem above the layered portion, further interrupting the flow of sap to the layered part of the plant. The notch is deepened gradually, as more and more roots are formed, every week or fortnight, till the layer is severed from the parent plant. Roses and several other shrubs and trees are increased by this method. Even such tender plants like Carnations can be increased by tongue layering.

(3) By ring-barking.—Just under the node selected for rooting, the knife is passed round the stem, cutting through the bark. 1/2 to 1/4 inch below, another cut is made all round the stem in the same way. The bark between these circular cuts on the stem is removed, exposing the wood. See inset 'r' in fig. 38. Soil is then packed round the part so operated upon. Crotons and Dracaenas are propagated in this manner.

(4) By serpentine layering.—Serpentine layering is well suited for making a number of plants from a long running branch or shoot, as in creepers. As seen in fig. 39, the same branch is layered in a number of places, giving rise to a number of independent plants, when each rooted portion is separated from the parent at points crossed by the dotted lines 'a' in the figure.

(5) "Stem layering" or "gootying".—Stem layering is done in the case of tall stems, which cannot be conveniently bent down. Terminal portions of upright branches are stem-layered. It is done as follows:—A healthy branch with well
ripened wood is chosen. The stem is cut half way through, just under a leaf or leaf-scar, where it is desired the stem should root; then, it is slit upwards for an inch or so, as in separating a tongue, described above. The cleft is kept open by a small pebble. In some cases, the stem is ring-barked at the desired place as described above, in place of making a tongue. Soil is pressed round the part operated upon and it is secured in position by covering it with a piece of old gunny bag or cocoanut-fibre cloth or moss and bandaging it tightly, as shown in figures 40 and 41. The soil is kept moist by applications of water. The following device ensures continuous soil moisture. See fig. 40. An earthen pot with a small hole made in its bottom is suspended by its neck over the ball of earth. A clean knot is tied at one end of a piece of cotton thread-rope and the other end is passed through the hole in the pot, and drawn out till the knot sits tight against the hole, covering it. The rope is then wound round the gunny bag and firmly tied. Water is poured into the pot; it passes slowly through the cotton rope to the ball of earth, keeping it moist always. This device is very helpful in the case of plants which take several months to root and when
the stems layered are so high that they cannot be reached easily for watering. The pot is filled with water as often as necessary. A notch is made just below the ball of earth every two months, till the stem is separated from the parent finally. The method described above is known as “gootying” in India.

In place of the gunny bag, bamboo receptacles or two halves of a 3-inch pot may be used as shown in figure 42 to hold the soil round the stem. A close jointed hollow bamboo with an internal diameter of about three inches is cut into several bits under each joint. The bits are then split in the middle, the two halves of each bit, forming a receptacle for holding soil. The centre of each bit is cut semicircularly to admit the stem when the halves are brought round it. After the stem is operated upon as described above, the halves are brought together round it, keeping the cut portion about the centre of the vessel; the halves are tied together firmly and held in position by a small piece of stick tied crosswise to the stem. Into the bottom of the vessel are put a few pieces of charcoal or coarse sand, to close the crevice round the stem, if any, to prevent soil from running out. The vessel is then filled to about half an inch from the top with sand which is kept moist by supplies of water when necessary.

**PROPAGATION BY DIVISION OF SUCKERS, OFFSETS, RHIZOMES, ETC.**

Plants growing in clumps as Chrysanthemum, Michaelmas Daisy, Violet, Amaryllis, Tuberose, etc., consisting of old plants surrounded by smaller ones, are easily propagated by division.

**Suckers.**—Some plants form clumps with suckers from the stem or from the root or from both. Stem suckers spring from the base of the stem below the surface of the soil. Root
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Suckers arise out of adventitious buds formed on roots; these may be close to the stem or away from it. All suckers grow at the expense of the parent plant, getting their nourishment from the latter till they themselves develop roots and are able to start independent existence. Division of clumps is usually effected at transplanting time. Care is to be taken that the roots are damaged as little as possible. The outer pieces or parts are selected for replanting, as they produce more vigorous and floriferous plants than the parent plant at the centre which has exhausted itself. Each sucker with some roots on it is capable of furnishing a plant in course of time if it is potted or planted out.

Runners.—Runners are prostrate stems rooting at the joints as they creep along. The runners are cut close to the parent plant and started independently. Strawberry is propagated by runners.

Bulbs.—Bulbs, some kinds in large numbers, and some in a limited number, produce little bulbs exterior to themselves round their base, as in Amaryllis and the Tuberose. These smaller bulbs (offsets) are separated from the old ones and started individually. Some bulbs which do not freely produce...
offsets are injured at the core, for instance by cutting out the growing bud; then they produce offsets, from which they can be increased. In some other kinds of bulbs, as in Crinum and Pancratium, the flattened base is cut into three or four parts to give rise to bulblets, which are then separated and transplanted.

**Corms.**—Some corms like the Gladiolus produce small corms or off-sets, (also called spawns), as in bulbs, which can be grown to bloom in one or more seasons. Others like Caladiums are propagated by the eyes or buds which are formed on the old corms. Those eyes or buds are cut away with a portion of the old corms and started independently.

**Tuber.**—In the case of tuberous-rooted plants like the Potato, large number of tubers or underground swollen stems, bearing buds or node-like scars are produced; each of these is capable of giving rise to a new plant. The tuber is divided into several parts, each part having an eye or bud or sprout, in addition to a portion of the fleshy stock. Dahlias do not really bear tubers. Their roots are fleshy and contain much reserve food for use during the next growing season and they are attached to a condensed part of the stem or crown bearing one or more buds. Thus, Dahlia clumps are so divided that each piece separated has a part of the crown with at least a bud in it.
Rhizomes.—Rhizomes are creeping underground stems, producing aerial shoots above from buds and roots from below.

The Canna is the best example of a rhizomatous plant. It is raised by cutting the rhizome into bits, each bit having a bud in it.

PROPAGATION FROM PROLIFEROUS BUDS AND BULBILS

Several plants produce "aerial offsets" in the axils of leaves or on flower stalks or on leaves as on the fronds of certain Ferns, which are all capable of giving rise to new plants; they often drop off the parts of the parent plant to which they are attached when fairly mature, and look like veritable youngsters. They are independently started in small pots or sown like seeds in seed-trays and then transplanted. Agaves produce a number of young Agaves, called bulbils, on their flower stalks, like seeds. Several varieties of Anthericum produce on their flower stalks, young plants which develop roots, from which they can be propagated. Ferns like Asplenium bulbiferum produce babies in the form of nodules on their fronds. These,
when mature, can be started as young plants in small pots. The entire frond may be laid in moist soil, giving rise to a number of plantlets, from every nodule in course of time.

PROPAGATION BY GRAFTING

**Graft. Scion.**—Grafting is an operation in which two cut surfaces of the same or different plants are so placed as to unite and grow together. The plant or the part of the plant on which grafting is done is called the stock. The part of the plant which is inserted in the stock or grafted on to it is called the scion or the graft.

**Purposes of grafting and budding.**—Grafting serves several purposes:—(1) It is generally done to perpetuate and multiply varieties of plants which have been endowed with particular qualities and which cannot be transferred with any degree of certainty to their offspring from seed or which cannot be easily or speedily propagated by any vegetative means as from cuttings and layers. Guava seedlings, for instance, may turn out to be inferior to the parent kind.

(2) By using hardy disease-resisting stocks thriving in particular climate and soil conditions, any species which does not thrive under those particular conditions, can be grown successfully as a graft plant. For instance, loose-jacket oranges, grown on their own roots, die of die-back disease after some time, in particular soils. But the same oranges grafted or budded on seedlings of sour lime, are longer lived. Similarly, in the case of Apples, blight-resistant stocks are always used. (3) Weak growing species grafted on vigorous growing species are very often benefitted by a communication of vigour from the stock to the scion. (4) Grafts are often made to obtain rapid results. For instance, the Sapota takes 8—10 years to fruit from seed, and only 2 or 3 years from a graft. (5) Though generally, it might be observed that the stock and scion retain their individuality in the graft, it is true that in some cases, the stock has a decided influence upon the scion in producing some radical change, as for instance in rendering it more dwarf, more floriferous or fruitful, or in making
it produce fruits of better quality or flavour or the opposite of them. Thus, stock selection is of very great importance in fruit industry. (6) Grafting is sometimes useful as a reparative process, as in bridge-grafting, supplying new tissues to connect parts which are separated by wounds.

Physiology of grafting and budding.—To attain anything like success in grafting and budding operations, it is necessary that one should have a conception of the structure of the stem and a knowledge of the physiology of those operations. It has been mentioned in Chapter II that in grafting and budding, the object is to bring the cambium surfaces of the stock and scion in contact with each other so that they might unite by the activity of the cells of the cambium. Unless the cambium layers meet fairly well, the cells of the scion will not be able to get from the cells of the stock, the moisture which is essential for enabling the scion to pass down from its growing buds the material for forming callus and for securing the complete union of the stock and scion. Perfect union only takes place after the scion has made some progress in growth and leaves, which enable it to manufacture enough plastic material to heal the wounds completely and to provide uninterrupted communication between the cells of the stock and scion.

Choice of stock and scion.—There are some points which should be remembered in selecting stocks, in addition to those which have been mentioned above. The stock and the scion should be related, as varieties of the same species or as spec-
cies of the same genus. For instance, a Sapota cannot be
grafted on a Mango stock. Greater the affinity between the
stock and the scion, better is the union. Again, the natural
vigour of the stock and the scion should be the same as far
as possible. It may sometimes be preferable to have the
stock in a state of vegetation slightly in advance of the scion,
as otherwise the flow of sap is insufficient to supply the wants
of the scion. Shoots selected as scions should be firm and
well ripened. Watery shoots are valueless. The scion should
be selected from branches and branchlets of trees or shrubs
which are noted for their superior flowers or fruits, as also
the freedom with which these are borne. Similarly, in any
one tree or shrub itself, same considerations should prevail
in selecting the scion.

Grafting operations should be carried on in shade in
moist growing weather and the parts operated upon should
be protected from sun and air until union is complete. For
this purpose, the part operated upon should be covered over
with grafting clay or better still with grafting wax to ex­
clude air and rain.

Grafting clay.—Grafting clay is made by mixing two
parts of clay or fine soil with one part of cow-dung and
kneading it with a little water.

Grafting wax.—Grafting wax is prepared in the following
manner:—2 ounces of beeswax are melted and 8 ounces of
powdered resin are added little by little stirring the mix­
ture. The fire is then removed and 8 ounces of linseed oil
are added to the mixture gradually until the whole becomes
a tenacious mass. The whole stuff is then kneaded in hot
water.

Wax-tape.—Wax-tape for binding the parts in budding or
grafting is made as follows:—Thin muslin is torn into strips
of ½ to ¾ inch breadth and rolled on wooden sticks. These
are dropped into a mixture of two parts by weight of bees­
wax, one part by weight of paraffin wax and three parts of
resin, kept melting over a slow fire. The sticks are allowed
to remain in the melting liquid for about ten minutes and
then taken out and dried. The strips of waxed cloth may
be unwound from the roll before use.
METHODS OF PROPAGATION OF PLANTS

Kinds of grafting.—There are several kinds of grafting devised by gardening ingenuity, some one method being more serviceable, than the other in particular cases and circumstances; but the principle involved in all methods is the same, namely, the bringing together, of the cambiums of the stock and the scion. The following are a few important methods:—

1. Grafting by approach or inarching is the simplest kind of grafting, which is largely practised in India. This method is chosen when the trees or shrubs bearing the stocks and scions are so near each other that their branches may be bent and united. Graft Mangoes, Sapotas and Guavas are, for instance, made this way. Seedlings of the thickness of a lead pencil, either grown in pots themselves or lifted into pots and established therein are raised to the branch.

Fig. 40. Grafting by enarching. The stock and the scion are cut at c c after union to get the graft plant R.

The cambium layers are in contact with each other, and then bandaged together firmly with grafting tape or raffia and covered over with grafting clay or wax. For the stock and the scion to unite, it takes four weeks to three months or more, according to the kind. The stem of the scion is notched every fifteen
days after the second month under the part operated upon till
the stock is able to maintain the new plant grafted on it. Then,
the head of the stock above the point of union is cut off and
the scion is severed from the parent plant by cutting it com­
pletely clean below the point. The cut surfaces on the stock
and scion in the graft are smeared with white lead or a thin
splash of tar to prevent decay and keep off borers. Inarching
can be done during any part
of the year, but the time best
suited for the purpose is
when the stock and scion are
in vigorous growth.
The other methods of graft­
ing, in which the scions are
not on their own roots, are
not quite successful on the
plains of India.

(2) Whip or tongue graft­ing is most generally prac­
tised as the scion much soon­er covers the stock in this
method than in others. Whip­
grafting is especially suited
for small stocks or branches
of an inch or less in dia­
meter. It is necessary
that the thickness of
the stock and the scion
is the same. The head
of the stock is cut off
in a sloping manner end­ing above a node. The
cut may be conveniently
three to four inches long
according to variety. A
notch is made about the
middle of the sloping cut,
downwards about half an
inch deep. The part of
the scion which is of the same dimensions is cut similarly in shape in a slanting direction and a slit or tongue is made in this slanting cut in the middle to fit into the notch in the stock. After the scion is fitted on to the stock, the parts are bandaged together tightly and covered with grafting wax.

(3) If the diameter of the stock is much greater than that of the scion, cleft—or slit—or crown-grafting methods are adopted. Old trees are renovated by heading back all the branches and engrafting them with young growths. Two or three grafts may be inserted on each branch to make provision for failures. In slit-grafting, the crown of the stock is cut across in the proper season and a longitudinal wedge-shaped slit, two to three inches long is made in it with a strong knife or chisel. The cleft is held open by a wooden wedge till the scion is prepared. The scion with a bud at its top is selected and the lower portion of it is properly shaped to fit exactly into the cleft in the stock. The stock and the scion are fastened together and waxed.

(4) Root grafting is illustrated in figure 53. Root cuttings of Apples may be grafted with select scions as seen in the figure and inserted in soil for rooting.

(5) In ornamental gardening, herbaceous grafting is resorted to for perpetuating certain soft-wooded plants. The stock is horizontally cut just above a node or a leaf-base, at the place selected, which is not purely of a herbaceous nature but is becoming woody in texture. The leaves just under the node are left in tact but others occupying the region to be operated upon are removed. A slit is made in the centre of the stock to a depth of an inch or two and part of the wood on either side of the slit may be sliced away to make a shaped cleft. The scion is shaped after the manner of a wedge so as to fit
into the cleft in the stock; it is then inserted into the stock, and secured in position with coarse worsted or grafting tape, commencing the tying at the top and winding the turns down to the lower parts. The part operated upon is provided with a paper shield to protect it from the drying action of sun and air. A piece of moist cotton-wool may be placed round the part to keep it from drying up.

**PROPAGATION BY BUDDING.**

What is budding.—Budding is a form of grafting and it consists in inserting a mature bud with a piece of bark attached to it, taken from the plant which is desired to be propagated, underneath the bark of the stock plant in such a way that the nascent tissues of the stock and the scion (the bud) are brought into contact with each other and binding the part operated upon. In course of time, by the activity of the cells, new wood is formed which unites the stock with the bud. As the bud gets more and more united with the stock, it gets from it more and more nourishment and develops into a shoot carrying flowers and fruits. Budding is done on stocks of small diameter, about the thickness of a pencil, at a time when the bark separates easily from the wood. The bud employed as scion should be mature but not too far advanced in growth.
Budding is an operation which is easily learnt by amateurs, requiring some amount of care, definiteness of hand, and practice for success. With enough number of stocks at one's disposal and obliging friends to supply buds from desired plants, budding is a cheap and expeditious method of making a collection of Roses. And, budded plants are more valuable than grafts in the case of such kinds as Citrus, Apple, Peach, etc.

**Conditions for successful budding.**—Shield or T-budding is the method most generally employed. The following points have to be borne in mind to ensure success in budding:

1. The stock selected should be hardy and suited to the conditions of particular soil and climate.
2. There should be close affinity between the stock and scion as varieties of the same species or as species of the same genus.
3. The sap should be in active circulation in the stock so that the bark separates readily from the wood.
4. The bud chosen should be neither too young and undeveloped nor too old and overgrown. It should be selected from neither at the base nor too much at the top of the shoot.
5. The operation should be performed in as short a time as possible, as nascent tissues are vitiated by exposure to air. The bud should never be allowed to dry up by being exposed to sun and it should be removed from the parent plant and prepared just before the operation. If removed earlier, it should be preserved from wilting by keeping in water.
6. The bud should be inserted without any tear or injury to the tissues. This involves the careful removal of the wood that is attached to the bark containing the bud and the clean separation of the bark of the stock from the wood for the insertion of the bud. A budding knife, which is furnished with a flat handle, is very serviceable for lifting the bark without injury to the tissues.
7. Budding can be performed during any part of the year but the time for most successful results is August and September. Strong sun and rain are injurious. Best results are obtained if the operation is done in dull cloudy weather and in the cooler parts of the day.

**Budding-how done.**—Shield—or T-budding is done as follows:

It is advisable to bud as low down on the stock as possible, unless one wants to make standards of some height.
All side shoots on the stock are rubbed off up to the point selected for budding. All suckers from the base of the stem are also removed, as these side-shoots and suckers take a good deal of nourishment for their growth without leaving enough of it to the stock for supplying the growing bud, after budding. A horizontal cut is made across the rind and quite down to the wood, as at 'a' in the figure D, on the stock about half an inch above a bud 'x'. From the middle of this incision, a longitudinal slit 'a b' about an inch long, is made so that a cut, shaped like the capital letter T, is formed by drawing the edge of the knife downwards in a line through the bud 'x'. Care is taken to cut through only the bark without injuring the wood beneath. The bud at 'x' is shaved down to the level of the bark; the bark on either side of the slit 'a b' is gently raised with the flat handle of the budding knife, without tearing or injuring it in any way. Now, the stock is ready to take the bud. A suitable bud is chosen from a young shoot of the current year. With a clean sloping cut 'cc' made by inserting the knife about half an inch below the bud and passing it upwards and inwards till under the bud
and then outwards in such a way that a piece in the form of an escutcheon or shield with the bud in its middle is detached from the shoot. The piece contains a slip of bark with a wood bud on it and a small piece of wood behind it. The part of the wood which is attached to the bud is then carefully removed. For this purpose, the point of the knife is slipped between the wood and the bark at the upper end of the piece, the wood is raised a little so that it could be gripped between the knife and the finger, and then pulled away from the bark with a jerk. In removing the wood from the bud, it is important that the core of the bud or the eye is left in and not withdrawn from the bark. In other words, the small bulge which forms the base of the bud is neither to be injured nor removed from it. Thus a shield-shaped piece of bark containing a wood-bud with the leaf on the underside is obtained. If the underside of the bark presents a little hollow behind the bud, it is useless and thrown away, and another bud attempted. The blade of the leaf is cut away leaving a portion of the stalk. Holding the bud with the leaf-stalk, it is introduced into the slit ‘a b’ from above after opening it out on either side with the handle of the knife; it is then pushed down gently with slight pressure so that it is placed smooth between the rind and the wood of the stock and the bud occupies its natural position at ‘x’. Any part of the bark attached to the bud and which is too long for going into the slit ‘a b’ is cut off. After exactly fitting the bud into the stock and allowing the bark of the stock to return to position over the bark of the shield, the shield and the stock are tied closely round with raffia or strands of plan- tain fibre, beginning below the slit ‘a b’ and proceeding to the top of it, leaving the bud with its leaf-stalk uncovered and peeping through the turns of the tie. The knot is tied above the slit. The operation is now finished. It should be done as quickly as possible to prevent the bud from getting dry. The bud is shaded from severe sun by a paper shield or some other device.

Three weeks or a month after the buds are inserted, they are examined to find out if they have “taken.” Those which
are black and shrivelled up are dead. Those which remain fresh and plump have joined with the stock. If the operation is successful the bud becomes fresh and full, the shield unites with the wood firmly and the leaf-stalk drops off. At this time, the bandage is loosened so that it may not clench the stock and injure or destroy the bud. After a month more, the bandage may be removed altogether. All shoots which push out from below the bud are to be rubbed off. When the bud has developed into a shoot, the stock is cut off about three inches above the bud and the cut surface is smeared with white lead or a thin splash of tar. The short length of stock thus left above may be useful to fasten the new shoot developed out of the bud and thus prevent it from getting blown off by wind. After a few more months, the stock is further ‘headed back’ close to the bud. When this is done, the whole effort of the stock is directed to the inserted bud. Thenceforward also, side shoots and suckers, if any, from the stock, are removed constantly.

In patch budding, a rectangular patch of bark is removed from the stock and a similar patch removed from the plant to be propagated is fixed exactly into the depression and tied firmly round with raffia or plantain fibre, after smearing a small quantity of grafting wax over the parts.

MAKING NEW VARIETIES

It is the ambition of every garden enthusiast to raise something new which will be welcomed by his fraternity as an acquisition. New varieties can be easily raised by an observant amateur in one of two ways:—(1) from seeds, obtained by cross-fertilisation and hybridization of flowers of two different species, or two varieties of the same species, or of two species belonging to the same genus, and (2) by vegetative propagation of ‘sports’, and fixing them, as mentioned below.

The transference of pollen from one flower to another is very simple and it forms the essence of plant breeding. In many flowers, the male and female parts, the stamens and the stigma respectively, are easily distinguishable; in others, they
are identified easily with a magnifying glass and a knowledge of botany.

The first necessity in cross-breeding is to emasculate the flower and this is effected by removing the anthers holding the pollen grains of the flower, which is to be the seed-parent. The second necessity is to protect the stigma from possibility of chance fertilization by the agency of wind, insects, etc., by enclosing the emasculated blooms in thin muslin bags.

At the correct moment, when the surface of the stigma is most receptive with the sticky honey on it, (this differs in different kinds of flowers), the pollen from the selected flower is transferred to it; a small camel hair brush will be found serviceable for this purpose. The flower which has been thus cross-fertilized, is bagged till the stigma withers and cannot receive any pollen. The bag is then removed, the seed pod gradually develops and ripens, when the seeds are collected.

There are however some limitations to the possibility of effecting crosses. There must be close affinity between the two flowers selected as varieties of the same species or as two species of the same genus. For instance, it is not possible to cross a Carnation with a Corn Flower. In some rare cases, bigeneric hybrids have been raised, as Laelia Cattleyas (orchids). Though chance fertilization has resulted in adding to the list of novelties, the hybridizer should try and work up his creation to his aim, which should be to get a new thing, which would be an improvement upon the parent plants. At the same time, it is necessary to mention that it is impossible to forecast with certainty what would be the nature of the cross. It is always shrouded in mystery, and it is this which makes the pursuit so very fascinating.

**Sports and sporting.**—Any departure from the normal in the several parts or entire plants themselves is called sporting. All or any part of a plant is liable to change sometimes, the reason for this change being unknown. Sporting may be observed in flowers, leaves, stem or root. Where only red flowers are expected from seeds collected carefully from a red flower, a white flowered plant may come up as a freak, or in any red flowering plant, a white flower may be pro-
duced. If seeds are collected from such white flowers and sown, it is just likely, a number of white flowered plants may be secured, and thus the variety may be fixed by further selection. Bougainvillea Mrs. Wathen is a sport of the scarlet-crimson flowered kind, B. Mrs. Butt. A branch of Mrs. Butt produced fine orange coloured sprays of bracts and this was perpetuated by vegetative propagation of the shoot. Though the variety has been fixed fairly well, one finds sometimes Mrs. Wathen "reverting" to Mrs. Butt or bearing orange coloured bracts on some branches and scarlet-red bracts on others. Many new varieties of Roses are but sports of some old varieties. New varieties in Crotons are often made by propagating branches and shoots which bear foliage characteristically different from the normal. A Pentas carneae, with leaves variegated green and white has been likewise produced. A sporting shoot is propagated by cuttings, by layering, or by grafting; and thus the sport is, if possible, "fixed." In other words, its characteristic is perpetuated.
CHAPTER VII

PLANTING AND TRANSPLANTING

Two familiar operations.—Planting and transplanting are familiar and essential garden operations. Planting consists in transferring young plants, shrubs and trees from nursery beds or pots to their permanent places in the garden. Transplanting consists in lifting plants bodily from their positions and removing them to more desirable or agreeable places and planting them there in new and better soil. Several kinds of plants are benefited by one or more shifts, being stimulated to vigorous and healthy growth, by the increase of fibrous roots. In the routine of gardening, transplanting is also resorted to for filling up vacancies or replacing weak and unhealthy plants with fresh and vigorous ones.

How seedlings are transplanted and then planted out.—Though the expressions planting and transplanting are familiarly used in connection with trees, shrubs, and larger plants, it may not be out of place here to refer to these operations with regard to seedlings of annuals and other young plants from the nursery. Before finally planting these out in beds or potting them, they are gradually inured to open air conditions, as described in pages 61 and 62. For planting them out, the flower beds or borders, as the case may be, are dug up to a depth of about a foot and a half, the soil is mixed liberally with well decomposed leaf-mould and manure, at least a fortnight or two before planting. A day or two prior to planting, the clods of earth are broken up, the soil is made fine and smooth and levelled and copiously watered to render it soft and mellow for planting. The positions to be occupied by the young plants are marked out; the plants are set at such distances apart that when fully grown, they would just touch each other. For marking out the places for the young plants, a bed-marker may conveniently be used. The young plants are taken out of the seed-beds or seed-pans with as much of soil attached to their roots as possible, without dan-
maging them, and placed in fresh soil in holes made for their reception with a dibber or a trowel. The holes are then covered and the soil pressed round the stems on the roots. When the planting is finished, there are to be no depressions in the soil round the stems. The bed is then copiously watered. The plants are shaded with green twigs or bamboo thatties held by supports. Till the plants are well established, no more water than is necessary to keep the soil just moist is to be supplied. The young plants may however be sprayed with clear water, both morning and evening with advantage. The supply of water is gradually increased with the increasing growth of the plants. The twigs or thatties are removed completely after four or five days by which time the plants may be expected to establish themselves.

Season for planting and transplanting shrubs or trees.—The best season for planting or transplanting shrubs and trees varies in different parts of this country. Where rainfall is moderate, the beginning of the rainy season is best suited for the purpose. Plants which are natives of cold countries and which grow vigorously in the cold season such as the Rose, do better when planted out during the close of the rainy season. In districts where rainfall is excessive, planting and transplanting operations are best postponed till about the closing of the rainy season. But, all robust plants may be planted or transplanted during any part of the year, with proper attention being given to several important details of the operations.

Transplanting failures.—Transplanting involves to some extent at least a destruction of the plant’s root system. There is a loosening of its attachment to the soil and its progressive activities are arrested for a great part for the time being. Thus transplanting is rather a violent operation, considered from the standpoint of the plant and hence requires to be done with very great care to be successful. Care is therefore to be taken that the plants recover from this set-back as rapidly as possible. Certain conditions are necessary for the rapid recovery of plants to active growth. Some of these are dependent upon the nature and structure of the plants themselves.
PLANTING AND TRANSPLANTING

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and some on the prevailing weather and climatic conditions. Soft-wooded plants transplant better than hard-wooded plants; plants in dormant state transplant better than those in active growth; and young plants establish sooner than old ones. A cool and moist weather is preferred to a hot and dry one; evenings are better suited than mornings or afternoons, as plants refresh themselves during the cool hours of the night. To overcome the dangers of transplanting, the soil is well prepared and kept moist, not allowing it to run dry; part of the top of the plant is removed usually to minimise loss of water by transpiration; some shade is provided till the plant establishes itself well. Overhead watering by means of a syringe, during the hot hours or occasionally when the leaves wilt, refreshes the plant to a great extent. The stem and branches of trees transplanted are covered with straw which is kept moist by syringing water on it to remove loss of water by the plant as much as possible.

Planting of trees and shrubs.—After marking out the positions for planting, holes are made at least a foot and a half wider and deeper than the roots will occupy when they are spread out. It is best, however, to prepare, a couple of months

[Fig. 56.-I]

I. A—Shows too shallow planting.
   B—Shows correct planting.
   C—Shows too deep planting.

II. To show how roots are to be spread out as in B, while planting.
before planting, pits about three feet cube, spacing them in such a way that the adjacent trees when fully grown do not touch each other but have some space between them so that all of them get uninterrupted air and light. In making the pits, the surface layer of soil, which is generally good, is kept on one side unmixed with the rest of the soil. If the soil is bad below, it is replaced with a mixture of about three parts of manure, two parts of red earth, and one part of sand. If the soil is fairly good, it is mixed with manure; sand is added to the soil if it is heavy and the hole filled, using the top soil for filling the upper portion of the pit. The bottom of the hole is forked for drainage. This is further assured if a 4—6 inch layer of broken bricks and stones is spread on the bottom of the hole and this is covered over with dried leaves or straw to prevent clogging. In places infested with white ants, it is advisable not to have much manure in the soil, especially round the plant. The soil is watered through and gently pressed down, a day previous to planting, so that it may not further settle down after planting. While planting, a small hole is made in the centre of the pit slightly larger than the ball of earth holding the roots of the plant. A layer of sand is put into this hole of which the ball of earth is placed, the plant occupying the centre of the hole. Before putting the plant into the hole, all its damaged roots are cut back clean beyond all breaks and serious bruises. The roots are spread out in the hole and covered with sand. The hole is then filled up with fine soil, working the fine soil and sand between the roots. The soil is pressed down firmly by treading it down, leaving a shallow depression all round for watering. Care is taken that the plant is not buried deeper than in the nursery. A small ridge may be formed round the stem about two feet in diameter for watering. The soil is soaked...
through with water. In the absence of rain, the plant is watered once in three days liberally. The new plant is protected from severe sun, especially during summer, with coconut leaves or thatches or by planting some green branches of the Milk Bush (Synadenium grantii) or Milk Hedge (Euphorbia tirucalli) which also serve as guards, till the plants are well established.

**Transplanting of trees and shrubs.**—Transplanting of fully grown trees can only be successfully done with the help of elaborate machinery and hence it is rarely attempted in private gardens. Transplanting of young trees and shrubs is done in the following manner:—The plant must be lifted with as many roots as possible and replaced in fresh soil with the least possible delay. For this purpose, a trench is opened out at a suitable distance away from the stem which may vary from a foot to four feet according to the size of the tree or shrub; the soil is gradually removed till roots are reached; then in between the roots the soil is worked without injuring the larger roots that cross the trench. With long crow bars, the ball of earth holding the roots is gently lifted and loosened from its attachment with the rest of the soil. When the trench is sufficiently deep, the diameter of the ball of earth may be reduced to a convenient size with a fork, leaving the protruding roots uninjured. The tree is then bodily lifted taking care not to break the ball of earth and not to bruise the bark of the stem in the operation. All the roots with jagged cuts or bruises on them are clean cut back to healthy portions, as bruises and bad cuts bring on decay which will spread to the entire plant, killing it. The plant is then lowered into the hole prepared for it, which is wide enough to take in all the roots when spread out. Fine soil is worked in between the roots and the hole filled with good soil which is pressed down layer by layer. Replanting is done to the same original depth, if not one or two inches deeper. It is not safe to place any fresh manure in contact with the roots.

All broken limbs are removed. The leaf surface of the tree is reduced to limit transpiration; and the tree is cut back, if necessary, to concentrate the sap at the roots for formation.
of new roots to establish the tree. "Heading in" or cutting the top of the tree is most desirable in many species. If the tree has several strong long branches, each one of them may be reduced to one third its length. If the tree has one long branch with several smaller branches starting from this leader, each of the smaller branches may be cut back to half a dozen or more buds, according to the tree; if there are only a few of such branches, they may be reduced by two thirds of their length. The cut surfaces are all covered with white lead or a thin splash of coal-tar, or with a paste of cow-dung and red earth in tar water, to prevent fungus and insect attacks.

After the tree is planted, it is to be supported by being tied to a stout long stake, firmly fixed to the ground close to the trunk and protected from cattle by a tree guard. The stem may be advantageously wrapped round with moist straw to limit loss of moisture from the tree. The tree is then copiously watered soon after planting, so that the entire ball of earth and the new soil above and under it, are well moistened. After such liberal watering, it may not be necessary to water again for another three days or so. But the tree may be refreshed by spraying on it clear water both morning and evening. It might be provided with shade if the sun is severe.

The ground around the stem is watered freely every week or so, in the absence of rain. Too much water is not however to be applied, forming puddles at the bottom of the hole in which the tree is planted. Throughout summer, the transplanted tree should get its regular water supply, the soil being soaked through at each watering and not merely sprinkled on the surface. As the surface layer of earth is drying up each time after watering, it may be stirred to a depth of one or two inches, forming a dust mulch. This retards loss of moisture from the soil by evaporation and the tree is enabled to get the full benefit of the water supplied.
CHAPTER VIII
WATER AND WATERING

Supply of water to the garden.—To maintain a garden in good condition, an unfailing supply of pure fresh water is necessary. Brackish water, with a large percentage of alkaline salts, is thoroughly unsuited for growing a majority of plants. Such water can be rendered safer for use by addition of requisite quantity of lime.

The source of water is very often a well. The old methods of lifting water by the mote, the pecottah, etc., are superseded by the use of labour-and time-saving power pumps, driven by, electricity or oil-engines. There are several types of modern appliances for lifting water, suitable for deep or shallow wells, capable of delivering any required quantity of water. They can be handled and worked by any trained person.

An efficient scheme for watering a fairly large garden consists in pumping up water from the well to an overhead tank or reservoir and in conducting the water to the several parts of the garden through a system of distribution pipes. The farthest parts may conveniently be watered by means of hose pipes connected to the distribution pipes. The overhead tank may also be dispensed with by pumping water direct from the well into the distribution-main and regulating the supply to different parts of the garden by means of gland-cocks. Though such a scheme involves some initial outlay, it is cheap in the long-run on account of the saving of labour and trouble in carrying water in pots to the trees, shrubs and plants in different parts of the garden.

In the case of cottage gardens, hydraulic pumps may be fitted up to the wells, replacing the pulley and the rope. There are several makes of these, which are very serviceable, strong and durable, and easy to work. Automatic pumping sets with H.P. motors are recently introduced and they are becoming increasingly popular, as they occupy very little space and can be used in connection with narrow wells.
Necessity of water for plants.—It has been mentioned in Chapter II, that water is a constituent of plant food and that its value consists essentially in its solvent action, dissolving nutritive salts and thus in acting as a carrier of food to the roots of plants.

Watering is an important operation in the cultivation of plants. The health of a plant depends in a great measure on the exercise of judgment and care with which it is supplied with water. Success largely depends upon knowing when and how much to apply. Watering is learnt by experience, assisted by some knowledge of the commoner facts of plant physiology and soil physics and chemistry.

Plots of ground are watered either by irrigation through channels from the source or with a hose from a stored supply as mentioned above. Water cans with their spouts fitted with detachable ‘roses’ are very necessary for watering seed-beds, seed-pans or boxes, pot plants, etc. A coarse ‘rose’ is used for larger plants while a fine one is used for watering very delicate and small seedlings.

While too little of moisture in the soil checks the growth of plants and hastens their premature decay, too much of it soddens the soil, causes the roots to rot, and consequently causes the plants to suffer and die. A safe guide would be not to water a plant till the soil has become dry but not “powder-dry.” This condition is reached when the plant would suffer if watering is further delayed. Watering, whenever undertaken, should be done to soak the soil through and not merely to moisten the surface. Mere sprinkling of water on the surface of the soil is injurious. It merely chills the surface soil, and is soon lost by evaporation; besides it draws the tender roots to the surface to be scorched there by severe rays of the sun. The best plan for watering trees, shrubs, and large plants in beds and borders, would be to stir the surface soil to a depth of 1—2 inches with a fork, to apply water in the evening copiously wetting the soil through and hoisting the soil after a day or two, covering it with a “dust-mulch.” In summer, it would be advantageous to further cover the loosened soil with decayed leaves. This mulch would prevent rapid evaporation of moisture from the soil and prolong the
interval between any two waterings, and in addition preserve
the roots from the scorching rays of the sun.

The quantity of water and the frequency with which it is to
be applied depends upon a number of factors, chiefly the nature
of the soil, the nature of the plant, and the extent of evapo­
ration that takes place from the soil. Light soils require com­
paratively larger quantity of water than heavy soils which are
naturally of a greater water-holding capacity. Rapid growing
plants are more greedy of water than slow-growing ones. Soft­
stemmed plants, especially those with large leaves, need as a
rule, more water than hard-wooded plants. While soft-wooded
plants recover soon after application of water even if they flag
for want of water, hard-wooded plants suffer from permanent
injury and possibly death too, from the soil becoming too
dry. As a general rule, no plant in active growth should be
allowed to flag and suffer checks in growth from deficiency of
water. Plants in dormant state need no water or very little
of it, while those in active growth should be supplied liberally.

The seasons of active growth and rest of particular plants
should therefore be watched and watering should be accord­
ingly regulated. Small cuttings, or freshly potted or planted
plants are not in a condition to use much water till their roots
take hold of the soil and grow. Freshly planted seedlings and
young plants do not need to be watered for one or two days
after the first copious watering done soon after planting them.
As more and more roots are formed and the plants make pro­
gressive growths, the dosage of water is increased. Plants
with plenty of foliage on them require more water than those
with sparse foliage or those which have their stems pruned
back or which have lost their foliage on account of disease or
insect or fungus pests. Unhealthy plants are best kept on the
dry side till they show signs of renewed vigour. Plants in
shade require to be watered at longer intervals than those ex­
posed to sun, as more water is lost by evaporation from the
ground in the sun than in shade.

Plants are best watered either in the morning or late in
the evening. The hottest parts of the day should be avoided.
In the case of plants which need to be watered more than
once a day to prevent them from flagging, the times of water­

ing are so adjusted that no watering is done when the sun is hot. Plants in shade are preferably watered in the morning as excessive humidity of the atmosphere round about them during the cool hours of the night may subject them to attacks of mildew.

As plants are sensitive to heat and cold, water of a higher or lower temperature than the soil or the superincumbent air should not be applied. Well water, if it is too chill in the morning, should be allowed to stand over in a reservoir for a few hours. Waste water from bath rooms should be cooled down to atmospheric temperature before it is applied.

The several points which need emphasis in watering pot plants have been mentioned in Chapter IX.

A majority of plants are greatly refreshed by syringing clear water on them. But plants with hairy foliage as those of Gloxinia, Petunia and the like and some such as Maiden Hair Ferns with fine delicate foliage dislike overhead watering. Syringing is of great value. It dislodges the dust from the foliage, enabling them to carry on their functions of assimilation and respiration better; it checks loss by transpiration and thus enables the terminal shoots and young leaves to receive a sufficiency of sap from the stem; it keeps the air cool for the plant and this is greatly relished by several plants as Ferns and Palms; and lastly it keeps away many an insect pest.
CHAPTER IX

CULTIVATION OF PLANTS IN POTS

A horticultural necessity.—Cultivation of plants in pots is a horticultural necessity. It is one of the effective means of beautifying a garden. Pot plants are easily handled and removed conveniently to desired situations in the garden for purposes of decoration. In times of scarcity of water, a much larger number of plants can be grown in pots than in the ground. Plants such as tuberous-rooted Begonias, Gloxinias, Cinerarias, etc., which are not hardy enough to be grown in open ground are only grown in pots in sheltered situations. The same is true also of frail seedlings, which are either pricked into seed-pans or planted in 2 or 3 inch-pots singly, are established and hardened in them before they are planted out or shifted to larger pots.

Demerits of pot culture.—Pot culture is, however, not free from difficulties and disadvantages. It is doubtless true that it is opposed to the natural mode of growing plants in the ground. They are forced to grow in circumscribed limits in limited root space and quantity of soil with limited food contents and restricted aeration. They are further subjected to extremes of humidity and temperature, especially when placed in exposed situations. They are thus subjected to severe trials of endurance, as a result of which, they weaken and die unless they receive due care and attention. Potting is an interesting operation, which though simple, requires a certain degree of skill and practice to do it in the right way.

Pots.—Pots are made of burnt porous clay in various sizes, to provide the requisite amount of soil and root space to different kinds and sizes of plants. They have straight sides and are made wider at the top than at the bottom to hold the greatest bulk of compost where the feeding roots are and to facilitate easy removal of soil, intact with roots. (ball of earth) at the time of planting out or repotting. Usually, the vertical height of the pot is the same as the internal dia-
Pot sizes vary from 2 to 18 inches. Pots with a protruding edge at the top with a bulge or curve in the middle of the sides are to be avoided as they do not allow the ball of earth to be turned out intact. Only well baked, but not cracked pots, with uniform thickness throughout except at the rim where it ought to be double the usual thickness, are to be purchased. Small pots up to six inches should have a hole at the bottom, or at the side at the junction of the bottom with the side; larger pots should have one or two more holes according to size. Small 2-3 inch pots are used for potting singly very small seedlings during the first transplanting. They are shifted to larger pots, as the pots they are in are filled with roots. 6-inch pots are the most favoured for growing well rooted cuttings of several kinds of plants and small plants of all kinds. 9-inch pots are commonly used for growing almost all kinds of annuals. Large 15-18 inch pots are used for growing Dahlias, Cannas, large Crotons, shrubs, Roses, etc.

Pots of special sizes and shapes are used for special purposes. For seed-sowing, what are called seed-pan, which are broader than deep, are preferred. Again for plants like Ferns, which have a shallow root system, pots less deep than the normal are used. For seedlings of trees, as those of the Mango for instance, with long tap roots, long pots are used. Orchids which require plenty of drainage and aeration for their roots are best grown in pots perforated all over the sides. Pots used in the cultivation of bog plants, virtually consist of two distinct pots, one inside the other, a narrow space being left between the two for being filled up with water, damp moss, or sand to keep the soil in the inside pot containing the plant always moist.

Provision for drainage.—The first essential of good potting is the provision for efficient drainage. The water supplied to the plant should pass out of the pot after wetting the soil through. It should not be allowed to stagnate in the pot round about the roots. The drainage of a pot is effected in a simple way. For pots up to four inch size, a single piece of broken pot, which is known technically as a creck, is put against the drain hole, with its concave or hollow side turned
towards the hole. If extra drainage is necessary, a few smaller pieces of crock may be placed next to it. For larger sizes, a large crock is placed against each of the drain holes and some more pieces of crock are placed above these overlapping each other with their hollow sides all turned downwards. These smaller pieces are then covered over with a layer of broken pieces of the size of a pea. Finally, the crocks are covered with a layer of coarse sand or cocoanut fibre to prevent fine soil from getting washed down into the drainage material and clogging it. For small pots up to six inches or so, drainage to a depth of \( \frac{1}{2} \) inch will do. For larger pots up to nine inches, \( 1\frac{1}{2} - 2 \) inch depth of drainage may be necessary. Larger pots require a greater depth of drainage material. Pots for Orchids which require perfect drainage, have nearly \( \frac{1}{4} \) to \( \frac{1}{3} \) of their depth filled with crocks.

**How potting is done.**—After the pot is thus filled with crocks, suitable compost is put in to a sufficient depth with its centre somewhat elevated to a point. Fine sand is sprinkled on the soil; the plant is held in the centre and its roots are carefully distributed round the conically shaped soil; fine sand is again sprinkled on the roots covering them; then compost is put all round, gently firming it as each layer is put in, till about half an inch of space is left on top in the case of small pots and correspondingly more in the case of larger pots. When the potting is finished, the level of the soil is up to the first pair of true leaves in the case of seedlings, and up to the level of the mark on the stem showing the depth up to which the stem was in the ground or pot previously, in the case of all other plants replanted.
Repotting, why and how done.—Repotting of a plant is done for one of three purposes. A growing plant soon fills the pot with its roots and often needs a larger pot for satisfactorily continuing its growth. It is then "shifted" to the next larger sized pot, with its roots and soil intact. This operation can be done at any time of the year provided the plant is in a growing condition and its roots are ready to take possession of the new soil. Repotting is also done when the soil has got old and turned sour, in which case the ball of earth is broken up to free the roots from as much of the old soil as the safety of the plant permits. Repotting is, again done, to provide fresh rich soil for the roots; these are cut back, the ball of earth is reduced in size, and the plant is put again into the same pot. Repotting which involves the breaking the ball of earth and disturbance of the roots is only undertaken when the roots are beginning an active growth and not when they are dormant or resting.

Repotting.—Repotting is done as follows:—The plant to be repotted is watered an hour, or so before the operation for easy removal of the ball of earth from the pot. If the soil is dry, it is just likely the ball of earth will not come out easily and the plant will have to be pulled out damaging a number of roots. The soil is rendered too moist and is liable to give way while being turned out, if watered immediately before repotting. Keeping the right hand under the surface of the soil and holding the pot in an inverted position with the plant between the first and second fingers, the rim of the pot is gently tapped against a protruding object, such as the edge of the potting bench or the edge of another pot, keeping
the other hand on top of the inverted pot. The ball of earth comes out clean from the old pot; if however it does not come out the soil is pushed through the drain hole with the finger or a blunt stick to move it and still if it does not come out, the pot is broken to free the soil from it. All crocks under the ball of earth and all the superfluous and old soil are gently removed. From the ball of earth all round, decayed and superfluous roots are clean cut out with a sharp knife, and some of the thickest roots are carefully drawn out of the ball of earth to establish in the new soil round the sides of the new and larger pot. Then the plant is potted as described above. Usually repotting is done into the next larger sized pot, allowing about an inch and a half of new soil all round the old soil. If the roots are not many, after their necessary pruning back the plant is put into a new pot of the same size as before. Thus, the choice in the size of the new pot depends much on the nature of the plant itself and on the quantity of roots already present in the old soil. Soft-wooded plants require generally more fresh soil than hard-wooded plants. Plants with plenty of roots may not suffer much if they are put into a pot slightly too big for them.

The following are some important points that require to be attended to in potting or re-potting operations:

1. **Use clean pots.**—New pots should be soaked in water for about half an hour. Otherwise, they absorb too much moisture from the soil preventing the newly potted plant from making any progress. Old pots should be scrubbed both inside and out with coconut fibre and even washed in hot water to remove all dirt and moss, which would otherwise prevent good aeration of the soil. Cleaning also removes remnants of past disease, fungus spores, etc. But on no account should the pots be wetted immediately before use, as the new soil would stick to the pot and would interfere with aeration.

2. **Use clean crocks.**—Only clean crocks should be used. Old crocks should be well washed and freed from soil, lest it should be washed into the drainage of the new pot clogging it. Again unclean crocks may infect the new plant with disease if it contains remnants of past disease.
3. Use suitable soil.—It is necessary that each kind of plant should be grown in a soil mixture which is best suited for it.

4. Potting soil not to be quite dry.—The potting soil should be used in a moderately moist condition. A handful of soil pressed firmly should mould itself to the shape of the hand without dripping moisture and should at the same time crumble when it is disturbed without being so dry as to fall to pieces when pressure is released. If the soil is dry as dust, it cannot be easily worked and firmed. Further it will not be wetted entirely while being watered, as the water has a tendency to run down the sides without moistening the dry soil.

5. Pot firmly.—With most plants, it is desirable to pot firmly. By firm potting is meant, pressing the soil in the pot to such an extent that the plant cannot be pulled out easily. But firm potting does not mean certainly ramming the soil down very hard.

As a general rule it might be stated that soft-wooded plants require less pressure or less firm soil, while hard-wooded plants require a corresponding degree of greater firmness. Palms, Roses, Croton, etc., require the soil to be well firmed. Geraniums and Carnations do not thrive if the soil is too loose. Plants with fleshy roots generally require a comparatively loose compost. Soon after potting, watering is done through a fine-rosed can to settle the soil down round the roots.

6. Allow space at top for watering.—After firming the soil, there should be about half an inch of space in the case of smaller and one inch in the case of larger pots, at the top for affording sufficient room for watering.

7. Wet the soil before repotting.—Plants should never be repotted when the earth holding their roots is quite or nearly dry; it seldom gets soaked afterwards, when surrounded with soil of a moist nature through which water passes readily, leaving the dry part to remain as before. The plant to be repotted may be watered two to three hours before repotting.

8. Don't use oversized pots.—It is necessary to use some judgment in choosing the pot. It is safer to put a plant in a
CULTIVATION OF PLANTS IN POTS

pot slightly too small than too large for it. A plant in a pot too large for it with plenty of inert soil about its roots is in far greater danger of being injured by careless watering than a plant in a small pot filled with active roots. The latter soon recovers from wilting when it is watered but an overpotted plant which gets into bad condition by waterlogging and consequent sourness of soil seldom recovers. Unless there is fear of the plant getting pot-bound, that is, of becoming stunted in growth on account of roots filling all the soil and suffering for want of more root space, a plant is grown in the same pot, putting it back into the same pot at each repotting. Plants in small pots, when they grow and fill the pots with roots, are moved to next larger sized pots or those which are not more than two or three sizes larger than the old one.

As soft-wooded plants are generally vigorous growers, they are safer put into proportionately larger pots than would be desirable for slow growing hard-wooded plants.

9. Don't plant too deep.—Too deep potting is very harmful, especially to hard-wooded plants. Too shallow potting is likewise injurious as roots will not get a firm hold on the soil and will get shaken with every breath of wind. It is always safe to plant in such a way that the old ball of earth is not placed lower than what it had been previously.

10. Remove to shade after potting.—After potting, the plants should be removed to a shady place until root action commences afresh. After they are established, they are gradually hardened by admitting more and more sun to them, before they are actually put in the open.

11. ‘Plunge’ pots which are in sunny situations.—Pots left in exposed situations, especially those in which plants with large soft leaves are grown, are best plunged up to the brim into the ground or into larger pots with intervening space filled up with ashes or sand. This would prevent the sides from heating up and injuring tender roots. Plunging would also help to minimize evaporation of moisture and thus keep the soil, as far as possible, in an equable condition.

12. Feed by top dressing or with liquid manures.—The soil in the pot soon gets exhausted, partly due to its nutritive contents being washed away by streams of excess water per-
Colating through the soil after moistening it and coming out of the drain holes, and partly by their being used up speedily by the growing plant. Hence, pot plants should be supplied with necessary food now and then. This is done in one of two ways, by "top-dressing" with rich soil or by applications of liquid manure. Top-dressing consists in the removal of one to three inches of old soil from the top of the pot without damaging the roots and replacing it with fresh compost, particularly rich in manure. How liquid manure is applied has been dealt in chapter IV.

13. Examine occasionally for grubs.—The soil has to be examined now and then for grubs, which are very destructive on roots, ultimately causing the plants to die. When a plant looks unhealthy and its leaves are turning yellow and the soil is loose and holds moisture, one may expect grubs in the pot. No satisfactory and safe method of killing these worms of the soil has been found. The only remedy is hand-picking, which very often means disturbing the root system of the plant. When the soil is full of grubs, it is safest to pull out the plant and replant it in new soil.

14. Prune, generally, before repotting.—Plants are best pruned, sometime before they are actually repotted, allowing the new shoots to develop to some extent by that time. In the case of Roses and some other plants however, pruning is done after repotting, when the sap is rising satisfactorily and the temporary setback received during repotting is overcome.

15. Exercise care in watering.—Pot plants require to be watered much more carefully than those growing in the ground. Two common mistakes in watering pot plants are, applying too little or too much of it. If the watering is in excess of the requirements of the plant, the soil becomes sour for want of aeration. So, the soil can be prevented from turning sour by allowing it to run dry, but not so dry as to cause flagging of the plants. When the soil is quite dry, the danger is that any water applied runs through straight without soaking the soil. In this condition, it is best to leave the pot in a tub of water for some time. If there is not enough space at the top of the soil, watering will have to be done twice at in-
Thunia Marshalliana (Page 492)
(By Courtesy of Mr. L. Narain Rao, M.Sc.)

Laelia Cattleya (Page 489)
(By Courtesy of the Superintendent, Govt. Gardens, Bangalore)
 intervals of quarter of an hour or so. A good rule in watering pot plants is to do so only when the soil is fairly dry or when the plant is likely to suffer if it is not watered within a short time. Another good rule is to water thoroughly, if at all. One should not go about watering every pot equally. The needs of particular plants vary. Freshly potted plants, as seedlings and rooted cuttings, etc., require particular care in watering, as they easily suffer by either excess or deficiency of water.

If the soil in the pot is moist, a dull thud is caused by gently knocking the side of the pot with the knuckle. If the soil is dry, a sort of metallic sound is produced. The weight of the pot, when it is lifted, will also give an indication of the moisture in the soil. When the soil is approaching dryness, only so much of water is applied which is just enough to soak through the entire soil without overflowing through the drain holes. Excessive applications will result in impoverishing the soil very soon, by taking out of the soil, dissolved food elements, each time the watering is done. It is advisable not to water the pots when they are heated up by the sun. The hot hours of the day are to be avoided for purposes of watering. Certain plants require to be watered twice a day, especially in summer.

SOIL FOR POT PLANTS.

Soil mixtures—their constituents.—The soil for pot plants consists of a mixture of earth, manure, and other materials which are evenly distributed in it. As the compost plays a very important part in the life of a plant, as it is the medium which supplies water, food, and air to the roots, no pains should be spared to provide the best soil mixture for the plant. As the needs of different classes of plants vary, composts should be varied accordingly. The ingredients which usually enter into composts are loam, leaf-mould, manure, sand, charcoal, brick pieces and mortar rubble. The proportion of the several ingredients in the made-up soil is varied so that its texture and manurial value may be suited to the needs of each class of plants. Loam, generally, forms the basis of all potting soils. In our country, red earth, which is a kind of fairly heavy
loam containing iron, is used. It should however not be so heavy as to be sticky like clay. Generally, horse- and not cow-manure is used in our composts. The manure should have been well decomposed. Leaf-mould should have been thoroughly decayed and sieved through quarter inch meshes. Leaf-mould serves to render the soil porous and it also modifies the heat during decomposition of the horse manure in the compost and makes it safe for tender roots of plants. River sand should be used. It should not be very fine. Its particles should be large enough to render the soil porous even after it is well pressed in the pot. Brick pieces and mortar rubble are used for making the soil porous to a high degree, as is required in the cultivation of such plants as Cacti, Orchids, epiphytes like Bilbergia, etc. Charcoal has a charm for roots. It renders the soil porous like brick pieces; it helps it to remain sweet and not turn sour; it helps to prevent to some extent stagnation of water at the roots and it also prevents the plant from suffering from drought. Bone meal has an excellent slow manuring value and on account of its slow but sure action, it is used in almost all composts for pot plants which are not repotted to bigger sizes too often.

The following are some soil mixtures which are used for growing particular classes of plants mentioned below:

<table>
<thead>
<tr>
<th>Soil Mixture</th>
<th>Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Annuvils</td>
<td>3 parts Horse manure, 1 part Red earth, 1 part Sand</td>
</tr>
<tr>
<td></td>
<td>2 parts Leaf mould, 2 parts Manure, 1 part Loam, ½ part Charcoal</td>
</tr>
<tr>
<td>2. Soft-wooded flower plants such as Geranium, Violet, etc.</td>
<td>6 parts Horse manure, 4 parts Red earth, 3 parts Sand, 2 parts Loam</td>
</tr>
<tr>
<td>3. Bulbs and Tubsers such as Canna, Dahlia, etc.</td>
<td>2 parts Red earth, 2 parts Sand</td>
</tr>
<tr>
<td></td>
<td>4 parts Red earth, 4 parts Horse manure, 3 parts Sand, 2 parts Leaf mould, 1 part Lime rubbish</td>
</tr>
</tbody>
</table>

4. Roses:

<table>
<thead>
<tr>
<th>Soil Mixture</th>
<th>Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 parts Horse manure</td>
<td></td>
</tr>
</tbody>
</table>

5. Crotons:

<table>
<thead>
<tr>
<th>Soil Mixture</th>
<th>Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 parts Red earth</td>
<td></td>
</tr>
</tbody>
</table>

6. Species:

<table>
<thead>
<tr>
<th>Soil Mixture</th>
<th>Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 parts Horse manure</td>
<td></td>
</tr>
</tbody>
</table>

7. Others:

<table>
<thead>
<tr>
<th>Soil Mixture</th>
<th>Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 parts Red earth, 2 parts Leaf mould, 1 part Lime rubbish</td>
<td></td>
</tr>
</tbody>
</table>
### Cultivation of Plants in Pots

<table>
<thead>
<tr>
<th>Number</th>
<th>Type of Plant</th>
<th>Loam</th>
<th>Red earth</th>
<th>Sand</th>
<th>Horse manure</th>
<th>Leaf mould</th>
<th>Brick pieces</th>
<th>Lime rubbish</th>
<th>Charcoal</th>
<th>Horse manure</th>
<th>Lime rubbish</th>
<th>Sheep manure</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.</td>
<td>Palms</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Ferns</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Bepogonias</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Caladiums</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Dracenas</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Dieffenbachia and similar tropical foliage plants</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Anthurium, Philodendron, etc.</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Orchids generally</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Succulents</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Ornamental shrubs and creepers</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Fruit Plants</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
17. Soft and Hard-wood cuttings.—

18. Seed-sowing.—

| 1 part | ... Leaf mould |
| 1 ½ "  | ... Red earth  |
| 1 "    | ... Sand       |

How compost is made.—Compost is made by spreading the ingredients, layer by layer, one above the other in their respective proportions, moistening it slightly after each layer or material is put. For instance the compost for annuals mentioned above is made by spreading 3 baskets of manure on the ground, 1 of red earth over this, and 1 ½ of sand over the latter. This is continued till a large heap is made. If the layers are not moistened at the time of forming the heap, a depression is made on it to hold water, which is poured slowly to soak the soil through. The compost should be prepared in this manner a month before it is wanted for use, and stored under cover or under the shade of a large tree. The heap should be turned over and the ingredients well mixed, before use, so that they may be evenly distributed in the soil.


CHAPTER X

PRUNING

Principle of pruning.—The general principle underlying pruning is the encouragement of the plant sap to flow towards certain desired parts of the plant, such as the stem, leaf or roots, to promote their growth and vigour by removing certain other parts which are not wanted and for the growth of which plant-sap would be wasted. The removal of certain parts of the plant results in the lessening of the struggle for existence among the remaining parts of the plant, more nourishment being distributed to them after pruning. Pruning, thus, is an invigorating process, calculated to produce a definite effect in the formation of shoots, flowers, fruits, and roots too. Pruning is an important operation, which if neglected, results in plants losing their condition. The necessity for pruning is readily observed by comparing a regularly pruned rose bush with one allowed to take care of itself. The former bears large fine blooms on strong and healthy shoots. The latter is unhealthy and produces straggly weak shoots bearing miserable specimens of blooms. The necessity for pruning is also observed in the case of other shrubs, trees, and plants, whether cultivated for their fruits or for their flowers. In the case even of annuals, like Balsams, the flowers produced on plants grown to a single stem or with only two or three side shoots are larger and superior to those produced by plants with a number of shoots on them. In a bunch of two or more fruits or in a cluster of two or more flowers, if only one fruit or flower bud is retained and the others removed, a large sized fruit or flower is obtained. Similarly, by thinning out some branches of a tree or shrub, the others grow vigorously. Pruning would easily become a mischievous operation, if ill done. Drastic pruning or too frequent pruning very often kills a plant instead of improving it. The method and the time of pruning should be varied with the
character and habit of the particular classes of plants. Very often the idiosyncracies of a particular variety will have to be studied before putting the knife upon the plant. Broad principles can however be laid down for the guidance of the amateur and these should be necessarily modified to the requirements of particular plants.

**Purposes of pruning.**—It is not every tree, or shrub or plant that requires pruning. Pruning, when it is done, is only for any one or all of the following purposes:

(i) To train or shape the tree or shrub or plant to some desired form or size, by cutting away all growths tending to depart from it, as in trying to produce topiary effect, trimming hedges, making standards, etc.

(ii) To encourage vigorous growths in and to admit of air and light to parts retained, by removing superfluous or overcrowding or thin and weak branches from a tree, shrub or plant.

(iii) To change the habit of wood-production to the production of greater number of flowers or fruits of larger size and superior quality. The concentration of vigour to certain parts “pushes” flower or fruit buds. Reduction of unwanted growths by thinning and disbudding vegetative, flower or fruit buds results in improved quality and probably in quantity also.

(iv) To rid plants of fungus diseases and insect pests by cutting away all dead and badly affected parts.

(v) To improve the health and increase the vitality of old and sickly trees and shrubs by a shortening of the branches and a general reduction in their heads.

(vi) To increase flower and fruit production by checking the growth of a tree or shrub by cutting away a portion of its roots. This is effected by root-pruning and also sometimes by girdling or ringing.

**Prune in the right season.**—The purpose of pruning may be entirely defeated by pruning at the wrong season. As a general rule, it may be mentioned that pruning should only be done when the plants are least active in growth or are resting. Deciduous shrubs are mostly dormant from the time they shed
their leaves till they break out again with fresh foliage. They are best pruned about a month after the falling of their leaves and before the growing season sets in. In the case of other plants, pruning is done some days after flowering is finished, as they are then least active in growth.

The time for pruning is often easily determined by ascertaining the flower-bearing habit of the plant, according as it blooms on the shoots of the last season or on the new wood of the present season. The time when the plant blooms, gives a rough idea when to prune. Most of the shrubs which bloom in spring, that is in February—March, produce their blooms on wood made in the last season and their buds are perfected before the winter and remain dormant then. This is true of a large number of evergreen shrubs which require as long a season of growth as possible for production of blooms and those deciduous shrubs which bloom on wood made during the preceding year. They are best pruned just after the flowering season. But, those shrubs, which flower on their current season's growth as Hydrangea, Hibiscus, Jasminum, etc., are encouraged to produce greater quantity of fresh wood by pruning in winter or early spring, that is, in December to February. Pruning is done by cutting back the shoots to one or more buds, according to the requirements of the particular kind of plant, from the point of their origin, some kinds standing severer pruning than others. Pruning does not consist in the entire removal of the shoots that have flowered or in cutting back the plant indiscriminately low down.

The following points are worth noting in pruning operations:

1. **Clean cut necessary.**—In all pruning operations, a clean cut should be made. For this purpose a pruning knife with a sharp edge is essential, for cutting small stems. For larger ones, secateurs, which cut the wood clean and not pinch and flatten out the wood before cutting, are to be chosen. A hand saw is necessary for cutting still larger branches or stems. After the cut is made with the saw, the rough surface should be smoothened with a sharp knife, so that the wound may heal rapidly.

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2. How a cut is to be made.—The shoot should be removed by means of a clear straight cut, with a sharp instrument by making a sloping wound, forming an angle of 45 degrees, just at the back of a bud, as shown in b. in fig. 60, which shows correct pruning. The cut is seen to enter on a level with the base of the bud on the side of the shoot opposite to the bud and pass out on a level with its top, slanting slightly across the shoot. Such a clean cut rapidly becomes covered over with new growth as the bud pushes. All the other figures, a, c, d, e and f, show bad pruning. In figure a, the wound is made too low down and it exposes the communication between the base of the bud and the interior of the stem to the drying action of air, as a consequence of which the bud dies. Figures c, d, and e are bad cuts, as they would leave a portion of the branch above the bud, which would die in course of time and would have to be removed. It may also cause the shoot to die back. Figure f, illustrates an ugly and dangerous cut which injures the branch on which it is made. These figures, are taken from Lindley’s Theory and Practice of Horticulture.

3. Prune to keep the centre of the plant open.—The bud to which the cut is made should face away from the centre of the plant. The new growth will tend to follow the direction at which it is pointing. It is always desirable to keep the centre of the plant open to sun and air and for this purpose the limbs should be made to grow outwards by cutting to the bud pointing outwards.

4. Don’t leave stubs.—In amputating large branches of trees and shrubs, care should be taken to remove them close to the branch or trunk from which they start and the cut should be as parallel with such branch or trunk as is practically possible, as seen in fig. 61. In no case should stubs be
allowed to remain, as they do not heal readily and give rise to fungus infection which spreads from the decayed wood into the interior of the branch giving rise to cankers.

5. Seal cut surfaces.—A very necessary operation after pruning is to smooth out jagged cuts, if there be any. When this is completed, the wounds unless they are very small on tiny twigs, should be dressed with something to seal the closed ends. A thin splash of tar, or better still, a coat of white lead is used for this purpose. Neglect in sealing the wounds may cause injury by “bleeding” (that is the sap oozing out through the cut end of the stem), besides leaving easy access for fungus diseases and borers.

6. How pruning is done.—Pruning is started by cutting off all dead wood, diseased growths, and thin and weak twigs, etc. Then, all growths which intertwine cutting off air and light to desired parts are removed. Generally, weak shoots are cut back severer than strong ones. After deciding upon the frame work to be retained, the shoots are cut back to desired number of buds, keeping in mind that cuts are to be made only above buds pointing away from the centre of the plant. In thinning buds, leaf buds should be distinguished from fruit buds. The former are usually more pointed than rounded.

7. Tree pruning.—Tree pruning is done only very rarely. A tree usually assumes a definite form which is characteristic of the species. Trimming of a tree is rendered necessary only to curtail its encroachment over a place which cannot be permitted or to remedy an uncouth shape. It is however imperative when a tree has been damaged in some of its parts as for instance by a storm. It is often necessary to train a young tree to form a substantial framework for a future large tree. Ordinarily, it is not desirable to have in a garden a tree which begins to branch lower than about ten feet from the ground level. It would obstruct the view and prevent the enjoyment
of parts of the garden. Seedlings are planted out in their places permanently and allowed to grow at the top removing all side growths. If however, a number of vigorous growths emerge from the stem, one of them, the strongest and the straightest growing, is retained and staked. In course of time, this shoot takes a vertical growth in a line with the old stem without showing any bend. In a few cases, as in Millingtonia hortensis, Cassia species and Spathodea, vigorous suckerlike tall growths are produced, one of which is retained as the trunk for the future tree. All side growths are removed from the stem till it reaches a height of about twelve to fourteen feet. The terminal growth is arrested by cutting away the top of the stem just above a node. This “heading” induces formation of a number of shoots. Out of these, four strong ones are selected, which grow towards the four directions, and which are above ten feet from the ground to form the frame work of the tree. In selecting the shoots to be retained, care is taken that any two of the retained shoots are not placed on a line opposite each other. If they “fork” at any place, they have a tendency to split during stormy weather. The stem is well supported by providing it with a stout bamboo stake.

8. Pruning fruit trees.—In this country, fruit trees do not require to be regularly pruned. Tropical and semi-tropical fruit trees as Mango, Litchi, etc., are pruned only with a view to thin out the centre, should the branches overcrowd each other.” A few shoots may be cut out here and there during the early stages of the tree to form a foundation and give a shape to it. Young trees should not be allowed to bear flower or fruit much too soon, as they would be seriously stunted and their useful life greatly shortened. Fruit production places the tree under a great strain; a young tree cannot be expected to make plenty of new growth and at the same time bear heavy crops of fruits. It is best fruit plants are not allowed to crop till they are three to five years old.

9. Some amount of regular pruning may be necessary in the case of such temperate trees as Apples, Pears, Plums, Apricots, etc., on hill stations. Each kind has a law of prun-
ing for itself, depending upon the nature of its growth and upon how its flower buds or spurs are borne. Generally, it might be mentioned that pruning of such trees follows two main lines: first, that which is directed to encourage the production of new wood, which is effected chiefly by pruning the main branches or the leaders of the tree and secondly, that which is necessary to induce fruitfulness, which is effected by pruning subsidiary growths or the laterals. In our country, with its hot enervating climate, pruning if done at all, should be very light. In temperate climates and on hill stations in India, for promoting vigorous new growths, which is of the highest importance in the case of bush trees, the main shoots or leaders as they are called are shortened by half to two thirds of their length. All cuts are made above a bud which points outwards, with the result that the tree assumes the form of a goblet with the centre open to sun and air. The thinner side growths or laterals as they are called, which bear the fruits are treated differently. They are discouraged from producing wood growths and encouraged to produce fruit spurs, by shortening each lateral to two or three buds of its base. In the next season, the buds plump up and produce flowers or produce a short shoot bearing a terminal flower. If it results only in a vigorous leafy shoot, the shoot is again cut back to one or two buds. Pruning, done in the manner described above, helps to retain the plant in a bearing condition. Pruning of fruit trees is a subject by itself and is not within the scope of this book.

10. Root pruning.—Root pruning is resorted to as a last measure in the case of fruit trees which show a tendency to make free growth and produce very little or no fruit, after trying manuring with superphosphate and ring-barking. Root-pruning needs exercise of great skill and care, to be really beneficial. Mere ruthless hacking of the roots of the tree will kill it.

The operation is carried out as follows:—A trench, three feet wide and about three feet deep is made half way round the tree. While digging down, care is taken not to injure the fibrous roots which cross the trench; they are tied into bun
cles and covered over with a mat or some other material shielding them from the effects of sun and the drying action of air. If no roots are come across even after digging down to a depth of two to three feet, the soil is gently worked till the roots are reached. Keeping only a few of the larger roots, which are absolutely necessary to anchor the tree and to prevent it from toppling over during stormy weather, roots above the thickness of an inch are clean cut off, the cuts being effected upwards to help formation of fibrous feeding roots on the surface, quite within the reach of the manure and water applied. The idea of root-pruning is to sever as many deep-going tap roots as is consistent with safety, to induce the formation of a mass of fibrous roots, which absorb manure laid on the surface. Tap roots provide moisture in great abundance by penetrating deep into the soil. The trench is then filled up with good loam, to which may be added well decomposed manure. The roots of a tree usually spread as far as its branches and this fact furnishes a safe guide for fixing the position of the trench for root-pruning. It is safe not to prune all round the tree at one time. Root-pruning is best done in two stages; roots on one side, being pruned one year and those on the other side, the next year. November to January seems to be the best time for this operation.

11. **Ringing or girdling.**—This is effected by removing a quarter to half an inch of the bark in a circle on the stem. The sap ascending the stem stops at the part operated upon and the descending sap collects there to form a callus. If the tree has reached the fruit bearing stage, fruit buds appear in place of leaf-buds, during the following fruiting season. Ringing is best done during the monsoon period. A wire tied very firmly round the stem, serves the same purpose as ring-barking. It should however be removed after a period of six months. Ringing in this country, is a drastic operation which may result in the killing of the branch or stem operated upon, and should be adopted only as a last resort in the case of trees which fail to fruit.

12. **Wintering**.—In the hot parts of India, where it may be dangerous to root-prune trees and shrubs, with a view to
force them to bear flowers and fruits, they are "wintered." Wintering is done in connection with such flowering shrubs as Roses, Jasmine, etc., and a majority of deciduous fruit trees such as apple, peach, plum, guava, and grape vine. In the resting season, water is stopped gradually to the trees or shrubs, the soil above their roots is removed exposing them to the sun for three to fifteen days according to the age and the hardy nature of the plants concerned. The roots are then covered over with the same soil, enriched with manure or with fresh compost. Watering is then copiously done. The leaves begin to turn yellow and fall off and those that are still on the plants are stripped off the shoots. The sap which had gone down to the roots when the plants were wintered, begins to rise with the supply of water and soon leaf and flower buds swell bearing shoots and flowers.
CHAPTER XI

PLANT DISEASES AND ENEMIES

Introductory.—Innumerable diseases and enemies attack plants, causing them greater or less injury. Most diseases are caused by small microscopic bacteria, fungi, depredating insects, and disease-causing agents known as virus. Physiological causes, such as disturbed nutrition, enzymic activity and the like, also bring on disease. Most diseases and pests are not difficult to cope with by proper vigilance and adoption of suitable remedial measures. It would be wiser to keep off pests and diseases by protective measures, as for instance, good cultivation, spraying with preventive fungicides and repellants, immunization by establishing within the plant itself some condition which renders it immune or resistant to the attacks of pathogens. Careful selection and propagation from disease-free and disease-resistant stock and acclimatisation make plants immune to disease. All civilised governments forbid the importation of plants affected with dangerous insects and fungi and bacteria into areas and regions, where they do not occur. But, in spite of the best precautionary and other measures, diseases and pests do appear and cause havoc to plants. As they increase and spread rapidly, immediate steps should be taken to overcome them.

CONTROL OF FUNGUS PESTS

Nature of fungus attacks.—The harm done to plants by fungoid diseases is often more considerable than the mischief of insects. The greyish coating on the foliage of roses, peas, balsams, grape vine and many other plants, which weakens and often kills them is due to the attack of a fungus, which is well known as 'mildew'. Yellowish or orange-coloured swellings are seen on branches and branchlets of jasmines and Citrus plants, from which the plants very much suffer. Large branches and trunks of trees decay and die of canker and
rot which set in when the wounds caused while pruning or breaking naturally due to wind are not dressed. Seedlings are often noticed to “damp off.” Carnation stems and roots rot suddenly. Swellings are often noticed on the roots and stem of several fruit trees as apples, roses and several ornamental plants, which are responsible for their eventual death. All these are due to fungoid pests of different kinds. At times, even the most observant cultivator may find it difficult to detect the presence of fungus till appreciable destruction has been caused by them, as they are too small to be seen with the naked eye. Fungi begin as tiny specks on parts of plants and carry on disease and death very rapidly.

What fungi are.—Fungi are microscopic plants of a low order. They are devoid of chlorophyll, the green colouring matter of plants. Hence, fungi are unable to utilise sunlight as a source of energy for food assimilation. They can neither take in carbonic acid gas from the atmosphere nor absorb nitrogen. They have, therefore, to get their carbonaceous and nitrogenous food from other sources, chiefly from dead or living plants, which have them in a ready form. Fungi are broadly put under two distinct groups:—(1) Parasitic fungi, such as mildew, which get their food from living plants. (2) Saprophytic fungi, which exist on and derive their food from dead plants or other organic material. Mushrooms are examples of saprophytic fungi. Obviously, parasitic fungi are most dangerous to the growth of plants, inflicting serious loss unless checked in time.

Effect of fungus attack.—Fungus attacks result in the death of some particular organs of the plant, such as a branch, leaf, bud, or in the death of the entire plant, or in the shortening of its life by a premature development of buds, deformation of leaves or stem or branches and the gradual weakening or death of the plant.

How fungi spread.—Fungi increase by spores which are minute cells. The body of the fungus, which is called the mycelium, is threadlike and much branched. The threads composing the mycelium are known as the hyphae and they are the organs which draw nourishment from the host plant.
The mycelium or the hyphae may be one or more celled. They give rise to spores which correspond to seeds without embryos of the higher order of plants. Spores are carried from place to place by wind and water and they germinate on suitable plant tissue. They absorb moisture, swell, and send out germ-tubes which penetrate the host plants and become the mycelium, when they lengthen and branch out.

**How fungus attacks can be prevented.**—Weak plants fall a prey to fungi more readily than strong healthy specimens. Proper attention to plant sanitation checks the on-coming of disease. Good cultivation and cleanliness are primary essentials. Plants should have a plentiful supply of air and light and regular and suitable supplies of water. Too much of moisture at the roots or excessive humidity of atmosphere round the plants often brings on fungus attacks, especially the damping off of seedlings and mildew. Want of proper drainage in the soil, deficiency of phosphorus and other foods in it, sudden changes of temperature during day and night, extremes of weather conditions brought about by rains following drought, overcrowding, growing of same crops in the same plot of ground successively, are some of the causes for the outbreak and spread of fungus diseases. All cut surfaces, after operations like pruning, should be protected from fungus getting a hold on the plant by smearing them with white lead or a thin splash of coal tar. Diseased plants or parts of plants should not be thrown away but should be burnt. Diseased leaves, branches, etc., should never be thrown away into manure pits as they assuredly spread disease among healthy plants in the following season. Alternation of crops tends to put down the spread of many kinds of fungus, more especially in root-crops and annual plants; some diseases remain in the soil and attack the same kind of plants, if grown in it season after season. Soil infected with dangerous fungi is best replaced to a depth as far as the diseased roots have travelled. Otherwise, it should be disinfected by freely incorporating lime into it. In all such cases, it is best to dig in lime freely, leave the land fallow, exposing the soil to the action of sunlight and air for a period of about four months. In all cases
where fungoid attacks are commonly apprehended, preventive spraying with a standard fungicide, is a very helpful protective measure.

**Familiar fungus diseases.**—Fungoid diseases afflicting fruits, vegetables, and ornamental plants are so many that it is impossible to refer to every one of them here. The following enumeration will give a general idea of the nature of the common pests.

**Mildew.**—The foliage of Roses, Sweet Peas, Peas, Balsam, Grape-vine, Apple, Tomato, etc., are sometimes coated with a powdery ash-coloured substance, which in due course causes the leaves to fall off, young shoots to wilt and perish, and prevent buds from developing or opening out into blossoms. This is characteristic of the mildew. It consists of several parasitical genera, species, and varieties, attacking different species of plants. It begins as minute dots and spreads rapidly. Great difference between day and night temperatures generally brings on the attack. Preventive sprays with Bordeaux mixture are very helpful in keeping off attacks. Remedial measures are practically useless unless taken in hand immediately the attack is suspected. Badly affected parts are best cut out if possible and all affected leaves, etc., collected and burnt. The best known remedy against mildew is Bordeaux mixture. A cheaper remedy, better suited to certain plants, than the Bordeaux mixture, is lime sulphur solution. Sulphur powder applied on affected parts previously rendered wet by dew or spraying with water, is also very beneficial.

**Rust.**—There are several kinds of rust, attacking particular kinds of plants. The disease reveals itself by yellow or orange or brown or dark spots and blotches on the epidermis of the stem in most cases and in some on leaves also. Rusts are very harmful and they are difficult to eradicate after they get hold of the plant. Attention to plant sanitation, good cultivation and preventive spraying are the usual protective measures. Rust-resistant varieties of plants should be evolved by hybridization and selection. Badly affected plants should be destroyed by fire. The soil may need to be replaced or disinfected.

**Stem-rot; Root-rot; Fruit-rot.**—Rotting of roots, stem, and
fruits, in some kinds of plants as Carnations, Violets, Apples, Tomatoes, etc., is caused by attacks of fungi. Overwatering, want of drainage, and heavy texture of the soil are often contributing causes of rot. Soils infected with root and stem-rot should be disinfected by digging in lime. Infected roots, stems and fruits should be burnt to prevent the spread of the disease during coming seasons.

The bark of some trees, as the Apple, is susceptible to rot at the junction of the soil with the stem, as a result of which the trees perish. This "collar-rot" is prevented by encircling the stem of the tree from the portion wherefrom the roots spread to well above the ground level with special pots, which are known as collar-pots, and watering the plants only outside the pots, so that moisture does not come in contact with the stem.

Fruits susceptible to rots, as apples and tomatoes, etc., can in a way be protected from severe attacks of the fungus rot by preventive spraying with Bordeaux mixture, after the fruits are set and before they become large and ripen.

"Damping off" disease.—Young seedlings often rot at or below the surface of the ground and fall over or wilt, when they are known to "damp off". This is caused by various fungi in the soil. "Damping off" disease can be controlled by thin sowing of seeds, skill in watering, and adequate light and ventilation. Watering should only be done in the morning. It should not be done more than necessary. Seedlings in pans exposed to the sun should be watered only after the soil has cooled after removing the pans to the shade. Sprinkling of sharp sand or charcoal-powder over the surface of the soil prevents the attack. If "damping off" has started, spraying the soil surface with a weak solution of formalin or Bordeaux is recommended.

Crown gall.—This causes rounded fleshy or woody tumers on roots and sometimes on the parts above the ground also, usually starting from wounds, and growing at the edges every year, very often girdling or causing the tree to break off. Galls may be expected in stunted orchard trees, whose crown and main roots should be examined periodically. Badly infected trees are best pulled out and replaced with fresh ones using fresh soil. If the disease has not too far advanced, it is easily controlled by chiselling out the galls and removing all un-
healthy tissue up to the healthy portions of bark and sound wood, by sterilizing with solution of mercuric chloride, and then covering the wounds with Bordeaux paste.

Leaf Spot.—Leaf spots appear in brown or black patches with irregular margins increasing in size, the area surrounding the patches assuming a pale yellow colour. Defoliation soon takes place. This disease is noticed commonly on Roses and Chrysanthemums. Affected leaves should be removed from the plant and burnt. Thereafter, the plant should be sprayed with Bordeaux mixture.

Sooty mould.—Sooty mould is a saprophytic fungus developing upon the honey excreted by aphids, bugs, scales, and such other insects. The black sooty substance noticed on the leaves and young stems of Mango, Guava, Sapota and such trees is nothing but sooty mould. It blocks the pores in leaves and prevents them, from carrying on their respiratory and food manufacturing functions, thus weakening the trees considerably. Spraying with hot water in which soft soap is dissolved is very helpful. First, soften the mould by gentle spray and then wash it off with a forcible one.

Miscellaneous diseases.—The causes of certain diseases as 'little leaf', 'die-back', 'mottled leaf', 'rosette', etc., are not definitely known. They are known as physiological diseases and they show a marked relation to soil conditions and occur more especially in dry, sandy, or gravelly or 'hard-pan' soils, which are deficient in humus. These diseases appear under conditions of irregular moisture also. It is not worthwhile attempting to grow kinds of plants which are known to be susceptible to such diseases in particular localities or soils.

Gummosis.—Exudation of gum from roots and stems of plants is known as gummosis. It weakens the trees and sometimes also kills them. It is not known to be any specific fungus disease. It may be brought on by several causes as unsuitable soil, poor condition of soil, excess or lack of water, sun-scald, and attacks of parasites. Badly gummed branches may be removed. Diseased areas of bark should be carefully cut out and the wounds treated with Bordeaux paste. Gummosis and die-back are very common in the case of Citrus plants.
Chlorosis.—Pale condition of foliage is also very common in the case of Citrus plants. The cause may be due to improper drainage, want of nitrogenous food or of iron in the soil, want of irrigation, and many other conditions, which should be studied before deciding upon what to do. Spraying the foliage with Bordeaux mixture, which is rich in copper, is believed to render it green in the case of Citrus and Apple trees. Ferrous sulphate may be stirred into the soil at the rate of quarter of an ounce per square yard of space.

Standard Fungicides.—A fungicide is any substance that is used to kill fungi and their spores. It is usually a sulphur or a copper compound. Lime also is often used as a fungicide. Any fungicide used should satisfy two conditions. It should be effective against the parasite. It should not injure the plant in any way. Fungicides in the form of powder are best applied with the help of powder-blowers. They consist of a receptacle for holding the fine powder from which it is expelled in the form of dusty particles by pressing a bulb or moving a handle as in bellows. Liquid fungicides are applied with the help of a hand syringe, or a bucket sprayer, a knap-sac sprayer, or a barrel-sprayer, the size of the instrument used depending upon the number and size of the plants to be sprayed. The efficiency of spraying depends upon the nozzle of the machine which should discharge the liquid in a fine mist so that it floats in the air in a cloud and settles on the foliage and affected parts. Nozzles which squirt heavily are no good at all. Timely and thorough application of fungicides will check the spread of disease, though the injury already done cannot be repaired.

Bordeaux Mixture.—It is the best fungicide discovered for plant diseases caused by fungus. It is made by mixing a solution of blue vitriol (copper sulphate) with milk of lime. The mixture should be used soon after it is made, as it is only then the gelatinous precipitate that is formed adheres to the surface of the leaves for a long time. If allowed to stand over for three or four hours, the mixture loses much of its adhesive property. It is prepared in the following manner:—Dissolve in a wooden tub (iron containers are corroded by blue vitriol) 5 lbs. of copper sulphate crystals in enough hot water and make up to 40 gallons. In another vessel, slake 5 lbs. of quick lime,
by adding enough water to cover it. After slaking, add 10 gallons of water. Strain the milk of lime through a wire strainer. Pour the copper sulphate solution slowly into the milk of lime, stirring the mixture thoroughly. The solution is ready for use. 5-5-50 is the formula, which is easily remembered. For making 50 gallons of mixture, 5 lbs. of blue vitriol and 5 lbs. of lime are used. If the mixture is made from copper sulphate crystals and lime of best quality, test for free copper, which is injurious, may be unnecessary. If lime is deficient, a clean knife blade dipped in the solution for about a minute will be coated with a trace of copper colour. More lime should then be added to neutralise the free copper. To enable the mixture to stick better, 2 to 3 lbs. of common treacle might be added. Calcium caseinate, one pound in fifty gallons of water, is a good spreader and prevents chemical reactions where different materials are mixed together.

Lime-sulphur solution.—Lime-sulphur solution is effective against mildew, leaf curl, and many other fungus pests, and against scale insects. It is a valuable spray at the resting period of plants. Start slaking 4 lbs. of fresh lime in an earthen vessel. Stir in gradually 8 lbs. of fine sulphur, using enough water to prevent burning. Allow to boil for about fifteen minutes by the heat of lime. Then add more water and boil for some time. Dilute to 50 gallons and apply. Unless the solution is weak, it burns the foliage.

Lime sulphur solution mixed with lead arsenate makes an useful combined fungicide and insecticide.

Potassium sulphide.—For powdery mildews, potassium sulphide solution is effective. The general strength of the solution recommended is one ounce in three gallons of water. This should be varied according to the nature and hardiness of the plant.

Potassium permanganate.—30 to 40 grains in a gallon of water is useful, sprayed on herbaceous and bulbous plants, as a preventive measure.

Corrosive sublimate.—Mercuric chloride, one ounce in ten gallons of water, is useful as a good antiseptic wash for cut wounds on plants. Poured over the soil, it prevents root maggots, as on Cabbage roots. Uncut seed potatoes may be soaked
in the solution for about half an hour before planting, to prevent diseases.

**Sulphur powder.**—It is applied in the morning with a powder blower or dusted through a thin muslin bag, on the foliage when it is still wet with dew. It is a well-known remedy against mildew of several kinds.

**Lime.**—Lime is used as a disinfectant of the soil, in club-root of Cabbage and such other diseases in the soil. Quick lime is powdered and incorporated into the soil and the land left fallow for a period of about four months.

**Bordeaux paste.**—The paste is prepared only for the day’s use by dissolving separately blue vitriol (copper sulphate), 12 lbs. in 8 gallons of water and quick lime, 24 lbs. in 8 gallons of water, and mixing them.

N. B. Both copper sulphate and corrosive sublimate are poisons, which should be kept out of the reach of children and pets. They should be suitably labelled and kept inside cupboards.

**CONTROL OF INSECT PESTS**

**Causes for outbreak of insect pests.**—Great many are the insect enemies of plants, and they exhibit striking peculiarities in form, size, colour, structure and habits, and methods of transformation. Though an active warfare has been carried on by man against destructive insects, they have not appreciably decreased. On the other hand, they seem to be frightfully on the increase. The economy of their natures is extremely favourable for their reproduction on an immense scale. The ignorance of the layman in respect of their life history is so great that he is helpless in his struggle against their ravages. Efficient means for the destruction of insects can only be devised if one knows their nature and habits.

It is not every insect that the gardener comes across that is harmful to his plants. There are a good many insect garden friends, as the honey-bee and the lady-bird beetle. They are helpful either to fertilise his flowers for formation of fruits and seeds, or are helpful to prey upon insects which attack the plants. The outbreak of insects is due to several causes. Deforestation increases pests by upsetting the ba-
lance of life in relation to the parasite and the host plants; so also indiscriminate shooting of insectivorous birds as minas and woodpeckers. Proper want of rotation of crops and the introduction of new varieties of plants, vegetables and fruits with the insects that damage them but not with the natural enemies of these insects are also responsible for the increase of insects.

Insects.—Insects are living beings which have a jointed body consisting of three principal divisions; (a) the head with the antennae (the feelers,) and the mandibles (the biting lips), or the proboscis (the sucking apparatus.) (b) the thorax and (c) the abdomen. Insects breathe not through lungs but through the tracheae, which are long tubes running through their body and limbs. Some insects as beetles bite and chew their food like higher animals, their jaws or mandibles moving horizontally. These are known as "chewing insects." Others puncture the tissues of the epidermis and suck plant juices from inside through a tube or proboscis. These are known as "sucking insects."

The life history of insects.—Insects pass through a series of changes in their life history. Most of them pass through four distinct phases of existence, which are:—(1) the egg stage (2) the larva stage. The larvae emerge out of the eggs laid by adults, either beetles or moths, and the larvae are known differently as grubs, borers, caterpillars, worms, maggots, etc. Larvae are voracious feeders on roots and foliage and flowers and fruits. Most kinds are fantastically marked with a variety of colours, while many assume the colour of the young shoots or flowers on which they feed, thus eluding notice. They can be found out only after diligent search. Their presence is indicated by the damage done and the droppings on the leaves and on the ground. (3) The pupa stage. The larvae after a destructive course of living, build cocoons round their bodies and go to rest. (4) The adult stage. The larvae transform themselves into winged beetles or moths and emerge out of the cocoons. Their chief occupation is to lay eggs. But certain kinds among them, as Rose beetles are very destructive on foliage and tender stems.
Methods adopted for controlling pests.—Various methods are adopted for controlling insect pests. The grower should always have his eye on his plants and foresee when and how insects attack the different kinds of plants and take suitable preventive measures. As in the case of fungus pests, prevention is easier and better than cure, in dealing with insect pests. Insecticidal methods are to be adopted when the cheaper and commonsense methods fail.

Good cultivation destroys the hiding places of insects and removes weeds and wild plants which often act as host plants for insects from which they multiply and spread to garden plants.

Proper rotation of crops helps much to keep down the increase of insect pests attacking particular plants.

Plants, maintained in a vigorous and healthy growth by feeding them with suitable manures, and watering regularly, are better able to resist attacks of insect and fungus pests than weak ones.

Hand-picking of insects, like beetles, is efficacious, if resorted to on the first appearance of the pest, when its numbers are still small. They are dropped into a basin or vessel containing water with a film of oil, preferably kerosene, floating on top. The more active insects as grass-hoppers may be caught with the help of a simple hand-net, by sweeping it over the plant. Such a net can be easily made by tying a bag of thin cloth or net to a loop of split bamboo or cane, which is fixed on to the arms of a Y shaped branch, of which the main stem forms the handle of the net.

Several adult insects as moths and beetles are blinded by light and caught with the help of light-traps. If only a few, a light can be taken near the plant and the insects picked. If there are too many of them, an ordinary lamp may be suspended over a basin of water with a film of kerosene floating on the surface and kept burning throughout the night near the plants attacked. The insects are attracted by the light, dash against it, and fall into the water. On still warm nights, large number of insects can be killed in this manner. Fires kindled near the plants will also attract insects which would
be destroyed. Smoke scares away insects and a light smoky fire near by or under Mango trees is helpful in destroying or scaring away hoppers.

Branches and shoots attacked by borers, should be cut away, if small, and burnt, to prevent the insects from coming out and attacking other plants.

Burning with a small torch may be resorted to in the case of such insects as caterpillars, which gather gregariously forming large patches on tree trunks.

Banding the base of the stem with a sticky tape or cloth dipped in melted wax or in a mixture of tar and crude oil emulsion in equal proportions, prevents many insects as ants, etc., from getting access to trees and shrubs.

Insecticidal methods should be employed when insects have attained such numbers as to form a pest. Insecticides are substances which are used to kill insects. They are sometimes used as repellents also. Insecticides may be solids, liquids, gases or vapours. They are usually classified under three heads:—(a) Stomach poisons. (b) Contact poisons, and (c) Gaseous poisons.

Stomach poisons are used for destroying insects like beetles, grass-hoppers, grubs, caterpillars, leaf-rollers, etc., which chew and tear off bits of plants, which they pass into the alimentary canal for digestion. Sucking insects as bugs, aphis, etc., cannot be killed by spraying stomach poisons on the plant, as the poison is not taken by them into the stomach. Nor can the plants be injected with poisons to kill these. So, contact poisons, which block the respiratory pores of the insects suffocating them to death, or which cause their death by irritation to their body are used in the case of sucking insects. Some sucking insects have too hard a coating, against which contact poison is not of much use. Gaseous poisons are used to destroy them. A deadly gas like hydrocyanic gas is evolved in a closed atmosphere and the plants attacked with the insects are placed therein to be gas-poisoned. This method is too dangerous to be employed in private gardens. Nowadays, what are called soil fumigants are used against such pests as white ants, wire worms, and other underground insects.
Application of insecticides.—Solid insecticides are “dusted” on the parts affected, in the form of a fine powder, through a thin muslin bag or powder sprayer or bellows. Liquid insecticides are applied in the same manner as liquid fungicides. “Fumigation” is the term applied for using gas-evolving insecticides. The method known as “trapping” or “baiting” is adopted in the case of certain insects when food materials are mixed with poisons and placed in their haunts.

Some remarks are necessary in connection with the use of insecticides in general. The insecticide should cause the least possible injury to the plant itself while it should be very efficient against the pest. The strength of the insecticide should be varied to suit the circumstances of each case. A stronger solution may be employed on cloudy days and on plants with mature foliage than that used on hot days and in connection with tender foliage. Due regard should be had to prevailing weather conditions. It might be useless to waste insecticides on rainy days, when they would be washed away. Insecticides should be used early in the morning or late in the evening. The foliage is injured if they are applied during the hot hours of the day. The substance should be washed off by spraying with clear water after it has effected its purpose.

The following are well-tried insecticides:

Lead arsenate.—This substance is available in the form of a paste or white powder. It is produced as a precipitate by mixing solutions of an ounce of arsenate of soda in three gallons of water and of two ounces of lead acetate in a like quantity of water. Lead arsenate is a safe, effective stomach poison, used against chewing insects as beetles and caterpillars. Unlike other stomach poisons as Paris Green and calcium arsenate, it is harmless to foliage, even if the strength used is stronger than the one recommended. It is best sprayed on plants in a state of colloidal suspension in water. Two pounds of the powder or three pounds of the paste thoroughly mixed with 100 gallons of water would be suited for normal conditions. Its efficacy may be increased by adding some molasses and lime to the mixture, 3 pounds of lime and 6 pounds of molasses being the quantity that may be added to
every pound of the insecticide. As a dry powder to be dusted on affected plants, it is best mixed with a neutral powder as powdered lime, wood ashes or road dust in the proportion of 1 pound of arsenate to 15 pounds of the other powder.

**Fish Oil Rosin Soap.**—It is a ready made dark brown semi-solid substance which is dissolved in cold water before use. The solution is sprayed on plants as a remedy against all kinds of sucking insects as plant lice, mealy and other bugs, scales, and mango hoppers. The usual dose for soft bodied insects is 1 pound of soap to 8 gallons of water. 2 pounds of soap may be used for hard covered insects. The spraying should be persistently done, a third or even a fourth time, to kill young insects recently hatched from eggs, on which the first or second sprayings may have been ineffective. The Kerala Soap works, Calicut, prepare and supply this soap.

**Honge Oil Rosin Soap.**—As Fish Oil Soap has a very repulsive smell, many favour the use of the Honge Oil Rosin Soap, which is prepared by the Mysore Government Soap Factory and which is claimed to be quite as effective on sucking insects as the Fish Oil Rosin Soap.

**Kerosene Emulsion.**—This is one of the oldest known contact insecticides. It is readily made when wanted. One pound of common soap is dissolved in one gallon of hot water. The solution is boiled for dissolving the substance well. After removing the vessel from the fire, two gallons of kerosene oil are added to the solution and the whole mixture is churned or violently agitated by being worked upon itself by a force pump. This should be done till the whole quantity of oil is emulsified. This can be diluted 10 to 15 times with water before use. An ounce of glue may be added to the mixture to enable it to stick better. If the oil is not emulsified properly, it is very harmful to foliage. It is on account of this reason that kerosene emulsion has fallen into disfavour.

**Lime Sulphur Solution.**—It is effectively used against scale insects. In combination with Bordeaux Mixture or with Lead arsenate, it acts as a combined insecticide and fungicide.

**Soap Solution.**—A solution of any bar soap, 1 pound dissolved in 6 gallons of water acts as a cheap contact poison.
against soft-bodied insects as plant lice, delicate larvae, and mealy bugs.

**Tobacco decoction.**—Tobacco and its products are some of the best known insecticides. There are several nicotine preparations such as Nicotine Sulphate in the market but the following can be prepared easily. A pound of tobacco stems and leaves is boiled in a gallon of water for about half an hour or it may be steeped in cold water for a day or two. In this decoction, about 4 ounces of any bar soap is dissolved. When cool, it is diluted with five to six times of water and sprayed upon the infected plants, against plant lice, mealy bugs and other soft-bodied insects. Even for the treatment of plant lice on tobacco plants, this decoction is found useful. Tobacco decoction is used when one wants to avoid the smell of the Fish Oil Soap, or the use of Kerosene emulsion on delicate plants whose foliage is likely to be injured by it.

**Ant poison.**—It is prepared thus:—125 grains of arsenate of soda and 1 pound of sugar are boiled and dissolved in a quart of water. Then, 1 tablespoonful of honey is added. When cool, the substance is placed in shallow dishes with crusts of bread or bits of sponge, on tasting which ants which are attracted in large numbers die.

**Poisoned bran mash.**—5 pounds of wheat bran, 1 pint of cheap molasses, 4 ounces of white arsenic, lemon juice of 1 fruit, and 7 pints of water are mixed to form a dry mash and scattered around the field to kill cut-worms, army worms, grass-hoppers, etc.

**Gondal Fluid.**—4 ozs. of gum, 8 ozs. of asafoetida, 8 ozs. of bazaar aloes, and 3 ozs. of castor cake are mixed well with water; clay is added to thicken. The resulting substance is painted on the base of the stems of trees which are liable to be attacked with ants or other pests.

**Quick lime.**—If spread on the ground in the form of powder keeps away slugs and snails.

**Vapourite** is a substance which is stirred into the ground for killing grubs, eelworms, millipedes, cockchafers, etc. It is a soil fumigant.

**Carbon disulphide** is an explosive nasty smelling volatile
liquid. Balls of cotton dipped into this liquid and dropped into holes, effectively kill ground vermin. To prevent the vapour from escaping, the holes should be sealed with moist clay. This substance is often used to fumigate insect-infested stored agricultural products and seeds. An ounce of the liquid may be necessary for every 15 cubic feet of space enclosed.

Some common insect pests.—Larvae of different kinds, known as caterpillars, grubs, worms, maggots, etc., attack foliage, flowers, and sometimes roots of plants. They appear mostly at the outbreak of the south-west monsoon and are best hand-picked. If too many, they are poisoned by spraying plants with lead arsenate.

_Cockchafer._—A well-known insect, both in the larval or grub stage and the adult or beetle stage. In both the stages, it is a voracious eater on the roots, foliage and flowers. Entire lawns and plantations are sometimes destroyed by them. The grub has a large bloated body. It remains under the soil devouring roots of all plants. It is a curse to pot plants, to the soil of which it gets introduced through the manure in the egg stage. The destructive work is carried on till the plant turns yellow in leaf, withers and dies. Vapourite is reported to be useful against grubs. The grub transform into beetles which are brownish in colour and are active at night on leaves and flowers and fruits too. These are best caught with the help of a light at night time and thrown into bottles containing water and kerosene. If the attack is too severe for hand-picking, lead arsenate sprayed upon the plants affords a sure remedy.

_Beetles._—Other kinds of beetles too are killed with lead arsenate or hand-picking. To mention some, Leaf-eating beetles as the Red Pumpkin beetles, Black Pumpkin beetles, the White weevil which feeds on cotton leaves; the Flea beetles which are steel blue or brown in colour. Some bore holes into leaves, while others are miners in the stem and other portions. Epilachna beetles are those which attack Brinjal and Cucurbitaceous plants. The Blister beetles are of a dull brown colour or are banded black with variable bands of orange on the elytra. Hand-nets are useful in dealing with them as they appear in very large numbers attacking field crops, flowers and foliage of
As their excreta is acid and likely to blister the skin, the beetles are best shaken into a basin containing water to which kerosene is added. The Rhinoceros beetle is a large thickset black beetle over two inches long and an inch broad. It flies at nights attracted by lights. It feeds upon the soft tissues of Palms, attacking the unopened leaf or the base of the fruit-stem and eating into the soft heart of the plant. It is killed while at work by transfixing it with stout wire passed into the part of the plant where it is suspected to be active. The Rhinoceros beetle is dangerous because it attracts the Red weevil, which is a small beetle, which lays eggs in the holes made by it. The eggs hatch into larvae which devour the stem, killing a large palm in a few months. The best remedy against the latter is to cut down and burn badly infested trees. There are some beetle borers which are treated with a creosote and chloroform mixture mentioned under borers. Some kinds of beetles are killed by putting into the holes neem oil in enough quantity to reach them.

Snails and Slugs.—These are very destructive on young seedlings and plants and they lay bare many a flower bed. They lie hidden in the soil during the day and come out during night. They may be attracted to poisoned food in places frequented by them or picked by light at night. Application of soot and lime powder to the surface of the soil keeps them off.

Earthworms.—These are a nuisance in pot culture. They enter pots through drain holes, move through the soil disturbing and loosening the roots. They may be removed from the ball of earth and turned out of the pot with a pointed stick. Vapourite may be used to exterminate them.

Borers.—Caterpillar borers, which are usually derived from moths do not bore down so deeply into stems of plants as beetle borers which are usually derived from beetles. The caterpillar borers are killed by punching them with wire or putting neem oil into the holes bored by them. Beetle borers are killed by plugging the holes with cotton wool dipped in a mixture of two parts of chloroform and one of creosote, and sealing the outside with beeswax.

Aphides (Plant Lice).—They are small soft-bodied insects
which gather in colonies on tender parts of plants like the shoots, tender foliage, buds, flowers, etc. They suck the sap from the plant, with the result that growth is checked and the affected part or plant gradually dries up. Plant lice are usually green, deep purple or black in colour and are commonly seen on beans, Cabbage, Radish, Citrus plants, Chrysanthemum, etc. Some species are winged and some are not. They multiply very rapidly and should be promptly dealt with. They do their work of destruction assisted by ants, by an interesting and peculiar relationship with them. The ants are attracted to the lice by their sweet excreta on which the ants feed, and in their turn, the ants help the lice in transporting them to fresher regions on the plant where they get fresh supplies of food by way of plant sap. Hence steps should be taken to destroy the ants also. Aphis are harmful in another way. On their excreta left on the foliage and parts of plant, the sooty mould fungus develops. (See page 129). Tobacco decoction, Fish oil Rosin soap, and sometimes mere soap water are used to get rid of plant lice.

Mealy and wooly bugs.—These are serious enemies to several kinds of plants, infesting all parts as roots, branches, leaves, flowers and fruits. They often collect in compact colonies depositing eggs in masses of cottonlike fluffy material. The newly hatched insects are very small and yellowish in colour. They soon get covered with whitish powdery wax which extends as rods and tails all round the body, a characteristic which has given them the common name by which they are known. They are sucking insects like aphids, but they are not easily killed with soap water or tobacco decoction. Kerosene emulsion or some oil compound is necessary to get rid of them. Repeated application of an oil insecticide as Fish oil Rosin Soap or the Kerosene emulsion or Crude oil emulsion may be necessary to get rid of them. Like the aphids and the scale insects, they also encourage ants and sooty mould.

Brown and Green Bugs and other Scale insects.—These are different species of sucking insects with hard horny coats on their bodies which makes it difficult for the gardener to eradicate them. Their hard coats prevent the action of contact in-
secticides on them, while stomach poisons are of no use. Repe­ted spraying with oil emulsions are to be tried. Against some scale insects, lime sulphur is effective. Fumigation is resorted to when other methods fail.

The San Jose Scale forms crusts on stems of Roses and other plants. The insect is circular in outline, is of the size of a pin head with a raised centre. Bordeaux Mixture is a good preventive against it. Lime sulphur is also effective. A paste of cow-dung, sulphur, and red earth in tar water is also useful, if applied on the affected parts of the stem.

Thrips.—These are small six-legged insects living on the underside of leaves, sucking the sap out of them. Like aphids, they thrive in the dry season. Syringing plants and the surface of the ground with water does good. Soap solution containing tobacco decoction is effective.

Red spider.—Red spiders are tiny suctorial mites, about 1/50 inch long, ranging in colour from misty brown to brick red, spinning small webs over their breeding ground on the under­side of leaves. Like thrips, red spiders are formidable enemies of the garden causing entire defoliation of certain plants, as Crotons. Like thrips, also, they increase rapidly under dry conditions of weather and can be kept under control by frequent spraying with water. Nicotine solution is effective against the pest.

Ants.—Ants not only encourage the increase of such in­sects as bugs, scales and aphids, but also are a nuisance by themselves, as they bite and injure tender stems of plants like the Dahlia, Aster, Amaranthus, etc., and also remove seeds from seedpans and nurserybeds. They may be poisoned with the syrup mentioned on page 138. They may also be attracted to bits of charred copra which may be dropped into kerosene when the ants have collected on them. To repel them from beds, four ounces of kerosene may be added to four gallons of warm tobacco decoction and the mixture freely used to water the beds. Ant hills should be destroyed by pouring into the holes half an ounce of carbon disulphide and closing them up with clay.

Termites (White Ants).—Termites are one of the most
dreadful pests which a gardener has to contend against. There are several species, some attacking dead stems and some attacking living stems, killing plants in a short time. A good quantity of sand all round the stem helps to keep off white ants for some time. If the collar of the plant, that is, the basal portion of the stem which is in contact with the soil is smeared over with lime sulphur solution, the white ants are kept at a distance till the insecticide gets washed out. Gondal fluid is also helpful to keep away termites. Ant-hills near the garden should be opened out and the queen ants killed. Four Oaks White Ant Exterminating Machine is very useful for fumigating ant hills with sulphur and arsenic fumes which kill the insects.

Other enemies of plants.—Stray cattle are to be kept out by a suitable fence or barrier. Trees and shrubs should be provided, if need be, with guards. Hares and rabbits should be scared away by spreading twigs and brambles round beds and borders. They could be caught with nets. Rats and bandicoots which scoop out soil uprooting plants should be destroyed by poison baits. Rat poisons are obtainable from the market. Crows and sparrows and some other birds are very troublesome, the former pecking at bulbous rooted plants and taking the life out of them and the latter eating away seedlings and removing seeds from seed pans and nursery beds. Crows are usually kept away by shooting one and hanging it up near the desired place to scare away others. It may also be necessary to protect the plants with a sort of net work made by strands of thread. Sparrows, bulbuls and such other birds can only be scared away by nets. Seeds should be dressed with a thin paste of red-lead in water before sowing. Bird lime can be used where sparrows and such birds rest.
CHAPTER XII

THE GARDEN AND ITS PARTS

The garden and its lay out.—A garden may be defined as an area embellished with plants, a valuable and pleasurable adjunct to a house. It affords light and pleasant recreation after a day's hard work and business cares, and is hence a necessity of modern life.

A garden is a work of art. A mere collection of plants will not make a garden. It is the skilful arrangement and disposition of plants over the area, making a design or pattern or picture as it were, that forms a garden. Gardening, then, necessitates not only the acquisition of an intimate knowledge of the science of plant-growing but also requires artistic taste on the part of the gardener. He should acquaint himself fully with his plant material, with the habits of growth and nature of the several trees, shrubs, and plants in order to enable him to allot suitable places for them in the garden design. He must think out and evolve a design which would give the maximum of pleasing effect, limited only by certain circumstances and conditions, the chief being the length of his purse.

In laying out a garden, several factors have to be taken into consideration, as for instance the taste and judgment of the owner, the position of the house in relation to the grounds, the size of the house, the extent of the grounds, the source of water supply, the shape and formation of the land, the labour available, the cost of making it and the ability of the owner to maintain it in condition. It is obvious, then, there cannot be any fixed design suited to all places. As in no two cases, the above-mentioned factors would be the same, no two designs can be identical. Garden planning is thus very elastic in scope and it affords immense possibilities for variety of design.

In the history of garden-making, there have been two styles, the formal and the natural, each fancied and ad-
mired by its own advocates. They are diametrically opposed to each other in conception. The natural style which is also called the landscape style, aims at an imitation of Nature inside the garden and strives to produce a rural effect with large open lawns, uninterrupted as circumstances would permit, and bordered by clumps of shady trees and shrubs. This type of gardening is suited to a place on the country-side, where the villa is small and situated on one side of a wide extent of grounds and where Nature furnishes a rich luxuriance of scenery and vegetation in and beyond the grounds. In cities and towns, where such natural advantages are not available, it is futile to attempt to reproduce in a small compass Nature's wild and rugged effects.

The geometrical or formal or the symmetrical style, as it is differently called, is as the name implies, entirely formal and is calculated to afford harmonies and contrasts in colours and a balanced whole, one half of the design being a counterpart of the other. Supposing such a garden to have a line drawn across its centre, the flower beds on either side would be similarly placed, similarly made, and filled with similar plants. There is thus a method, symmetry and attention to minute details in this style of gardening. It would harmonise with massive buildings with enormous frontage.

The style of gardening which combines the good points of both, the natural and symmetrical styles, and which is now most favoured goes by the name of the picturesque or artistic or free style. It dispenses in great part with the formality and flatness of the geometrical style. It takes into consideration the essentials of the typical natural garden and displays great freedom in treatment. This free style is capable of being adopted to suit the needs of almost all situations and hence is deservedly popular. It makes full use of trees, shrubs, flowering and foliage plants, climbers, rocky places, streamlets and ponds, trelliswork and the grass, and is of diverse features.

As landscape gardening has made a name for itself and is the ideal of many a large estate owner, the principles to be adhered to for effective landscape gardening may be mention-
ed here. These are ably discussed by Bailey in his Book on Garden Making. He lays stress on the following points:—

The two leading concepts of landscape gardening are:—(1) To produce a “picture in the landscape.” The house is in the majority of cases, the central figure of the picture. The green lawn serves as the canvass. The plantings complete the composition and colour and (2) To resort to mass planting to produce the landscape effect, as the mass has greater value than individual planting, as it presents a much greater range and variety of forms, colours, shades, and textures, and as its features are so continuous and so well blended that the mind is not distracted by incidental and irrelevant ideas. The several other concepts which are subordinate to the above two and which also serve as explanations of the means and methods of making the picture are:—(i) The conception of the plan as a unit. Each area must be set off from every other area and it should be such that the observer catches the entire effect and purpose of the picture without stopping to analyse its parts, every piece contributing to one strong and homogeneous effect. (ii) Having some one central emphatic point in the picture. Usually this is the house. (iii) Keeping the centre of the space open, and filling up the garden frame on the sides with masses of plants. (iv) Avoiding scattered effects. Flowers and high coloured foliage plants are most effective against a background of green foliage. The proper places for the flowers are along the borders against groups, often by the corners of the residence, or in front of porches. (v) The flowers are only incidents in landscape picture. They serve to add emphasis, supply colour, give variety and finish. They are ornaments but the lawn and mass planting make the frame work. (vi) More depends upon the positions occupied by the plants with reference to each other and to the structural design of the place than upon the intrinsic merits of the plants themselves.

An extensive modern garden is usually made up of the following parts or features:—Roads, walks and paths, lawn, herbaceous borders, flower beds, Alpine garden or rockery, climbers and creepers over arches and pergolas, shade garden,
The garden-owner before commencing planting operations would do well to have clear ideas of his future garden and settle upon the several features which he is going to have and reduce his final decisions to a plan. Such a procedure would save many a disappointment, waste of money and loss of labour. Lack of forethought and fixity of design results very often in frequent undoing of what has once been done. Ultimate success depends on how the garden is designed and laid out to start with. If the leading features and their relative proportion and importance are decided upon, the details of selection of plants and planting can proceed slowly. When the plan is ready, one would begin with the boundaries by planting trees along the confines and some shrubs in front of them for mass or landscape effect. The grounds would be provided with a suitable fence to prevent cattle straying in. The land would be ploughed and cleared of all weeds, and levelled, if uneven. If the land is sloping, it may be advantageous to terrace it into suitable number of agreeable level bits. If waterlogged, the soil would be effectively drained by cutting out trenches and constructing rubble or tile drains. The carriage drives or roads would be marked out and made of gravel or laterite or any firm material. Likewise, paths and walks leading to several parts of the garden would be laid. Then, the lawn would be made by one of the well known methods. The open velvety lawn would probably lead to the trees and shrubs on the sides and in front. In front of the shrubs far beyond and facing the green sward would be the place for a neat border of herbaceous perennials and also of annuals for colour effect. On the lawn itself would be planted attractive and stately trees and shrubs of good form. Beds of Cannas and other hardy flowers would be carved out in the lawn. But care would be taken that any planting on the lawn should not look crowded to mar the charm of the green grass. High walls and ugly places would be screened away with tall growing shrubs. Along walks, in front of walls
or trellises, herbaceous borders would be laid in which varieties of plants would be grown supplying cut flowers throughout the year for indoor decoration. Each part of the garden would be demarked by an ornamental low hedge or edging, free use of edging tiles, edging plants, etc., accomplishing this purpose.

The following hints will be useful in making a garden:—

1. The modern garden as observed above is composed of several parts. Care should be taken that not one of them ends definitely in one place. Each part should be simple and contribute to make a harmonious picture along with the other features. Paths, flower beds, garden seats, etc., should not be placed in incongruous situations without regard for their surroundings, suitability and utility. Each part should be a garden by itself and should have a significance of its own and should be adorned in such a way that its usefulness may be promoted. But every such part should have an organic relation with the other parts such that the complex garden consisting of such diverse features looks a pleasing and refreshing picture as a whole.

2. Overcrowding should be avoided. It is advisable to have a few permanent features instead of cramping the place with too liberal and promiscuous planting. The idea should be that it must be possible to enjoy one part of the garden by itself, and at the same time, affording an uninterrupted view of the entire garden.

3. Let the garden and the house merge into each other. Let not the garden stop abruptly along a particular line in front of the house. Plantings round about the mansion, climbers against trellises on the porch, decoration of verandahs and rooms with attractive house plants, window plants and hanging baskets—all these serve to unite the house with the garden.

4. Simplicity of design should be aimed at in the execution of the plan.

5. Advantages already existing such as trees, etc., should be utilised as far as possible.

The Lawn.—A grass lawn has a charm all its own. It
serves to enhance the beauty of a garden, be it large or small. It is a delightful foil to masonry and to brilliant flowers. Grass, being one of the hardiest perennial herbs, it is not difficult to keep a lawn in good condition, provided one takes good care of it.

The view of the lawn from the verandah and the windows of the house should be free and uninterrupted. A spacious lawn may be enlivened by beds of flowering plants as Cannas or groups of shrubs as bright Acalyphas, or trees of attractive form as Araucarias, or specimen shrubs as Thuja orientalis or large succulents as Variegated Fourcrorya and Agaves. Zephyranthes may be planted here and there in pockets made in the lawn to form colonies of themselves and bear their beautiful flowers peeping out of the fresh green grass soon after a shower.

An ill-made lawn is a source of constant worry and disappointment. Some trouble should be taken to form a good lawn. The soil should be drained effectively if it is observed that water collects in pools and does not drain off after a heavy rain. In the hot weather, before the monsoon sets in, dig up the ground to a depth of about a foot and a half, pick out all stones and remove the roots of weeds etc. Expose the clods of earth to the scorching rays of the sun for killing weed-roots and to sterilise the soil. A day or two before the rains are expected, break the clods of earth and incorporate into the soil plenty of well decomposed manure and lightly roll the area. Level the surface by filling in depressions. For levelling, drive in a number of flat-topped pegs at regular intervals; place a straight board on two adjacent plugs, proceeding from one direction and adjust the level of the board with the help of a spirit level. Let the soil settle down during the first showers. Remove any weeds that may come up. After the ground has thus been prepared, lay out the lawn by adopting one of the following approved methods. The best grass for lawns in India is Cynodon dactylon, known as the Hariyali, (Tamil, arukam pillu). It is low growing, hardy and responds to frequent mowing.

(a) From seed. In this Country a lawn is seldom made
by sowing seeds. A lawn from seed is thought of only when grass roots are not available. About 20 pounds of good seed may be necessary for an acre. The soil should be reduced to a fine tilth and given a light rolling. Seeds should be sown on a windless day, evenly and thinly and covered with fine light soil. The ground should be rolled again and watered liberally with the rose of a water-can or with hose pipe fitted with a nozzle which would water with very light force. For the first few times, cut the grass with a scythe. Use a lawn mower, when the roots have established and are spreading.

(b) By turfing. Turfs (pieces of earth with compact grass on them) should be cut uniformly thick in squares from a place where the grass is short, compact and free from weeds. They should be spread upon the prepared ground side by side and beaten down flat with a turf-beater. Any cavities in between should be filled with fine soil. Then the entire turfed area should be rolled and watered liberally. This is the most expeditious way of making a lawn.

(c) By turf-plastering. Fresh Hariyali roots should be cut up into bits, 1½ to 2 inches long. In a pit, a mixture consisting of two parts of these roots and a part each of well decomposed horse manure, fresh cow-dung and red earth or loam should be made and rendered into a paste by stirring it with the necessary quantity of water. Spread the paste evenly over the prepared ground, previously watered if necessary. Cover the ground then with litter or a layer of coarse manure to minimise evaporation and preserve the roots from the heat of the sun. If there is no rain for the next two days, water liberally. Grass will shoot up in a fortnight. Cut with the scythe to start with and after three months, use the mower.

(d) By dibbling roots. This is the cheapest and the slowest method. Small roots should be dibbled about six inches apart into the prepared ground when it is wet after a rain. The roots spread and grow underground in the course of six months, making a fairly compact lawn, by frequent mowing, rolling and watering.

After making a lawn in one of the ways detailed above, rolling, mowing, watering, and restoration of patchy places—
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should receive regular attention. Weeds should be pulled out as soon as they appear. Otherwise they soon spread, seed, multiply and overpower the grass. Fill up the gaps occupied by weeds with grass roots and fine soil. In the absence of rain, water the lawn every ten days heavily, soaking the soil through to a depth of at least three quarter of a foot. As freely as the grass grows, mow it and roll it. This makes the lawn velvety and thick. But do not use the roller when the ground is wet and sloppish. To have a perfectly green lawn, feed it once a month with liquid manure prepared by dissolving 1½ ozs. of ammonium sulphate in a gallon of water. Rake the soil well with a rake or scarifier once a year before the rains, breaking up the old roots and top dress the soil with a rich mixture of well decomposed manure and sand. This stimulates vigorous new growths. Constant rolling often results in the formation of a hard crust on the soil which is responsible for bare patches. To break such hard, crust of soil, beat the ground with a hammer provided with spikes set two inches apart.

The following are a few select plants suitable for planting on lawns, as single specimens. Refer to the index for reference to pages dealing with the plants mentioned below.

Trees:—Amherstia nobilis; Brownea rosea and other species; Bignonia undulata; Callicarpa lanata; Callistemon lanceolata; Cerbera odollam; Erythrina crista-galli; Magnolia grandiflora; Plumeria rubra and alba; Saraca declinata.

Araucaria; Cupressus funebris, pyramidalis and some others; Erythrina Parellii; Pinus longifolia; Schinus Molle. Thuja orientalis variety compacta.

Shrubs, creepers and foliage plants:—Agave americana variegata; Agave Franzosonii; Furcraea Watsoniana; Dasylium; Musa superba; Pandanus Veitchi and P. Sanderi; Bauhinia Galpinii; Bougainvillea Formosum, B. magnifica, B. lateritia, and B. Mrs. Wathen; Buddleya Lindenii; Cestrum nocturnum; Clerodendron Fallax or Kaempherii; Dombeya spectabilis; Hibiscus hybrids in varieties; Ixora, in varieties; Kopsia fruticosa; Lagertroemia indica; Nerium oleander (the large double rose and the carmine-rose double varieties);
Gardenia florida; Hamelia patens (trimmed to shape); Allamanda Aubletii; Petrea volubilis (over a balloon); Roupellia grata (kept within bounds by frequent trimming); Con-quot orange (for its ornamental small coloured fruits); variegated Guava, etc.

Shrubs and Shrubgeries.—Shrubs are plants, generally with woody stems, smaller than trees and bigger than most herbaceous plants. In a typical shrub, there are several woody stems arising from the same root. Shrubs are either deciduous or evergreen. Evergreen shrubs are generally slower in growth and more difficult to transplant than deciduous kinds. For horticultural purposes, shrubs can be conveniently classified under three heads, (1) those that are grown for their handsome foliage and form, (2) those that are grown for their attractive flowers and (3) those that are grown for their attractive ornamental berries.

Shrubs play a great part in the garden scheme. On account of their permanent character, like trees, they form part of the framework of the garden. They form the chief feature of landscape gardening, placed in front of tall trees along the confines, and fringing the spacious lawn. Shrubs which are amenable to frequent trimming are chosen for topiary work; ornamentally clipped shrubs and standards are utilised to best advantage in formal gardens. A well designed shrub border consisting of a suitable admixture of choice deciduous and evergreen shrubs is a source of perennial pleasure. So are the smaller sized shrubs which can go effectively into herbaceous perennial borders supplying cut flowers throughout the year. Groups of shrubs planted by themselves in beds on lawns or as single specimens enliven the green sward. Again, groups of them planted next to the house serve to link the garden with the house. Tall growing shrubs are used to screen from view disagreeable objects as the privy, dust bin, the manure pit and so on, and to shut off the view of the kitchen garden from the ornamental garden. Handsome shrubs as Ixora, Thuja, Bougainvillea, etc., make charming tub-plants.

For planting shrubs, prepare pits about a yard each way,
and fill them with good soil, if the soil of the site is not good. Prepare the ground well, by digging it about a foot deep and removing all weeds. Space the shrubs at suitable distances apart. When they mature and reach their maximum growth, they should not overcrowd and cut off light and air to each other. Do not allow them to grow straggly or form clumps by throwing suckers from the base, unless they are grown only for purposes of propagation. By cutting away straggly shoots and rigorously suppressing sucker growths, the activities of the shrub are directed to a more plentiful and richer inflorescence. Keep the soil under the shrubs well aerated by hoeing now and then. This will save a lot of watering. In summer, mulch the surface of the soil with lawn clippings or litter, etc. Manure the shrubbery at least once a year, digging in plenty of cow or horse dung, before the rains. During the rains, the manure gives its full benefit to the plants. Study the habits of growth and flowering of the particular shrubs and prune them accordingly (see Chapter X).

Standards.—Shrubs may be trained to a single stem and allowed to branch out and form a handsome head only above a particular height, when they are known as standards. There are a number of shrubs, such as Bougainvillea, Ixora, Holmskioldia, Hibiscus, Murraya exotica, Lantana, Lagerstroemia indica, etc., which may be trained to standard forms without much trouble. Favoured varieties of Roses may be budded on to tall stocks of Edward or the Briar Rose to form handsome flowering standards. Epiphyllum and Phyllocactus herbaceously grafted on tall stocks of Cereus make very ornamental plants. Herbaceous perennials as Geranium, Fuchsia, Hydrangea, and Heliotrope, are, as small standards, effective.

For making standards, select specimens with a tolerably straight central stem. Cut away all side growths close to the central stem and remove all suckers to the ground level. Provide the plant with a stout stake and fasten it with clasps, made of galvanised iron or zinc strips. They can be cut into the form shown in Fig. 62. Keep the shoot growing till it attains the desired height—say 2 to 4 feet—and then pinch out the top, three inches or so above a pair of leaf buds. Soon shoots
emerge from below. Prune these and the side shoots originating from them till a good head is formed. In course of time,

![Fig. 62.](image)

Take a piece of zinc plate and cut it in the form shown in A and along the lines shown. Then the cut bit could be bent into two circles as seen in B and then clasped round the stem and the stake as in C.

by careful and close pruning of the new growths as often as necessary, a neat cup-shaped head will be formed. Watch for growths from the stem below the head and for suckers from the root and remove them, as they grow at the expense of the standard and would kill it in course of time.

Standards and half-standards are invaluable for decoration of terraces. In formal gardening, they are planted alongside walks and paths in beds containing low growing plants as Moss Verbena. Standards may be effectively used to ornament lawns. Even in herbaceous and shrub borders, they may be effectively planted to show their bunch of colour amidst dark evergreen foliage or less striking flowers.

**Flower beds.**—Flowers are most effective when massed in beds. They give real colour—bright and cheerful and lasting for a long time. In India, with a well-arranged and thought-out scheme, one can easily have a succession of delightful flowers by periodical planting. Some kind or other, annual or perennial, can be grown almost throughout the year in beds. As several places in India vary widely in climatic conditions, the sowing time of annuals vary accordingly. Generally, in the plain country, up to an elevation of about 2,000 feet, the sowing of some annuals is done from October to De-
encumber for flowers in the hot weather. Again, sowing of certain kinds is done in April and May for flowers in the rainy weather. For flowers in early cold weather, sowing is done late in July or in August. Generally, all those kinds which are sown from October to December in the plains are sown in March to May on the hill.

Flower beds should be simple in design. They should be square, rectangular, circular or oval. Not only are such simple designs executed easily but they are in less danger of getting out of shape during digging operations, than complicated patterns possessing numerous points, angles and irregular curves.

The number and size of flower beds in a garden are determined by its extent and type. In a strictly formal garden, flower beds are picturesquely laid out in well marked-out bits in pairs; they form the chief feature of the garden along with the topiary, and ornamental trees and shrubs such as Araucaria, Cupressus, Thuja, ornamental Palms and the like. In the landscape style, flower beds are comparatively smaller in number and they are given only a secondary importance. Flowers are chiefly grown in the borders and in front of shrubberies to brighten the landscape view. In the free style of gardening, the position and number of flower beds are determined by their necessity and by the effect they are calculated to produce. Beside lawns, on lawns, and along main walks flower beds find their usual place.

In the garden scheme, the tallest growing species are planted at the back of borders or along compound walls or in beds on lawns far away from the residence. The medium sized plants are planted in the central area and the dwarfish growing ones in the front. In filling any one bed with different kinds of annuals or herbaceous perennials, the same principle is followed.

One should have a taste for arranging the colours in one's garden. There should be a harmonious blending of colours in the colour scheme of the garden to make a pleasing picture. Colours are said to harmonise when different shades blend insensibly into each other. The spectrum or the rainbow colours merge into one another in the following way, red with orange,
orange with yellow, yellow with green and so on. Harmony, is easily determined by the eye. A gradation from red to deep pink, light pink, and white is pleasing. The stronger colours which attract the eye before the milder ones should find their place in remote beds near the margins, and on the flanks. For instance, the bright scarlet Salvia splendens and the deep yellow Marigolds are distressing when placed directly in front of the house in small beds. The blues, the lilacs, the light purples and the roses would be suited for the front.

It may not be possible always to give an ideal aspect for all flower beds. Far away from the robbing roots of trees and in bright sunshine, thrive most bedding plants, though some may do well in semi-shade also. Flower beds should be dug up at least 15 to 20 days before sowing or bedding out small plants. For most annuals, it would be enough if the soil is worked to a depth of 18 inches. But for deep rooting plants such as Sweet Peas, Cannas, etc., the beds should be dug up to 2 feet. If the soil is bad, it should be improved by adding sand to heavy soil and heavy loam to light soil. Plenty of well-sifted leaf mould and horse or cow-dung, well-decomposed, should be forked into the soil long before the beds are got ready for planting. If the soil is too bad to be improved conveniently quickly, it should be removed to the necessary depth and replaced with fresh compost, the best being the one which is generally used for pot plants. A week before planting or sowing, break up the clods of earth, remove stones and pebbles and mix the manure well in the soil. A basket holding about half a maund of manure should do for about 18 sq. ft. of space. Level the bed in such a way that it slopes slightly and uniformly from the centre to the edge. In rainy season, raise the level of the bed by 3 to 6 inches above the surrounding ground to prevent flooding. Three or four hours before sowing or planting, water the bed freely. Before planting mark out the positions to be occupied by the plants. The height and the area that each plant would occupy when mature should be taken into consideration. When in bloom, the plants should just touch each other giving a continuity in flower and leaf from plant to plant. Overcrowding would result in weak-stemmed plants which would topple, one
over the other, and would not bloom satisfactorily. A clear space of 3 to 6 inches should be left unfilled by plants by the edge of the bed. For planting, make a hole with a trowel or dibber large enough to accommodate all the roots of the plant with the soil attached to them. Draw earth over the roots of the plant after putting it in the hole and press the soil lightly all round. The depth of planting depends upon the kind of plant and its habit of growth. Balsams, for instance, are covered up to the level of their second set of leaves. Several other annuals are covered up to the level of their first seed leaves. The soil should be soft and mellow at planting time. If too dry, it would not allow a good opening to be made for planting; if too wet, it would be sticky and very inconvenient to work. While planting large beds, wooden boards or stone slabs should be placed at convenient distances apart in the beds for stepping on to avoid foot-marks in the bed. After planting, the bed should be copiously watered with a watercan furnished with a rose. If the weather is not cloudy, the tender plants should be protected from strong sun by shading them with green twigs stuck into the bed. Till the plants establish and begin to grow, watering should be carefully done. Any excess may end in their rotting, and want of water will end in their withering away. The shade should be removed after the plants establish, which is generally in a week.

Attend to the needs of the flower bed now and then. Stir the surface soil to a depth of two to three inches every fortnight as this amount of aeration of the soil would stimulate the plants to vigorous growth. This scarifying of the soil is especially necessary after a rain when the surface hardens and cracks. When the plants turn yellowish in leaf, either they suffer from too much of water or for want of nourishment in the soil or from the activities of root-eating grubs. Examine the soil for these and pick them out. Feed the plants with weak liquid manure once a week or ten days or fork in well-decomposed manure in between the plants.

Carpet beds.—Carpet beds which were very common in formal gardens of old, have ceased to be a fashion now. But, they are interesting in their own way. Carpet bedding consists in
covering a bed or series of beds forming a design, with close low growing plants. In the design are brought out certain figures and letters by means of plants with varying habits of growth or having differently coloured leaves. It is usual to have a background of plants of one colour and to run through it plants of other colours in masses, stripes or ribbons, so as to produce the artificial effect desired. Carpets are designed in a number of ways, according to the taste of the gardener and the plants at his command.

Carpet beds are troublesome to maintain in good condition. They require constant attention. The plants should be trimmed now and then, not allowing them to outgrow their own limits in the pattern. Vacant spaces arising by death of plants caused by root-eating grubs or otherwise should be filled with a stock of similar plants which should be kept ready for use. The beds should receive once in three months, a dressing of well-decomposed manure which has been carefully freed from larvae of beetles.

The following list furnishes a few select plants that are useful for forming carpet beds:

* Alternanthera* (N. O. Amaranthaceae). Small evergreen herbaceous perennials, growing 1—2 ft. high, with small leaves, coloured and tinted with orange, scarlet, yellow, bronze, rose, and purple shades, there being several species. All are easily raised from cuttings, inserted where they are wanted to grow, two inches apart. They stand trimming well and thrive in the sun.

* Cineraria maritima* (N. O. Compositae). Popularly known as the “Dusty Miller” with silvery downy leaves. Propagated from cuttings. Grows 1—2 ft. high and stands trimming.

* Coleus salicifolius* and other dwarf species. (N. O. Labiatae) Dwarf spreading types of Coleus with attractive coloured leaves, growing 1—2 ft. make good plants for ribbon effect. Propagated by cuttings or from seed.

* Echiveria* (Cotyledon secunda) and other species. (N. O. Crassulaceae). Succulent leaved plants, with dense rosette of leaves, which are almost round. Grow 3—6 inches high. Raised by suckers, cuttings, leaves. Only suited to medium and
high elevations. Remove flowers to retain plants in good condition. Replace old plants which have no leaves at the bottom with new ones.

_Herniara glabra and its variety aurea._ (N. O. Illebraceae). Called Rupture wort. Ornamental trailing herbs about an inch high, with ornamental dark green or golden coloured leaves. Raised from seed or by division.

_Impatiens repens I. malabaricum_ (N. O. Balsaminaceae). Herbaceous compact low growing plant with reddish succulent stem and yellow bright flowers. Leaves are succulent and small. Excellently suited for rockeries, hanging baskets and low bedding. Liable to damp off in summer. Hence make a number of plants by cuttings to safeguard against loss.

_Lobelia succulenta_ (N. O. Campanulaceae). Called the Nilghiri Grass. Dwarf spreading perennials with grass-like foliage, flattened to the ground. The variety _L. succulenta rubra_ is pretty. These are marsh plants, which are easily raised by division.

_Paronchia argentina and capitata_ (N. O. Illebraceae). Known as Nail-wort or Whitlow-wort. Dwarf creeping perennial herbs, about 9 inches high, with white flowers surrounded by silvery bracts. Propagated by division or from seeds, sowing them where they are wanted to grow.

_Pilea_ (N. O. Urticaceae). Small herbs 3–8 inches high with graceful fernlike foliage consisting of minute thick leaves. Make mosslike growths. _P. muscosa_ is perhaps the best species.

_Portulaca_ (N. O. Portulacaceae). Low growing annual with trailing stem and short thick leaves and brilliantly coloured flowers. Raised from seed.

_Pyrethrum Parthesifolium_ aureum and other species. (N. O. Compositae). Known as Golden Feather. A pretty golden foliaged herb, 6–9 inches high. Better suited to high and medium elevations than to the plains. New plants should be made every year in the plains where the colour deteriorates after a year. Raised from seed or by cuttings or by division.

_Santaolina chamae-cyparissus._ (N. O. Compositae). Called the Cotton Lavender. An evergreen shrubby plant, 1–1½ ft. high, with strongly scented leaves and shoots which are covered with cottony down. Raised from seed and by cuttings.
Scutellaria andamanensis. A small herbaceous perennial, 4–6 inches high, bearing whitish flowers.

Sedum (N. O. Crassulaceae). Called Stonecrop. Showy succulent herbs, about 4 inches high. Sedum repestris is an excellent species. S. sexangularis can be grown satisfactorily at low elevations. Others do well in cool places at medium and high elevations.

Sempervivum (N. O. Crassulaceae). The House Leek. Stemless succulent plants with fleshy green and variegated leaves, mostly in rosettes, thriving only from medium to high elevations. Grow 6–12 inches. Suited for carpet bedding and rockeries.

Spergula = Sagina glabra and its variety filifera aurea (N. O. Caryophyllaceae). Known as the Pearl Weed or Pearl Wort. Perennial evergreen herbs, 2–3 inches high, with ornamental foliage and flowers. The stems are creeping and the leaves are narrow, green or golden yellow.

Torenia asiatica (N. O. Scrophulariaceae). A creeping perennial herb, with purple flowers like those of Torenia Fournierii.

Vittadenia australis (N. O. Compositae). A creeping perennial herb with dark green small leaves and daisylike tiny white flowers.

Borders.—Borders are continuous beds of more length than width containing plants of a heterogenous character as distinguished from flower beds which are composed of plants of one kind only. Borders are named differently as shrub or herbaceous perennial or mixed borders according to the plant material used to fill them. When composed mainly of shrubs, they usually skirt along walls or run in front of a row of trees behind them or in front of hedges and fences forming the boundary or screening undesirable places as manure pits, etc. A herbaceous border is mainly composed of herbaceous perennial plants of varying habits of growth and colours of bloom. A mixed border, as the name indicates, includes (a) shrubs which are not very heavy and woody and do not take much root space, (b) undershrubs which are smaller than shrubs and have comparatively soft stems, (c) herbaceous perennials, (d) annuals
which flower in masses and last for a long time in bloom, and
(e) such bulbous plants as Dahlia, Canna, Tuberose, Amaryllis,
Zephyranthes, etc., which are striking. A mixed border may
be composed of perennial herbaceous flowering plants and
annuals and biennials or only of annuals, when it is called
an annual mixed border.

A border serves the means of bringing together in harmo-
nious association a large number of plants which need not be
grown separately in beds. It enables the keen gardener to
study at one glance the habits and requirements of a number
of varieties of plants which are also a perennial source of supply
of cut flowers for decoration indoors and is thus of entrancing
interest to him. There is no wonder then, that borders are the
chief attractions of all modern gardens and have replaced for-
mal flower beds and rows of pot plants staged in tiers.

A heavy shrub border usually skirts walls and forms the
framework of the landscape view along with the trees behind
it. Other kinds of borders are effective on the verge of lawns,
besides important walks and paths, and the carriage drive, in
front of massive shrubberies, hedges, walls, and trellis. It is
essential that borders should be sheltered from high winds and
should get the full benefit of the sun. The site should be dug up
to a depth of 2-2½ feet and well incorporated with decomposed
manure. If soil is wanting in drainage, it should be attended
to. The method of planting to be followed depends on whe-
ther the border is single or double fronted. If it is single front-
ed, the tallest plants are put at the back and the dwarf plants
in the front, such that the plants present a sloping aspect from
the back to the front. If the border commands two aspects, the
tall plants are placed in the middle of the border in a row, the
medium sized plants next to them on either side and the small
growing ones next to these and edging them on either fronts.
Unless the border is 10-12 feet wide, there cannot be any free-
don in planting. Only small plants can be thought of for bor-
ders measuring 3 to 4 feet. Bold masses of colour cannot be
attempted in a cramped space. But an annual mixed border is
effective and artistic even if it is only four feet wide. The choice
of plants for filling the border should be such that at no time
is there any patchy effect. Similar plants are best planted in
groups of threes and fives far apart from each other for effect­
ing displays of masses of colour. Lanky growing specimens
should be placed by bushy plants to cover their nude stems so
that only their blooms may be visible above the foliage of ad­
joining plants. A shrub border only demands annual manuring
and hoeing and mulching in dry weather. A herbaceous border
requires greater attention. As the plants soon get exhausted in
this enervating climate of ours, they should be frequently fed
with top-dressings of well decomposed manure or applications
of liquid manure. They should be regularly watered. Suckers
should be now and then removed from plants which are inclin­
ed to form clumps, to enable them to bloom well. Vacant spaces
caused by death of plants should be replanted whenever neces­
sary. A well prepared herbaceous border need not be disturbed
for a year at least.

It should however be mentioned that formation of bor­
ders and especially the herbaceous border, is not a simple
matter. It requires an intimate knowledge of the kinds that
succeed best, their habits of growth, the heights they attain
to, the season and duration of their blooms, and the sequence
of flowering of the various plants which make up the border.
The plants should be of a hardy nature, and bloom strikingly
and for a long time. Our climate is responsible for the fact
that we cannot have in the plains as effective a herbaceous
perennial border as in England and such countries in the tem­
perate zone. Our selection is restricted to a few good kinds
only, and we should utilise them to the best advantage. The
tall growing Delphiniums, double Hollyhocks, Michaelmas
Daisies and several such ornaments of the English borders,
we cannot have in our borders in the plains.

Five lists of plants are given below, with a view to help
the amateur in his attempts to form a mixed border, which is
the easiest kind of border to form and the best suited for our
country for low and medium elevations. List A includes the
tall kinds and list E includes edging plants and the other
lists furnish plants in the descending order of the heights they
grow to.
The descriptions and cultural notes of the plants mentioned in the lists are given in Part II of the book.

List A.

Amaranthus ruber. Annual. 5—7 ft.
Arundo donax variegata. Perennial grass. 6—8 ft.
Canna. Rhizomatous rooted plant. Tall kinds. 5—6 ft.
Clerodendron nutans. Shrub, white drooping flowers in large branches. 5—6 ft.
Dahlia. Tuberous rooted seasonal plant. 4—6 ft.
Gardenia florida. Shrub with double white scented flowers. Slow growing. 4—6 ft.
Hamiltonia suavelons. Shrub. 6 ft.
Hibiscus mutabilis. Shrub. 6—8 ft.
Hibiscus. Other kinds. 5—7 ft.
Hollyhock, single. Annual. 4—6 ft.
Nerium Oleander in different varieties. Shrubs. 5—7 ft.
Thevetia. White, Orange, or Yellow flowered. Shrubs. 6—10 ft.
Tithonia speciosa. Annual. 5—7 ft.
Verbesena gigantia, known as the perennial Sunflower. Shrub. 6 ft.

List B.

Barleria varieties in white, pink, rose, lilac, blue, and violet colours. Undershubs. 3—4½ ft.
Brunfelsia americana. Shrub. 4—5 ft.
Buddleia Lindenii and B. Veitchii. Undershubs. 3—5 ft.
Cestrum aurantiacum. Shrub, not woody. 5 ft.
Cestrum elegans. Climbing shrub. 5—6 ft.
Clerodendron fallax and C. Kaempferii. Shrubs. 4—5 ft.
Daturo suavelons. Single and double flowered. Shrub. 4—5 ft.
Franciscea uniflora. Shrub. 4—6 ft.
Justicea carne and J. chrysostephana. Undershubs. 3—4½ ft.
Stachytarphe rosea. Undershrub. 3—4 ft.
Tabernamontana coronaria, single and double flowered. Shrub, 4—5 ft.
Tecoma capensis. Shrub. 3½—5 feet.
Thysanolaena agrestis. Grass. 3—4 ft.
Pennisetum longistylum. Grass. 5—6 ft.

List C.

African Marigold. 3—4 ft.
Angelonia grandiflora. Undershrub, 2—2½ ft.
Barleria cristata, pink, rose, blue, light purple. Under-shrubs. 2½—3 ft.
Barleria Gibsonii. Undershrub. 2 ft.
Browallia major and minor. 2—2½ ft. Annual and herbaceous perennial.
Cannas of different colours. 2½—4 ft.
Clerodendron speciosa and Thomsonae. Slightly climbing undershrubs. 3—4 ft.
Clerodendron phlamoides. Shrub. 3 ft.
Gladiolus. Cormous rooted seasonal perennials. 3 ft.
Heliotrope. Undershrub. 2½—3 ft.
Ixora rosea, I. Singaporensis, and others. Shrubs. 4—5 ft.
Kopsia fruticosa. Shrub. 3—4 ft.
Mirabilis. Tuberosous rooted seasonal plants. 3—3½ ft.
Pentas carnea. Undershrub, 2—2½ ft.
Plumbago, blue, white and rose coloured species. Undershubs. 2—2½ ft.
Salvia uliginosa. Herbaceous perennial. 3—4 ft.
Solidago. Herbaceous perennial. 2½—3 ft.

List D.

Angelonia grandiflora alba. Perennial herb. 1—1½ ft.
Chrysanthemum frutescens and indicum. Herbaceous perennials. 2—2½ ft.
Campanula pyramidalis. Herbaceous perennial. 1½ ft.
Correopsis grandiflora. Annual. 1½—2½ ft.
Crossandra undulifolia. Herbaceous perennial or undershrub. 2—2½ ft.

Californian Giant Asters. Annuals. 2—2½ ft.

Cyanoglossum amabilis. Annual. 1½—2 ft.

Gaillardia picta, etc. Annual. 2 ft.

Daedalacanthus. Undershrub. 1½—2 ft.

Michaelmas Daisy. Herbaceous perennial. 1—2½ ft.

Salvia farinacea, leucantha, splendens and its hybrids, coccineas and its hybrids. Herbaceous perennials, grown as annuals. 1½—2½ ft.

Vinca rosea and its varieties. Undershrub. 1½—2 ft.

**List E.**

Ageratum, dwarf kinds. Annual. 6—12 inches.


Begonia semperflorens. Perennial herbaceous plant. 1—1½ ft.

Brachycome. Annual. 6 inches.

Candytuft. Annual. 6—8 inches.

Correopsis miniature. Annual. 6—12 inches.

Dianthus Heddewi and others (Pinks) 8—10 inches.

Dwarf China Asters. Annual. 6—12 inches.

French Marigold. Annual. 9—12 inches.

Michaelmas Daisy, dwarf kinds. 8—12 inches.

Phlox Drummondi. Annual. 5—9 inches.

Portulaca. Annual. 8—4 inches.

Rudbeckia. Herbaceous perennial. 8—12 inches.

Salvia azurea or graciliflora. Herbaceous perennial. 9—12 inches.

Zephyranthes, in varieties. Bulbs. 6—9 inches.

**Hedges.**—A live high impenetrable hedge, reinforced if necessary by one or two strands of thick barbed wire concealed in it, kept neat and tidy by trimming it to shape and keeping it within bounds, forms a natural boundary to a garden and it is hence preferred to compound walls by many. It not only is effective in protecting the garden from trespassing cattle and thieves but also ensures privacy and affords a pleasing sight when fresh with foliage or when in bloom. If tall enough, say 10—12 feet, a boundary hedge serves as a wind screen as
well. The best material for forming such a hedge would be a quick growing hardy shrub of a scandant or climbing habit of growth with attractive small foliage and handsome blooms. It should be a kind which does not attract snakes; it should be drought resistant; it should stand trimming to shape and it should be capable of being easily and quickly raised from seed or from cuttings to fill up gaps promptly.

Ornamental internal hedges are formed of small growing shrubs or undershrubs which have handsome foliage and bear in some cases handsome flowers as well. The usual height for an ornamental internal hedging varies from 1—2½ feet. Its object is to seemingly divide the garden into a number of parts, each containing a distinct feature of its own as a rosary or flower beds or plantation of bulbs, etc., each part being visible from the other over the short hedge, which is an attraction by itself. In a large garden several such hedges, like so many edgings, comprised of different kinds of plants break the feeling of flatness and enliven it.

As the boundary or the screen or the ornamental hedge are all meant to be permanent features of a garden, a certain amount of trouble should be taken in the preparation of the ground and in planting them. A good trench, 2 to 2½ feet wide and 2½ to 3 feet deep should be dug up and left exposed for a fortnight or a month, after which it should be filled with the soil enriched with manure. It is best that top layers of soil to a depth of 9—12 inches do not contain manure, as it will not help the newly planted cuttings to strike root, but only will attract white ants to them. If the soil is too light or clayey or gravelly, it should be improved as recommended in Chapter III. The planting of a hedge is usually undertaken only in the rainy season, in August. Either seeds are sown or cuttings inserted or rooted cuttings planted, the distance apart for sowing or for planting depending upon the nature of growth of the particular plant. Plants of such trees as Polyalthia longifolia or Inga dulcis or Pongamia glabra, may be planted 5—6 feet apart. Shrubs may be planted from 6 inches to 3 or 4 feet apart. Seeds should be sown or cuttings planted in two rows a foot apart triangularwise thus . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
Shoots should be tipped as they grow to induce them to branch out and the side shoots should be cut back to the desired dimension. A square hedge is the easiest to make. Only a few kinds of plants are allowed to grow to the desired height and then trimmed to shape. Most kinds are regularly trimmed and pruned for every top growth of 6—9 inches till the desired height is reached. This ensures a square formed hedge. An ill pruned or badly formed hedge presents a broad top and is wedge-shaped. A compact and a thick hedge is possible if it is trimmed as often as necessary cutting back the overgrowing shoots strictly to the desired dimension.

Two lists of plants are given below which are suited for forming boundary and ornamental internal hedges respectively. Several such kinds as Cactus, Opuntia, etc., have been omitted, as there is not much to recommend them except their thorny nature which helps to keep off cattle.

A. Plants suitable for ornamental internal hedges.—Refer to index for pages dealing with the plants mentioned below.

*Acalypha.—Dwarf-growing species as A. Hamiltoniana can be trimmed well, keeping the hedge neat from 1—3 feet high. Foliage brightly coloured. Plant rooted cuttings 8—12 inches apart.

*Barleria.—Undershubs, with very pretty flowers capable of being trimmed to an attractive hedge, 1½—2 feet high. Plant rooted cuttings 9—12 inches apart.

*Bougainvillea.—Almost all the species can be utilised to form a hedge, standing good trimming and bearing beautiful brightly coloured bracteal flowers in masses enveloping the hedge in a canopy of colour. Species particularly suited are B. glabra, B. cypheri, B. Mrs Fraser. Plant rooted cuttings 3 feet apart. Train shoots along barbed wire and cut back side shoots and leaders to freely branch and bush out.

*Buddleia Lindleyana and B. Veitchii.—Plant rooted cuttings 12 inches apart. Can be trained to a handsome hedge bearing scented lilac-blue flowers in long spikes. The plants are short-lived and hence, the gaps should be filled every now and then with plants kept ready for the purpose.

*Clerodendron inerme.—(N. O. Verbenaceae). Forms one of
the best and popular evergreen hedges, which can be continually trimmed with immunity to shape it. It is very hardy, drought resistant, and responsive to good treatment. Leaves are polished green and disagreeable smelling when bruised and hence, this hedge is supposed not to harbour reptiles. It takes about two years to form a tall hedge, as the shrub is rather slow growing. Flowers are white and borne in small clusters. But as they would detract from the value of the perfectly pleasant green foliage, they should be trimmed away. Plant cuttings of 6—8 inches, 4—8 inches apart, in two rows. Plant again if several fail to root. Trim at every stage of growth.

*Cupressus.*—Dwarf species as *C. macrocarpa* form very attractive hedges in medium to high elevations. At low elevations, require protection from strong sun. Evergreen, ash-green, pretty foliage. Plant young plants, about 6 inches high, in two rows, 12—18 inches apart.

*Daedalacanthus.*—Hedge, 1—1½ feet high, with pretty dark green foliage and deep violet spikes of bloom in plenty. Raise plants from cuttings or seed and plant them 9—12 inches apart in two rows.

*Duranta.*—A very suitable hedge plant thriving in almost any kind of soil and easily propagated from seed or cuttings. Plant 12—18 inches apart. If not sheared too frequently, handsome blue or white flowers are produced, and these are followed by charming yellow berries. The hedge grows even under shade. The variegated species is very ornamental.

*Eranthemum nobilis.*—With its green leaves which are veined with yellow, the hedge is ornamental when kept at 2 feet high. Plant cuttings 6 inches apart in two rows.

Other kinds of *Eranthemums* as *E. cinnabarimum*, *E. goldeana*, etc., as also the allied *Grauhorrhynchum* are used for hedging too.

*Euphorbia Bojeri.*—A hedge, 1½—2 feet high, is pretty with its foliage and bright coloured flowers. Plant cuttings 9—12 inches apart.

*Eupatorium cannabinum* = *E. heteroclinium.*—(N. O. *Compositae*). Makes an excellent internal hedging up to 2 feet
high. Plant closely, 6 inches apart and trim constantly. Light green foliage and Ageratum-like flowers.

_Hamelia patens._—Forms an attractive hedge with evergreen greenish brown foliage of small leaves. Stands close trimming to shape. Plant 12 inches apart. Slow growing but elegant when kept well. Proper height, 2½—3 feet.

*Hibiscus of kinds, especially rosa sinensis._—Hardy and quick growing. Needs constant trimming. Pretty; kept 2½—3 feet high, with the bright flowers peeping out here and there from among the rich green polished foliage.


_Lantana._—Forms a good hedge, standing trimming very well. Flowers are handsome but should not be allowed to seed, as the kind spreads like a weed. The yellow and the white flowering kinds are comparatively dwarfs and are hence good for short hedges 1½—2½ feet high. The commoner varieties can form hedges even 6 feet high.

_Malpighia glabra and coccigera._—Small green leaves and pretty flowers. Plant 9—12 inches apart. Keep the hedge at 2 feet.

_Meyenia erecta._—Keep the hedge 1½—2 feet. Pretty blue flowers peeping through the dark green foliage. Very ornamental with its fresh foliage and stray flowers peeping through it. Plant rooted cuttings 6—12 inches apart.

_Pedilanthus tithymalides._ (N. O. Euphorbiaceae).—The variegated variety with creamy white and green leaves borne on cylindrical thick stem which is also of the same colour is pretty, if kept trimmed at 2—3 feet. Easily raised from cuttings, which may be planted 5—6 inches apart.

*Plumbago capensis._—Makes a very attractive hedge, 1—3 feet high. Plant suckers or rooted cuttings 6—10 inches apart.

_Serissa foetida._ (N. O. Rubiaceae).—Dwarf pretty small shrub; can be kept at 2 feet high, with small shining dark green leaves; bears white flowers, which when bruised emit an unpleasant smell.

_Strobilanthes anisophyllus._—Known as the Gold Fussia.
Keep the hedge down at 18-24 inches. Loves shade.

B. Plants suitable for boundary or tall hedges.—Refer to index for pages dealing with the plants mentioned below.

*Acacia Farnesiana.—Makes a good thorny hedge kept thick at 6 feet high by constant pruning. Sweet scented flowers. Plant seedlings 12 inches apart. *Acacia concinna and A. modesta also make good hedges, suitable for large estates.

*Acalypha.—Taller species can be trimmed to a hedge, 6 feet high. Plant rooted cuttings 12 inches apart.

*Acacia concinna and A. modesta also make good hedges, suitable for large estates.

*Acalypha.—Taller species can be trimmed to a hedge, 6 feet high. Plant rooted cuttings 12 inches apart.

*Agave americana and other tall growing species.—Make ornamental barriers, 4-5 feet high.

*Aralia filicifolia and other tall growing species.—Ornamental foliage. Height 4-6 feet. Plant rooted cuttings 12 inches apart.

*Bambusa, dwarf kinds.—Make thick but uncouth fences, harbouring snakes. Bambusa nana is the best species for the purpose.

*Bougainvillea.—Keep at 6-8 feet high. B. glabra is the hardiest for the purpose. B. cypheri is dwarf growing and bushy.

*Casuarina equisetifolia. (N. O. Casuarinaceae).—Best for sandy soils. Should be planted 12 inches apart and pruned back before a large trunk forms. Its neatness much depends on periodical clipping at every stage of its growth, as otherwise it would soon become stumpy and bare. 6-8 feet.

*Clerodendron inerme.—See under list A.

*Dodonaea viscosa. (N. O. Sapindaceae).—Pleasing evergreen shining foliage. A large bushy shrub, drought resistant. Forms a pretty hedge when clipped and kept in order. Raised from seed and planted 12-15 inches apart.

*Duranta.—See under list A above.

*Furcraea gigantia.—Like Agave.

*Haematoxylon campechianum. (N. O. Leguminosae). Known as the Logwood. Slender tree with small shining leaves and bearing catkin-like small racemes of highly scented yellow flowers. Stands trimming very well, forming an admirable fence up to 8 feet.
*Inga dulcis.* (N. O. Leguminosae). Should be closely planted and trimmed constantly to form an impenetrable hedge with pleasing green foliage. Known as the Madras Thorn. (Tamil—Korukapuli).

*Jatropha curcus.* (N. O. Euphorbeaceae). Called the Physic Nut. Forms a quick growing hedge, 5—6 feet high. A drought-resistant common countryside fence. Sow the nuts where plants are growing.

*Lantana.* See under list A.


*Pongamia glabra.* (N. O. Leguminosae). A medium sized tree, making a good tall hedge, 10 feet high, if planted close and cut back. Sow seeds in situ or plant seedlings 2 feet apart.

*Polyalthia longifolia.* Sow seeds in trenches where they are wanted to grow. Plant 3 feet apart and keep the hedge at 8—10 feet.

*Punica granatum.* The Pomegranate. Planted 2—3 feet apart and kept close by constant trimming, it forms a good hedge 6—8 feet high with pretty foliage and attractive flowers and also fruits. Drought resistant.

*Synadenium grantii.* (N. O. Euphorbiaceae). Called the African Milk Bush. Makes a thick fence in a short time by inserting cuttings where they are wanted to grow 12 inches apart. Keeps evergreen in cool situations.

*Cactus, Cereus,* and Opuntia make good cattle proof fences but they soon outgrow their limits and become a nuisance.

**Roads, walks and paths in the garden.**—Every garden has necessarily a carriage drive leading from the entrance to the house or the mansion and to the garage and a few walks and paths which are indispensable to go round and reach the several parts of the garden. If they are too numerous or occupy too much space and are laid out without due regard to artistic principles, they mar the picture of the garden. Especially in small gardens, walks and paths, accentuate the smallness of the area. They should be direct and take as far as possible the shortest route to the given points. In formal gardens, as a gene-
ral rule straight walks, paths and roads prevail, while in landscape gardens, curved roads, etc., fit best into the picture. The curves should be graceful and easy and each bend should have an obvious meaning. They serve to achieve informality. Long borders would be monotonous but for their wavy and curved edges.

The width of the road is determined by the space available, the size of the house, and other considerations. Ordinarily, it varies from 12 to 16 feet. A walk is best laid out with a minimum width of three feet and a maximum of five feet in a large garden. At the time of forming roads, walks and paths, questions of drainage, curbing or edging should receive due attention. They should be well drained or placed a little higher than the surrounding ground with a crowning centre so that water may flow away to the sides. An inclination of one in one hundred would help to drain away water effectively. A solid foundation is necessary for roads, etc., or they become slushy and slippery during rainy season.

For making a satisfactory road, excavate the site to a depth of 12 inches at least. Make the bottom a little convex, that is high in the centre and sloping to the sides. Soak the ground well with water and roll it thoroughly. Upon the firm ed ground, closely pack a layer or two of large pieces of stone (metal) or well-burnt brick pieces to a depth of about nine inches. Pour water freely and roll again. Then spread a three-inch layer of macadam or laterite material or konga (a kind of lime stone). Again sprinkle water freely on top of it and roll well to give a hard road. For making a walk or path, it would do if the soil is removed to a depth of eight to nine inches. Cover the bottom with a five-inch layer of rough stones or brick pieces and roll well. Spread a layer of coarse gravel, 1½ inches thick. Again roll and cover with a layer of finer material to a depth of an inch or so. Clean white sand spread on a road, walk, or path, kept free from weeds imparts a sense of tidiness to the place. Immediately attend to the repairs of the road, walk, etc., should they go bad. Work the part to be repaired with a pickaxe to a depth of 4 inches, water, and pack closely into the space fresh gravel or metal, beat down with a heavy beater.
and roll well. Keep the roads, etc., free from grass and weeds. Use sodium chlorate solution to kill their roots. Keep the edge of the lawn clean cut with the edging iron if it abuts the walk or road.

Edgings.—The term edging is used to denote any material of any description which is employed in gardens for dividing beds, borders, etc., from roads, walks or paths, or for demarcating spaces allotted for particular purposes as flower beds. An edging may be live, consisting of dwarf growing plants, handsome in foliage, and if possible with flowers too, and capable of being neatly trimmed whenever necessary. An edging may also be mechanical, as edging bricks, slabs of stone or plates of iron, creosoted boards and so on. Edgings, whether live or mechanical, complete the orderly appearance of a garden.

A grass verge between a bed or border and the road or walk is pleasing to the eye and it further serves as a foil to the brilliant colours beyond it. The grass should be kept in good condition by feeding, watering, clipping, and rolling it every now and then. To be effective, it should be about 2 feet wide. The edge should be clean cut with an edging iron, preventing it from growing and spreading into the road. Edging bricks or iron sheets are often used to save the trouble of having to cut the edge to keep it trim but they are themselves obtrusive.

Mechanical edgings are of various kinds, and they are chosen according to one's requirements. Edging bricks are fixed into the ground in such a way that the rounded edge measuring about an inch and a half is above the ground. Cast iron sheets are less obtrusive. Plain cut-bricks may be put lengthwise, half in and half out. They may also be laid alternately in horizontal and vertical positions for purposes of greater ornament. Rough and irregular stones fixed alongside roads and paths, with dwarf plants of pleasant foliage hiding them from view partially form a natural kind of edging in gardens of natural style. Such an edging is common in shade gardens. Bottles, if available in large numbers, as from a brewery or a factory of aerated waters, would form an interesting edging, if plunged neck downwards about two thirds their length.

Plant edgings should be maintained by trimming them
every now and then and by planting fresh plants in place of deceased ones. The plants chosen should be hardy, should have lasting foliage, or flowers, or both.

The following are two lists of plants (refer to index also for pages dealing with the plants mentioned below) which are used ordinarily for edging purposes:

A. Foliage plants suitable for edging:

*Alternanthera. (N. O. Amaranthaceae). Evergreen perennial herbs, 4—9 inches high, with small handsome leaves, which are variegated differently in different species. They are green and yellow, or bronze and green or red and pink-green. The more handsome species are A. versicolor, A. tricolor, A. amabile, and A. spathulata. It is the most popular edging for flower beds and it is also used largely in carpet bedding for "lettering". It stands trimming. Cuttings should be planted 1—2 inches apart where they are wanted to grow. The soil should be kept free from cockchafer grubs.

Aspidistra.—Grows 1—1½ feet high with handsome long and broad radical leaves which are green and gracefully arching down. The variegated species with green leaves striped yellow is very pretty. Forms good edging in semi-shady situations along paths and walks. Propagated by division of rootstock.

Caladium Humboldtii.—Grows ¾—1 foot with small variegated white leaves. Very pretty in shade gardens. Propagated from tubers.

Cineraria maritima.—With its silvery grey foliage forms a good edging to Acalyphas and such shrubs in shrubbery beds.

Coleus.—Dwarf kinds like C. Hendersonii growing 9—18 inches high and with pretty coloured leaves form an excellent and broad edging for flower beds or green foliage shrubs and ornamental plants. Raised from cuttings or from seed.

Echeveria (Cotyledon).—On hill stations are useful for edging flower beds and rockeries.

*Eupatorium cannabinum.—Can be trimmed even to 6 inches.

Iresine.—Grows 1½—2 feet, has handsome foliage of either brilliant rose-red or green with rich variegations of yellow; these
An interesting Rockery of Peruvian Cactus
two species being the most valuable. Can be trimmed to keep bushy. Suitable edging for larger plants in shade gardens.

*Justicia gendarussa.*—Hardy edging which stands heavy rainfall. Can be trimmed to 8 to 12 inches. Thrives in shade.


*Pilea muscosa* and other species.—Grow 3—8 inches, have Fern-looking foliage with very small succulent leaves. Spreading habit. Useful as undergrowth in shade gardens and for edging rockeries and to form a verge-like edging. Hardy, thriving in shade, semi-shade and in sun in cool weather.

*Pyrethrum.*—A striking edging to flower beds.

*Santolina.*—Suited for edging red foliaged plants and borders in sunny situations.

**B. The following are a few floral edgings:**

*Alyssum; Amaryllis; Brachycome; Fairy Rose* (also called the Button Rose with small rose coloured or white flowers of the size of a button. The shrub only grows 1—1½ feet high); *Gazania splendens; Gerbera; *Lobelia erinus compacta; Plumbago capensis; *Saponaria; *Torenia; *Zephyranthes in species.*—Along walks and foot-paths, it is charming while in bloom.

**Rockery.—**In this country, the term rockery is associated usually with a large shady tree, a large mound of earth heaped up under it with a number of boulders imbedded in and jutting out of the mound, and a few plants, mostly hardy ferns, peeping through the interstices of the rocks. This kind of erratic structure cannot have any fascination to the real plant lover, as it is utterly devoid of beauty but on the other hand it acts as an effective means of destroying a valuable tree by suffocating its root system.

A real rock or alpine garden, which is well planned and well planted, provides such a variety of interests in a short compass that it has become an important feature of all modern gardens in temperate and subtropical climes. An alpine garden is intended to house a charming collection of alpine
plants or plants growing in crevices of rocks on mountain sides, under such conditions and environments as approximate as nearly as possible to those which obtain in their native homes. But, such ideal rock gardens filled with real alpine plants, covering stone projections or boulders with their neat dainty cushions, tufts, and rosettes of dense foliage and profusion of brilliantly coloured flowers cannot be thought of in India except on hill stations. There are, however, several subtropical plant gems, which would thrive in this country better on artificial rockeries than in pots or in the ground as they provide almost ideal conditions of drainage, aeration of roots and soil moisture for them. Rockeries also serve to dispel the monotony of long flower beds and borders and introduce a new interest and variety into the garden.

A variety of positions may be selected in a wide extent of the grounds for forming a rockery or rockeries. Portions of the grounds, where the soil is too bad or waterlogged or too overpowered by the shade and robbing roots of large trees
can be utilised for forming a rockery. So also, rocky situations where boulders present themselves above the surface of the ground. Advantage can be taken of the existence of trees for making isolated rockeries under them. Under groups of trees, rockeries may be constructed, so that a number of kinds of plants differing in requirements of shade and sunshine may be grown on them, those which love a greater degree of sunshine being given sunnier positions than others. In place of a continuous rockery running several feet of the grounds, it can be cut up here and there with neat paths, enabling one to inspect all the plants. Along sunny borders or in suitable exposed positions, rockeries may be made and filled with sunloving plants as varieties of Cactus, Agave, Aloe, Yucca, Kalanchoe and such others. To break the monotony of tiers of staged pot plants in conservatories or ferneries, a portion or portions may be allotted in them for a rockery on which are planted diverse handsome plants.

Artificial rockeries are not meant to make a display of several sizes and kinds of stones arranged in fantastic ways. The main idea is to provide an agreeable place for certain plants to grow. The stones of the rock garden give no doubt a characteristic effect but their chief function is to keep cool the roots of plants growing in their pockets and to shelter them and store moisture for their use. Any regularity of plan in the arrangement of rocks should be avoided. It is enough if a sort of rugged effect is produced by the use of stones varying in size and angular projections.

An artificial rockery can be made in the following way. The contour of the intended rockery is marked out on the chosen site and good garden soil enriched with manure and leaf mould is heaped up to the required height and well firmed, by moistening with water and beating with a turf-beater. In place of this soil, the ordinary potting compost can be used. Rocks are then fixed sloping backward into the mound so made, commencing from the edge, with larger stones leaving pockets or spaces between the stones for accommodating plants and finishing up with smaller ones. The spaces between the stones should be varied in size to suit growing in
them single plants or clumps of plants and plants with large or small root systems. It is necessary that the stones should be firmly fixed in the earth so that, even if a person walks on the rockery, the rocks will not shift from their positions. In a high rockery with a steep slope, the earth is likely to be washed away during rains and hence, it would be advisable to divide it into terraces. Under a large tree as the Banyan or the Rain Tree which spreads its roots along the surface of the ground, the rockery would soon be filled with the roots of the tree making it impossible for the favoured plants to grow. To keep these roots from the rockery, the area selected for the rockery should be dug up to a depth of about 9 inches and the soil replaced with mortar rubbish saturated with crude oil, or cemented on. Over this hard base, should be spread the compost for constructing the mound.

It is advisable to plant the rockery at the outset only with well established plants. A certain amount of knowledge of the habits of growth of particular kinds chosen for covering the rockery and a certain amount of taste in allotting them their positions against differently sized stones are necessary. Plants with a pendant habit of growth look graceful against overhanging pieces of rocks. Creeping plants should be allowed to trail along, filling fissures and hiding protruding rocks. Plants of a spreading habit of growth and those which grow forming clumps should be given larger pockets than others. The rockery should be thinly planted to start with. The plants grow and fill the rockery in course of time without overcrowding it.

The aftercare of a rockery which is thus well made and planted, consists in constant weeding, in the prevention of overcrowding by the free use of garden knife, in renewing or top-dressing the soil in the pockets with fresh rich soil, and copious watering in summer or dry weather.

A list of plants suitable for planting rockeries from low to high elevations in India is furnished below, with remarks on their culture and habits of growth. Refer to index for pages dealing with the plants mentioned below.
<table>
<thead>
<tr>
<th>Name</th>
<th>Situation</th>
<th>Flowering or foliage</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achimenes</td>
<td>Semi-shade or shade</td>
<td>Flowering</td>
<td>Select only acclimatised hardy species.</td>
</tr>
<tr>
<td>Agaves</td>
<td>Full sun or semi-shade</td>
<td>Foliage</td>
<td>Agaves, by themselves, without other plants, on extensive fully exposed rockeries are very showy.</td>
</tr>
<tr>
<td>Alonasia</td>
<td>Semi-shade or shade</td>
<td>Foliage</td>
<td></td>
</tr>
<tr>
<td>Ananas. (Variegated Pine Apple)</td>
<td>Sun or semi-shade.</td>
<td>Foliage</td>
<td></td>
</tr>
<tr>
<td>Anthericum, varieties of</td>
<td>Semi-shade or shade</td>
<td>Foliage</td>
<td></td>
</tr>
<tr>
<td>Anthurium</td>
<td>Shade</td>
<td>Foliage</td>
<td></td>
</tr>
<tr>
<td>Begonia semperflorens</td>
<td>Semi-shade</td>
<td>Numerous flowers</td>
<td>Thrives in open sun on hill stations. Tuberous plant.</td>
</tr>
<tr>
<td>Belamcanda</td>
<td>Semi-shade</td>
<td>Flowering</td>
<td></td>
</tr>
<tr>
<td>Bolus perennis</td>
<td>Semi-shade</td>
<td>Flowering</td>
<td>Thrives in open sun in cool places.</td>
</tr>
<tr>
<td>Bilbergia</td>
<td>Shade</td>
<td>Foliage and flower</td>
<td></td>
</tr>
<tr>
<td>Cactus Species</td>
<td>Sun</td>
<td>Foliage and flower</td>
<td></td>
</tr>
<tr>
<td>Caladium</td>
<td>Semi-shade</td>
<td>Foliage</td>
<td>Select hardy dwarf kinds.</td>
</tr>
<tr>
<td>Name</td>
<td>Situation</td>
<td>Flowering or foliage</td>
<td>Remarks</td>
</tr>
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<tr>
<td>Chlorophyton.</td>
<td>Shade</td>
<td>Foliage</td>
<td>Same as Anthericum.</td>
</tr>
<tr>
<td>Coleus.</td>
<td>Semi-shade</td>
<td>Foliage</td>
<td>Requires light and shade for satisfactory development of colours.</td>
</tr>
<tr>
<td>Cotyledon. (Echeveria)</td>
<td>Semi-shade or shade in plains and sun on hills.</td>
<td>Foliage</td>
<td>Succulent small plants, with rosette of leaves.</td>
</tr>
<tr>
<td>Euphorbia splendens.</td>
<td>Open sun</td>
<td>Flower</td>
<td>Hardy thorny plant, growing without care.</td>
</tr>
<tr>
<td>Ferns.</td>
<td>Shade and semi-shade or sunny situation, according to kind.</td>
<td>Foliage</td>
<td>Select only hardy kinds.</td>
</tr>
<tr>
<td>Fittonia argyrosura and rubro venosa.</td>
<td>Shade</td>
<td>Foliage</td>
<td>Ornamental leaved small trailing plants.</td>
</tr>
<tr>
<td>Gazania.</td>
<td>Open sun</td>
<td>Flowering</td>
<td>Perennial trailing herb with daisy-like flowers.</td>
</tr>
<tr>
<td>Herniara (Rupture wort)</td>
<td>Open or shady situation.</td>
<td>Foliage</td>
<td>N. O. Illiricaceae. Harly perennial ornamental leaved trailing herb.</td>
</tr>
<tr>
<td>Plant Name</td>
<td>Light Requirement</td>
<td>Bloom Type</td>
<td>Notes</td>
</tr>
<tr>
<td>----------------------------------------</td>
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</tr>
<tr>
<td>Impatiens sultani, Impatiens Holstii (Hill Balsam)</td>
<td>Semi-shade, Sun in cool weather</td>
<td>Flowering</td>
<td>I. repens is a creeping herb bearing yellow flowers.</td>
</tr>
<tr>
<td>Kalancho species</td>
<td>Sun</td>
<td>Flowering</td>
<td>Hardy perennial with trailing habit, bearing like flowers. Propagated from seed.</td>
</tr>
<tr>
<td>Lintaria cymbalaria. (Ivy leaved Toadflax)</td>
<td>Semi-shade or open sun</td>
<td>Flowering</td>
<td>Folage also is pretty.</td>
</tr>
<tr>
<td>Lobelia erinus</td>
<td>Sun</td>
<td>Flowering</td>
<td>N. O. Hydrophyllaceae. Thrives at medium to high elevations only. Hardy trailing annual.</td>
</tr>
<tr>
<td>Nymphaea (Californian Blue Bell)</td>
<td>Sun</td>
<td>Flowering</td>
<td>Stems, small, wiry and trailing; leaves, variegated white, pink, and green.</td>
</tr>
<tr>
<td>Ophiopogon (Variegated Pachysandra)</td>
<td>Shade or semi-shade or sun in cool places</td>
<td>Foliage</td>
<td>Creeping herb with roundish oval or heart-shaped leaves.</td>
</tr>
<tr>
<td>Pellionia</td>
<td>Semi-shade</td>
<td>Foliage</td>
<td></td>
</tr>
<tr>
<td>Peperomia argyrolea</td>
<td>Shade</td>
<td>Foliage</td>
<td></td>
</tr>
<tr>
<td>Phalaris arundinacea variegata (Gardener’s Garden, Ribbon Grass)</td>
<td>Sunny or shady position</td>
<td>Foliage</td>
<td>Small herb with variegated leaves.</td>
</tr>
<tr>
<td>Name</td>
<td>Situation</td>
<td>Flowering or foliage</td>
<td>Remarks</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>-------------------</td>
<td>----------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>Ficus microcarpa and others</td>
<td>Partial shade</td>
<td>Foliage</td>
<td>Creeping, spreading herb, 6 inches high, with fernlike foliage.</td>
</tr>
<tr>
<td>Rivinia humilis</td>
<td>Semi-shade</td>
<td></td>
<td>Ornamental berries.</td>
</tr>
<tr>
<td>Ruellia, varieties</td>
<td>Semi-shade</td>
<td>Foliage &amp; flowering</td>
<td></td>
</tr>
<tr>
<td>Saxifraga sarmentosa and some others</td>
<td>Semi-shade</td>
<td>Foliage</td>
<td></td>
</tr>
<tr>
<td>Schismatoglottis</td>
<td>Shade</td>
<td>Foliage</td>
<td></td>
</tr>
<tr>
<td>Sedum. (Stone Crop)</td>
<td>Semi-shade</td>
<td>Foliage</td>
<td></td>
</tr>
<tr>
<td>Selaginella, of kinds</td>
<td>Shade</td>
<td></td>
<td>Foliage</td>
</tr>
<tr>
<td>Streptocarpus</td>
<td>Shade</td>
<td></td>
<td>Flowering</td>
</tr>
<tr>
<td>Torenia asiatica</td>
<td>Sunny</td>
<td></td>
<td>Flowering</td>
</tr>
<tr>
<td>Tradescantia zebrina</td>
<td>Shade and semi-shade</td>
<td></td>
<td>Flowering</td>
</tr>
<tr>
<td>Verbena</td>
<td>Sunny</td>
<td></td>
<td>Flowering</td>
</tr>
<tr>
<td>Vinca (Periwinkle) varieties of</td>
<td>Sunny</td>
<td>Flowering</td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
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<td></td>
</tr>
<tr>
<td>Violets</td>
<td>Semi-shade</td>
<td>Flowering</td>
<td></td>
</tr>
<tr>
<td>Zephyranthes, species of</td>
<td>Sunny</td>
<td>Flowering</td>
<td></td>
</tr>
</tbody>
</table>

Succulents as Cacti, Agaves, Euphorbias, Mesembryanthemums, Phyllocacti, Yuccas etc., are best by themselves on open rockeries.
Conservatory.—There are numerous kinds of really ornamental plants with beautiful foliage or flowers or both, which cannot thrive in the open, exposed all day long to sun and wind. The delicate Ferns, the graceful Anthuriums and Aloscacias, the bright coloured Caladiums, the charming Gloxinias, the wonderful Orchids, the majestic Palms, and several other plants require for healthy and successful culture, a reasonable amount of shade and protection from sun and hot or cold breezes. In tropical gardens, the object of the conservatory or the fernery, as it is popularly known, is to provide and maintain the required shade and the cool atmosphere suitable for such plants. It opens out to the plant lover an immense field of possibilities to satisfy his desires. It is useful too, when adorned with specimen and blooming plants, as an agreeable and enjoyable retreat in hot summer days and as a place for entertainment of visitors and friends.

The fernery should face the east or north-east and be protected from the west and south by shade and creepers. If possible, it may, adjoin the building or be within easy access from it, in a well kept part of the grounds. The fernery should be so located that plants in it get plenty of light but little direct sunlight. It is not advisable to make a fernhouse in the shade of large trees, as the drip from them rots plants. The style of the fernhouse should harmonise with that of the building. The simpler it is, the better the creepers display themselves on it. The size of the conservatory is determined by considerations of available space and the taste and the ability of the owner to maintain a big or a small one. The fernery must be constructed on slightly elevated ground, which is well drained and furnished with a good solid foundation of small stones or broken bricks topped by a layer of firm gritty binding material, which is finished off for effect with a sprinkling of white fine sand. A short masonry wall, 2½ to 3 feet high, can with advantage be constructed running round the fernery and enclosing it leaving gaps for entrances. The roofing is supported by stone pillars or iron posts and may consist of a strong framework of iron girders and stout iron rods supporting a galvanised wire netting for the creepers to spread.
upon. To start with, over the frame work, is placed a matting made of split bamboo with one-inch meshes. Plaited cocoanut leaves may also be used to cover the top of the fernery, for providing shade till the creepers grow and cover the roof. Cocoanut fibre may be used for the same purpose. It is no doubt cheap but it requires to be renewed every year like the plaited leaves. Hanging baskets containing Ferns, Orchids, Asparagus, etc., could be suspended from the roof to beautify the fernery. A small cistern with a fountain playing would contribute to its better enjoyment in addition to being useful in keeping the place cool for the plants. The beauty of the fernery consists largely in the proper arrangement of the plants in it. Tiers of stone slabs or brick masonry are often necessary for the purpose. Where the conservatory is of large dimensions, its interior can be picturesquely laid out. In addition to the tiers or steps for staging plants, rockeries can be constructed in suitable positions, beds could be made for massing ornamental plants, walks can be laid out to enter and emerge out of well arranged groups of plants, and vases and tubs filled with attractive plants be placed in situations where they would catch the eye. The roof and sides should be covered with a quick growing light creeper, for naturalness and convenience. Bignonia gracilis with its bright green leaves and festoons of bright yellow coloured flowers in summer is the most favoured creeper for a fernery.

Of the plants that are usually grown in ferneries, the following are noteworthy:—Several species of Fern, Palm, Aralia and Panax, Alocasia, Anthurium, Dieffenbachia, Aglaonema, Dracaena, Heliconia, Alpinia, Hoffmania, Maranta, Rex Begonia, Peperomia, Begonia, Gloxinia, Cineraria, Cyclamen, Orchid, Saint Paulia, etc.

Following points demand frequent attention in the care and management of a conservatory:—

(a) The roof should on no account be allowed to be too thickly covered over with creepers, cutting off light beyond a reasonable degree. A thin shade is sufficient for a majority of plants. By a judicious pruning of the creepers, the amount of light required for the plants may be well regulated. With
too much shade, plants grow weak, long and lanky. On the other hand, should the sun be severe and shading be poor, the leaves of delicate foliage plants get burnt in a short time. A double ladder, 6 to 7 feet high is well worth possessing as it is very useful for thinning creepers covering the roof.

(b) Plants in the fernery, require to be watered with especial care. Being in the shade, fernery plants need less water or have to be watered at longer intervals than plants which are in the open. Every plant should be examined to see if it is being overwatered and if as a consequence, the soil has become sour and sodden it should be repotted. Some plants have their leaves arranged in a particular manner so that the rain water falling on them does not reach the roots; such plants, Caladiums for example, should be examined after the rains and watered if need be.

(c) Dust, accumulating on the leaves, should be dislodged by spraying with clear water every day or at least once in three days. This also keeps the atmosphere in the conservatory cool. The paths may also be watered and kept cool in the summer months.

(d) Plants grow in the direction, where they get the light from. To keep them growing erect and symmetrically, without contortions of the stem, they should be turned in their respective positions at suitable intervals.

(e) To keep off hot winds in summer and cold breezes in cold places, the fernery can with advantage be surrounded by tall growing shrubs as Panaxes and Aralias.

(f) A weak dose of liquid manure made from an oil cake applied alternately with liquid manure made from ammonium sulphate, once in fifteen days, helps to keep the plants in good condition with elegant foliage.

Garden adornments.—There are several adornments and necessaries such as fountains, statuettes, garden seats, ornamental posts and pillars, arches, pergolas, trellises, basket-plants, plants in tubs and vases, window-boxes embellished with plants, standards, etc., which makes the garden more enjoyable.

Statuettes placed in appropriate situations with artistic taste lend variety, and add charm to any garden.
The playing of a fountain is an interesting and arresting sight. The water in the cistern should be kept clean and not converted into a breeding place for mosquitoes. If of large dimensions, the cistern can be made use of to grow aquatic plants as Nymphias. Some gold and red fish may be reared in the cistern.

No garden would be complete without some seats. They should be placed in shady situations facing pleasurable parts of the garden and in ferneries and arbours, where they are most useful. There are several types of garden-seats available.

Handsome tubs and ornamental vases and urns are utilised to display plants in conspicuous places in the garden. Many attractive plants which would thrive in and adorn borders and beds may not be successful in vases and tubs. Plants have to be chosen so that they are suitable to the various positions in which the tubs, etc., are placed. Tub and vase plants require a lot of attention. As the plants attain growth and the vases or tubs are filled with roots, it is necessary that they should be watered copiously and fed with liquid manure frequently, as they keep on growing in a limited quantity of soil for some years. All decaying leaves, weeds, and spent blooms should be removed regularly. The plants should receive proper staking, when necessary. Tub plants are very useful for embellishing terraces, balustrades, stone steps, etc., in formal gardens. Cordylines, Palms, Crotons, Agaves, Pandanus, etc., make good tub plants.

Plant baskets of different patterns, filled with suitable plants and suspended with artistic taste in conservatories, verandahs, shady trees, corridors, and rooms, have great ornamental value. Neatly made pots of terracotta in which attractive plants are grown, can be placed in wire frames and suspended. Hanging baskets are usually made of galvanised wire or wood. The plants chosen for the baskets should by their habit of growth, blooming, and adaptability to cultivation be suitable for culture in them. For single plants for baskets, those which are erect growing and intermediate-sized, with graceful flowing foliage, do well. Plants which are of inter-
mediate or dwarf-growths, and those which droop gracefully, bearing attractive blooms or possessing graceful foliage are excellently fitted for growing in hanging baskets. Sometimes, for greater effect, one may desire to grow different kinds of plants with different habits of growth in the same basket. For instance, a handsome Dracaena or a little Palm with recurved foliage may be placed in the centre of the basket and dwarfer plants of a trailing habit as Tradescantia, Fittonia, Vittadinia australis, etc., with beautiful foliage or flowers or both, inserted near the margins so that some of them may gracefully hang down the sides and sometimes against the cords or wire supports.

It is necessary to prevent the soil in the basket from drying rapidly. For this purpose, the basket is lined with moss or gunny bag or cocoanut fibre cloth, and filled with soil which can hold moisture for sometime. The soil best suited for hanging baskets may be composed of two parts each of leaf-mould, and of rich loam, and one part of horse manure. For tuberous rooted plants as Freesias, Begonias, etc., some sand should be added to the above mixture. For immediate effects, it is advisable to straight-away plant fairly well developed plants. These can be got ready by starting them from seeds or cuttings and growing them in four or six inch pots. It is necessary to see that they are watered regularly. The entire soil should be wetted; it is not enough if water drips down from certain parts of the basket through the soil. Basket-plants require to be fed with liquid manure as their roots are confined to a small quantity of soil which has to sustain the growth of the plants for quite a long period.

The following are some select plants suited for growing in hanging baskets; refer to index for pages dealing with the plants mentioned below:

- Achimines in varieties;
- Adiantum, (some kinds);
- Anaemia adiantifolia;
- Asparagus Sprengeri;
- Begonia recumbens;
- Coleus Rehnelitianus (has a trailing habit);
THE CARDEN AND ITS PARTS

Cyrtodeira fulgens has pretty foliage consisting of velvety brown leaves and bears bright crimson flowers; Davallia (Fern); Dracaena with graceful arching foliage; Fittonia; Freesia; Impatiens repens and Sultani; Ivy Geranium; Lobelia; Neprolepsis Marshalli and some other ferns; Oplismenus Burmanii variegatus; Orchids as Vanda, Phalaenopsis, Saccolabium, etc.; Palms, young ones; Pellonia Daveauana and pulchra are creeping herbs with ornamental foliage consisting of roundish oval or heart-shaped leaves, which are olivegreen with white and violet markings; Pilea microphylla; Petunia hybrida pendula, known as Balcony Petunias; Torenia asiatica; Tradescantia of kinds; Verbena; Vinea minor and its variegated variety; Vittadinia australis, called the Australian Daisy, a creeping herb, perennial, with small white daisy-like flowers and small leaves;

Perforated pots and urns filled with good compost and all the openings planted with ferns become very attractive in course of time with a mass of fine foliage. They are ornamental, suspended from branches of shady trees.

Arbours, arches, pergolas, and trellises serve as supports to several beautiful climbing plants and to dispel monotony in a level garden. Arbours are small cool places of resort in the garden. They are usually open on the sides or they have a lattice work of iron or wood with a roofing covered with elegant climbers. They should be placed so that a good view of the garden may be had from them or they may be placed in a corner so that one may there enjoy quiet, undisturbed.

Arches are supports provided for handsome climbers to
display themselves. The most suitable positions for arches are over walks. Archways should be at least seven feet high and four feet broad. The supports are best made of angle iron of suitable section and firmly fixed into the ground. The sides may be composed of galvanised wire netting.

*Pergolas* are series of connected arches, or in other words archways over walks, and they are quite enjoyable features in large gardens. Elegant climbers, or Grape-vine or Chow-Chow can be grown over the arches making a good show. The frame work may be made of strong supports which are connected together by wood-strips or iron rods. The roof and the sides may be composed of wire netting, for the creepers to spread easily.

*Pillars* of wood about seven feet high can be utilised for growing creepers on for effect. The girth of the pillars may be about a foot and they may be covered with wire-netting so that the climbers may go up easily and then gracefully droop down. Pillars are best placed at the junctions of walks in the corners, where they delight the eye.
CHAPTER XIII

WEEDS AND THEIR CONTROL

Weeds may be defined as plants which are not wanted where they are growing. Hariyali grass which makes excellent lawns is a troublesome weed in cultivated lands, walks, paths, roads, flower beds, etc. The blue flowering pretty little prostrate plant, Evolvulus alsinoides, is a weed on a lawn as it is prejudicial to the growth of grass. Ruellia and Turnera are examples of other beautiful weeds. Stachytarpheta indica (Canarese, uttirani) a common weed, bears blue flowers. Turnera elegans and Turnera ulmaefolia are two handsome shrubs which are often cultivated in gardens but they are weeds in uncultivated moist lands. Eichornia crassipes, the Water Hyacinth, overspreads large tanks and lakes in a short time rendering them useless. But it is one of the most attractive plants bearing large Hyacinth-like clusters of blue or mauve flowers.

Some weeds have high medicinal value but on that account they should not be encouraged in gardens. The juice of the leaves of Ageratum conyzoides which is known as the Goat Weed (Tamil, pum-pilli) is used by villagers for cuts and wounds. Phyllanthus niamn (Canarese, kirunalii gida) is a prostrate herb covering the ground with tiny green leaves, which are used for making cooling oils for bath. Euphorbia pilulifera (Canarese, akki soppu), the Asthma plant, is useful for making a specific for asthma. Amaranthus viridis (Canarese, daggali soppu) is used by the poorer classes as a vegetable green. So also Oxalis (Tamil, pulikkerai; Canarese, huliyaarai).

In agriculture, weeds add enormously to the cost of production of crops. The average cost of tillage to keep down weeds is estimated to equal a twelfth or more, of the value of the crop itself. They are alike the bane of pleasure gardens and homes. Alternanthera echinata, for instance, is a prostrate little shrub with forking branches, bearing innumerable round thorns, unfitting one to walk with bare legs.
Losses caused by weeds are many:—(1) They compete with crops for plant food, moisture, air and light. (2) They increase the cost of production by increased labour necessary to check them. (3) They increase the cost of preparing crops as food. (4) They impair the quality, destroy or lessen the value of several products. (5) They are the host plants for several kinds of fungus and insect pests destructive to garden plants. For instance, the black leg of Cabbage is spread by the wild Mustard plant which it harbours. Some wild Leguminous plants are hosts of bacterial germs which bring on blight to cultivated Beans. (6) Some of them are poisonous and may endanger the health or lives of animals and human beings.

For controlling weeds, it is necessary to classify them as annual, biennial and perennial weeds, as they call for different treatment. Best examples of annual weeds are Ageratum conyzoides, Amaranthus spinosus (Canarese, mullu dantu), Arge­mone mexicana, Tridax procumbens. These germinate from seed, grow rapidly, flower, seed in plenty and die, in a season. Perennial weeds do not die completely; they live storing their nourishment in rootstocks, rhizomes or tubers, for active growth under favourable conditions. Such are the Cyperus rotundus (Tamil, korai; Canarese, tunge hullu) and the Hariyali grass. The principal method of weed control is not to allow them to seed. The old adage, “One year’s seed is seven years’ weed” should be kept in mind by all gardeners. Annual and biennial weeds are best destroyed and kept in check by cutting away their tops. In the case of perennial crops, top growths come up again and again as they are removed; a repetition of the process every now and then should weaken them ultimately; per­ennial weeds are best destroyed by digging deep once a year at least, removing them root and branch.

Chemicals are often used to kill weeds. It is obvious they could be used only in connection with weeds on roads, walks, etc., which are far away from cultivated plants. Crank case oil or dilute sulphuric acid do not kill the roots of perennial weeds. Sodium chlorate and sodium arsenate applied to them are car­ried down to the roots which are destroyed. These chemicals are best applied to kill such weeds as the Hariyali, the Nut
WEEDS AND THEIR CONTROL

grass, Bermuda grass, etc. There are other chemicals as carbon-di-sulphide, which when injected into the soil, are absorbed directly by the area of the roots killing the latter.

Sodium chlorate is a dangerous substance, being a fire hazard. It is a vigorous oxidizing agent, setting fire to substances like cotton, wool, straw, etc., which may come into contact with it on application of gentlest heat. It is best dissolved at the rate of $\frac{1}{2}-\frac{3}{4}$ lbs. in a gallon of water and applied to the soil. About 300 gallons may be required for an acre. The solution is safely prepared in metal or earthen containers. Sodium arsenate is a deadly poison. Carbon-di-sulphide is a nasty smelling volatile inflammable liquid. It is to be used with care to prevent explosions. Its cost is against its use.

Weeds distribute themselves through manure, rain water, etc. In any programme for exterminating weeds, the co-operation of neighbours is essential in addition to individual efforts.
CHAPTER XIV

ROUTINE OF DUTIES IN A GARDEN

The following are a few of the essential duties which must be undertaken and attended to in order to maintain plants in robust health, to help them to continue flowering, and to give to beds, borders, shrubberies, and in fact to the garden as a whole, that touch of trimness which every garden should possess.

Keep the garden clean. Have the roads, paths, walks, and the inside of the conservatories, etc., cleanly swept and strewn with silver-sand for neat appearance. Remove dead branches and twigs from trees, shrubs, and all other plants. Keep the lawn clean by picking dried leaves, etc. Remove weeds wherever they may be found.

Go about the garden and make it a point to visit every section of it at least once a day. The mali's faults of omission and commission and his negligence, if any, will be noticed and the attention of the mali directed with a view to set things right. For instance, a plant might have been by oversight not watered, a pot plant might be water-logged and need repotting, another might have been attacked by some insect or disease and need immediate attention to prevent its spread.

Keep a diary for the garden and note therein all the garden operations that are undertaken. This will be a guide for the future operations and will be helpful for knowing to do the right thing at the right time.

Syringe plants with clean water to dislodge the dust accumulated on their foliage. Syringe the plants in the fernery and water the paths, especially in summer, to maintain a cool and fairly moist atmosphere, so much loved by plants.

Pay particular attention to the nursery portion of the garden. Any slight error in sowing the seeds, or slight carelessness in watering newly inserted cuttings or layers, etc., is certain to bring on failure.
ROUTINE OF DUTIES IN A GARDEN

Never water in driblets; water well or not at all. In summer, choose the evening time for watering as during the night there will be less evaporation—thus the plants will derive comparatively greater benefit—than if they were watered at day time.

Hoe the soil in the beds and borders, etc., before each watering. Never allow the soil to cake or crack.

Thin out superfluous shoots from plants, retaining only those which are really useful.

Thin the buds if necessary. This is necessary in the case of a number of kinds of plants. Carnations, Dahlias, Chrysanthemums, etc., carry three to four or more buds close together; remove all but the largest in each bunch, if large flowers are required; and the earlier the disbudding is done, the better, as this saves the strength of the plant from being wasted on unwanted growth.

Stake the plants which require support to prevent them from being blown over; do not bunch the growths together untidily by running the string round them; loop them loosely up to a central stake. For tying, pass a wet plantain-thread or any other tying material like raffia thread, around the stake, bring the two ends towards the shoot to be secured, at the same time cross them, then pass them around the shoot and tie the knot.

Protect shade-loving plants from severe sun and wind by providing them with suitable screens, whenever necessary.

Watch carefully against insect and fungoid pests and take prompt measures to eradicate them. Examine the soil occasionally—especially that of pot plants—for cockchafer grubs which have to be picked and destroyed.

Verandah and window-plants and those in conservatories getting a greater degree of light from one direction than another have a tendency to grow towards the direction of intense light. Hence, for ensuring uniform growth on all sides of the plants, turn them in their positions once in ten days.

Keep garden implements always clean and bright and store them in a shed or any suitable place when they are not wanted and do not throw them all about the garden to be searched for, each time they are wanted for use.
To keep the garden going all the year round and to secure the best possible results, you must look ahead, think out your requirements, and get them ready in proper time. Seeds should be obtained for sowing in the right time; beds should be dug up and the soil exposed for at least a fortnight to sun and air before they are refilled with plants; pits should be got ready at least a month and a half before plants are planted in them; composts for pot plants should be at least a month old before they can be safely used; bulbs should be taken out of the soil in right time and stored in a cool place till they are potted or planted out again; shrubs and plants which need to be pruned, should be pruned at the proper time and so on.
Phalaenopsis Schilleriana in a hanging basket. (Page 490)
(By Courtesy of the Superintendent Govt. Gardens, Bangalore.)
CHAPTER XV
FLOWER SHOWS

Within the last twenty years, rapid progress has been made in horticulture in this country due to the work of some horticultural societies. Flower Shows and Garden Competitions held under the auspices of these societies stimulate the interest of the public in gardening and encourage all people to form and maintain gardens. Garden Competitions have been responsible for many lovely gardens springing up round many a bare house and for the popularisation of many a charming plant. Flower Shows in which flower plants in pots are exhibited, as also cut flowers, vegetables and fruits, afford the public, plenty of opportunities to observe and note at one time all the best material available for embellishing gardens for exchanging ideas about culture of several kinds of plants and for observing the degree of success that could be achieved in the cultivation of particular kinds. It is the desire of many an amateur to show his plants and products of his garden in the Agri-Horticultural Shows but he is diffident of winning prizes as he is afraid that persons with greater experience and who he believes know the technique of growing and showing plants better than himself will walk away with the prizes. The following tips may be helpful to embolden amateurs to try their might at the shows.

Collections of annuals, herbaceous perennials and handsome flowering shrubs and creepers and foliage plants as Crotons, Dracaena, Palms, Ferns, Caladiums etc., are offered prizes. These should be grown in such a way that they are at their best on the day of the show. First regarding annuals:—Secure seeds of best quality from recognised firms, in time, at least a fortnight or a month before sowing. Sow the seeds thinly in seed pans so many days before the blooms are wanted according to the time each variety takes. Sow seeds not all at one time but at intervals of three or four days twice or thrice, to save disappointments due to damping off or miscalculations in
the time of sowing. Prick seedlings as soon as ready and pot or bed them out when they touch each other. Give them as much sun as they can reasonably bear. Pinch the shoots to bush them out. Keep only a few shoots, if large flowers are required. Stake the plants from the very beginning. For large flowers, freely remove all side buds keeping one or two only in a cluster in such kinds as Carnations etc. Do not allow the plants to bloom till good specimens of plants are formed. Keep on removing buds should they appear earlier than required.

Do not grow more than one variety in a pot. Do not mix several colours in a pots. As for instance, in Phloxes, grow them in separate colours. Do not grow plants in pots too big for them. Choose the proper size of pots and do not allow the plants to get lost in the pot. Unless the kind permits of more than one plant being grown in a pot as in Phloxes, as far as possible grow only one plant in a pot, and bush it out to fill the entire pot by frequent pinching of the shoots. For this purpose, seed sowing will have to be started earlier than otherwise. Grow more plants than are actually required for the purpose of showing, for there may be many failures, many may not bloom in time.

Next regarding perennial plants:—Grow them from cuttings or layers or from seeds as mentioned above for annuals, using the same care in transplanting, feeding, providing sun and air, staking, pinching back, disbudding, etc.

Regarding shrubs:—Repot them once or twice a year, with three or four tablespoonfuls of bonemeal for each large pot containing the shrub. After potting, wait for the sap to rise to the required height and so time the pruning that you can reasonably expect the blooms on the day of the show.

All show plants should be stocky and strong and this is ensured, only if they are properly fed with doses of liquid manure and are grown giving them the fullest amount of sun that they can bear without injuring the foliage.

A few observations on taking plants to the show are necessary. Take always a few more than the required number, as some of them may get damaged in transit or may not fit in while grouping. Stake them suitably so that they may not
brush against each other and get damaged in foliage and flowers. Clean the pots well, scrubbing them on the outside with cocoanut fibre brush. Remove the dust and dirt from the foliage by sponging or spraying with clear water. Remove all faded or old flowers and diseased leaves. Cut away shoots without blooms, if necessary to show off the blooms in others. Do not make the staking obstrusive. Do not artificially prop up flowers, in case of such species which really do not need to be staked. When the show prospectus says that only pot grown plants are to be shown, do not attempt to hoodwink the judges by lifting the plants a day or two before the show and potting them using a top layer of compost. Pot grown plants can be easily distinguished from those lifted from the ground. Take to the show only those collections of yours which in your honest opinion deserve first prizes. Keep good watch over your plants, for in all shows there are always busybodies attempting to steal or damage your plants. Put a mark on your pots to enable you to spot them out when missed. If not, you will often find your plants in the next entry, without being able to claim it successfully as yours. Label the plants in a simple unobstrusive way. Write the names, clearly and legibly, with an ink that does not blur.

About staging exhibits:—Take care you do not shove in more than the number of pots required under the rules. Let the varieties shown by you in any kind of plant be distinct. You cannot expect the judges to inspect your plants with a microscopic eye for finding out differences. Marks are usually allotted for staging, varieties shown and cultivation. Do not overcrowd your plants while staging. As far as possible each plant should stand out well, its individual merits capable of being studied. The different plants should harmonise with each other in the colour scheme and also with the background. Deep colours should be broken up by placing by them whites, cream, or ivory and such ones. Distinct colours should be placed farther apart to enable counting to be done easily. Let not the colour of the background obtrude. For this purpose, have such colours as light yellows, pinks, and whites immediately next to a black background. If it is white, let the contact colours
be scarlets, crimsons, purples and blues. The plants should
dovetail into each other; then only will the staging be effective.
Do not mix up large plants in big pots with small specimens
in smaller pots, as the latter would get lost in the group. How­
ever rare a variety, may be, do not put it up, as it will spoil
the effect of an otherwise good group, if it is not well grown.
Generally, it is the excellence of the plants, the blooms and the
effectiveness of the group as a whole that impress the judges
and not a few extra number of varieties.

Regarding cut flowers:—The blooms should be of good
shape, large, and fresh. They are the result of feeding the
plant with liquid manures and disbudding. Coarse flowers with­
out a good form will not win prizes though they may be large
in size. While arranging flowers in a vase, care should be taken
not a huddle a number of them into it. Again, clashing colours
as purples and scarlets should not be put into the same vase.
It is best to show flowers with their own foliage. Keep them
in water or wrap them in tissue paper when you take them
to the show hall. If they fade, dip the ends of the stalks in
hot water for a few minutes and after cutting off half to an
inch, keep them in water containing a pinch of salt or aspirin.
This helps them to keep fresh longer than otherwise.
PACKING AND EXPORTING OF PLANTS AND CARE OF NEWLY RECEIVED PLANTS

Plants, flowers, and seeds have to be carefully packed so that they may reach the destination safely. The kind of packing depends upon the plants themselves, the distance they have to travel, and the mode of conveyance.

Plants which have to be sent to comparatively short distances, necessitating a travel of two or three days only, are taken out of the pots or pulled out of the ground, with the balls of earth holding the roots intact, which are rapped in straw and firmly tied round and then soaked in water; such balls of earth so tied up, are then placed in a bamboo matted basket, stakes and extra straw being used to fix them up firmly in the basket without being tossed about; into the holes made on the sides of the basket are thrust long strips of split bamboo which are bent over and tied above the basket forming a sort of balloon; strong thread is tied over the plants from the edges of the basket holding them down. The balloon is finally enclosed in a mattress of palm leaves or gunny bag.

When the plants have to travel for five to seven days, the balls of earth are after being soaked through with water, covered first with a thick layer of moss and then with coconut fibre. The wet moss prevents evaporation of moisture from the earth for some days. Care is to be taken that only plants which have a well developed root system are selected for sending out. The plants are taken out of the pots or ground and left in moist sand for 20-30 days with their balls of earth immersed in it. Only the plants which remain fresh after the said period are exported, as they alone can be depended upon to stand the strain of the journey.

When the plants have to be sent over very long distances, the journey taking several days to complete, the balls of earth packed in moss as described above are put into boxes (Wardian cases) with a layer of moist sand or saw dust to prevent evapo-
ration as far as possible. Two holes are made at the top of
the box for ventilation.

Hardy deciduous plants as apples, pears, peaches, vine etc.,
are imported from distant places as from Australia, in the
following way. They are pulled out of the ground without
injuring the roots; these are covered with moist moss, the
leaves are removed and the plants are bundled up like sticks
and packed in large deal wood boxes. The plant sap is driven
to the root, where it is stored and preserved. Deciduous
plants and plants like Orchids are best despatched when they
are resting or are least active in growth. Bulbs, rhizomes,
tubers, corms, and such underground stemmed plants are best
sent, like potatoes, when they are resting.

As soon as a consignment is received, it is opened in a cool
and shady place and the plants are taken out carefully one by
one and their binding material and moss removed and the balls
of earth soaked in water. If the plants have no balls of earth
attached to the roots as in apples, the roots are dipped in a
paste of clay and cow-dung water. The plants are then potted
in a light porous compost, made up of 1 part of red earth,
2 parts of sand, 2 parts of leaf mould, and 1 part of spent
manure. Before potting, all dead and diseased roots are clean
cut back to healthy portions. The stems are likewise cut
back to healthy parts, if they have died back. The pots are
removed to a cool and shady place and watered with care;
they are not to suffer for want of water, but at the same time,
overwatering is avoided. The buds swell and grow into shoots,
when the plants are gradually hardened by exposing them to
more and more sun daily.
PART II

SELECT PLANTS FOR THE GARDEN
A judicious planting of trees contributes much to the beauty, variety and the enjoyable features of gardens and pleasure grounds. Trees afford shelter and shade and make summer time not unpleasant. Many are handsome in bloom. Some fill the air with the delicious fragrance of their flowers. Almost all of them delight and refresh the eye with their refreshing green foliage. Along with shrubs, they form the frame-work of the garden and being permanent, easy to grow and requiring very little attention, no garden of any pretension to size should be without them. They should be placed in positions where they shine best and are most useful. It is inadvisable to crowd them round the house cutting off light and air from it, or plant them where they overshadow places which could be utilised better.

Only such hardy trees which thrive under the particular climatic and soil conditions should be grown. As trees are permanent fixtures in the garden, the ground should be well prepared for planting them. (See Chapter VII for instructions on planting trees, and Chapter X for instructions for pruning them). Trees should be protected by tree guards from mischief by cattle or injury through any other source.

Sometimes, branches are torn off by wind or are badly cut by unskilled mals, with the result that decay soon sets in and big cavities are formed in the stem or the limbs, on account of the injuries sustained by them. Unless protected from further decay, the trees would get attacked by dangerous parasitic fungi and die in course of time. The decay may be prevented and the health of a tree restored thus:—All decayed wood is cut or scraped out and removed from the interior of the cavity, which is then well washed with an antiseptic, such as a solution of mercuric chloride (corrosive sublimate) or copper sulphate and lime. The edges of the cavity are also cut smooth so that
the cambium may grow freely and cover the cavity after it is filled. It is necessary for the success of the operation that the cavity should be so filled that air is entirely excluded from it. This is done by pouring and pressing into the opening a mixture of concrete and cement of such a consistency as will fill every nook and corner of the cavity. The finished surface of the filling should terminate with the edge of the cambium for it to grow and cover the surface rapidly.

Trees are either deciduous or evergreen. The deciduous kinds generally produce their blooms when they have shed their leaves or just after or are being clothed with fresh foliage. In India, the period between February and June is remarkable for the flush of bloom of many of the trees. Some trees, however, flower in August and September during the rains. Again, there are many, which flower intermittently throughout the year. A due proportion of the flowering trees selected in such a way that one or the other of them, is in flower throughout the year, is very much to be desired.

For purposes of convenience, trees are treated and grouped under three headings in this book: (A) Select flowering trees, which are grown for their beautiful or fragrant flowers, (B) Ornamental foliage trees, mainly grown for the richness and attractiveness of their foliage or form or both, and (C) Shade trees, which are grown for their shade. Only trees which are suitable for private gardens are considered.

(A) SELECT FLOWERING TREES.

**Acacia** (N. O. Leguminosae).—The following species of Acacia thrive only in upcountry. All of them are very ornamental.

* *A. longifolia.*—Known as Sydney Golden Wattle. Small spreading tree with pale yellow flowers borne in February-March and again in July to August. Very ornamental.

* *A. pycnantha.*—Known as the Golden Wattle. Medium sized very ornamental tree, while in bloom in the dry season, bearing masses of yellow blossoms. A native of South Australia.

* *A. dealbata.*—Known as Silver Wattle. A small Australian tree with finely cut leaves, the underside of which is
silver white. Large heads of yellow blossom are produced in February-March and in July-August, when the tree is very showy. Propagated from suckers which it throws out in plenty or from seed.

*A. decurrens.*—Known as the Black or Common Wattle. A large quick growing tree, introduced from Australia producing fragrant yellow flowers in the dry months.

*Amherstia nobilis.* (N. O. Leguminosae). Named after Lady Amherst, wife of a former Governor of Burma. One of the most ornamental and beautiful flowering trees. Called by some, the “Queen of flowering trees”. Small in size, of very slow habit of growth, allied to Saraca and Brownea and attaining a height of about 15 feet in Bangalore, though it is reported to reach 35—40 feet in its native home in Burma. The young leaves which are of a light purplish coppery hue are folded and clustered into long flaccid bunches gracefully hanging down the tips of the branches. Mature leaves are large, dark green, and paripinnate with 6—8 pairs of leaflets. As many as twenty flowers are borne in very long loose drooping vermilion coloured racemes, measuring 20 to 24 inches in length, supported by a slender thread of the same colour, hanging down from the axils of leaves. Each individual flower is about 7 inches long and is made up of a vermilion coloured peduncle which is nearly 3 inches in length, two very brightly coloured petal-like large bracts, and five petals, of which two are small and the others are large, red and tipped with yellow. The stamens, which are of the same colour as the petals are united at the base forming a keel, in which is lodged the style. The keel branches off into five crimson filaments, each of which carries a dark coloured anther. The tree presents a glorious and a striking aspect with its brightly coloured pendulous racemes of flowers and its finely coloured bunches of tender leaves gracefully hanging down the tips of almost every shoot all over the tree. The tree is in bloom for the greater part of the year but it is particularly attractive between April and May. The pods are broad, flat and crimson in colour. Seeds are mostly sterile. Propagated by layering or gootying. The tree is rare but it can be got out from Calcutta; and it is well worth in-
introducing into our gardens. It thrives at low to medium elevations in places where there is a good rainfall but it does not seem to thrive near the sea. Young plants die soon unless they receive particular attention to cultivation.

**Barringtonia.** (N. O. Myrtaceae). — ^Barringtonia speciosa** (showy). Very ornamental, medium sized, spreading, evergreen tree, with handsome foliage, consisting of large leathery shining leaves and bearing great heads of blossom, composed of large flowers, made up of numerous long deep rose coloured filaments. Propagated from seed, by layers, and from cuttings with leaf attached. Allied to the common Rose Apple tree.

*B. acutangula* is superior to the above species.

*Barringtonia racemosa* is another attractive species. It is a large tree, a native of Malabar, very showy when in bloom, with its very long pendulous racemes of pinkish flowers. All the above love moisture.

**Bauhinia.** (N. O. Leguminosae). Hindi, Kuchnar. Bauhinia is an extensive genus of shrubs and small trees, several of them being indigenous to India. Some species are really very ornamental, deserving prominent places in the garden. Members of this genus have characteristic leaves, having the appearance of a camel’s foot, being composed of two similar oval leaflets laid side by side and united beyond the middle. The flowers, which in many species are fragrant, are borne plentifully. Propagated from seeds easily.

The following species deserve special mention:—

*B. monandra* is a middle sized deciduous tree, 12 to 15 feet high, bearing very pretty pink flowers having dots and splashes of red and orange. One of the prettiest species. Similar to B. variegata.

*B. variegata.** (Canarese, “Kanchivala”; Tamil, “Mantharai”; Hindi, “Kuchnar”;) is a middle sized deciduous tree, very common in Malabar. Flowers are large, white, variegated with pale mauve and deep red, and borne in leafless condition.

*B. purpurea* is a fairly good sized tree, bearing showy fragrant flowers of a pink colour merging into purple.
B. alba is a medium sized tree, 10 to 15 feet high, with large white flowers.

*B. candida* is a very beautiful small tree or a large shrub, bearing pure white, sweet scented flowers in great profusion. Grows 8 to 10 feet.

*B. tomentosa* (Canarese, "Vanasampige"; Tamil, "Thiruvatti"); is a small tree or a large shrub, 8–12 feet high, constantly in blossom with beautiful sulphur yellow flowers with a dark purple centre. The colour changes to copper-yellow as it fades. The flowers are used for puja and hence the tree is commonly grown by Hindu temples and gardens.

**Bignonia.** (N. O. Bignoniac'eae). This genus which includes such excellent climbers as *B. gracilis, B. venusta,* includes some very handsome trees also:

*B. crispa* (Tamil, "Padiri") is a handsome tree with drooping, long, branches and shining foliage, bearing erect, pearly-white, crisp-edged, funnel-shaped, delicately perfumed pretty flowers, largely used in Hindu temples. Propagated by offsets.

*B. megapotamica.* (Rio grande Trumpet flower) is a handsome deciduous tree, 25 to 35 feet high, with branches gracefully sweeping the ground. Foliage consists of bright, olive-green, compound leaves with three or five leaflets. Very pretty, light pink flowers are produced in plenty in March and April. They are clustered in terminal bunches on almost every shoot on the tree. The colla is tubular with five lobes, which are frilled and thin. The tree is a good subject for a lawn or a small avenue. Propagated from seed, a native of Brazil.

*B. undulata* is a small tree, having loose spreading branches and narrow undulating leaves. It is attractive in March and April, when it bears racemes of large, erect, yellow or orange coloured flowers, which are attached close to the younger parts of the stem.

**Brassaia actinophylla.** (N. O. Araliaceae). Known as the "Umbrella Tree." A small but erect growing tall tree, about 25 feet high, having very few branches. Foliage is evergreen and consists of large radially divided leaves. Flowers are remarkable and are borne in brilliant scarlet or coral-red, termi-
nal radiating spikes, measuring 1½ to 2 feet in length. The tree very much improves in appearance, if headed back once in three years.

**Brownnea.** *(N. O. Leguminosae).* The Brownneas are very ornamental, very slow growing garden trees, introduced from Central America and Trinidad, bearing large clusters of rose or crimson flowers from the axils of leaves. The leaves are flaccid when young. As a class, the trees deserve to be made popular. They are usually propagated from seeds, from which they take 10—12 years to bloom. Following are the noteworthy species:—

*B. rosea* is probably the best of the Brownneas. It is a very handsome medium-sized evergreen tree with characteristic foliage and bright rose coloured flowers clustered in large round heads, borne at the ends of long and gracefully drooping branches. The foliage when young is very handsome, being produced in long drooping flaccid bunches, having coppery-pinkish hue, as in Amherstia and Saraca. Flowers are borne in April and May.

**B. grandiceps** is a smaller tree producing bright red flowers.

*B. coccinea* is of a somewhat dwarf spreading habit of growth, producing scarlet flowers.

*B. Aziza* has the largest blooms of rosy scarlet.

**Bursaria spinosa.** *(N. O. Pittosporae).* A handsome, evergreen, medium sized tree, 15 to 25 feet high, introduced from Australia. Has an upright, much branched, compact habit of growth. Flowers are creamy white, small and disposed either in terminal or lateral panicles. The tree is a conspicuous object from November to January, when it is covered all over with the elegant white blossoms. Easily grown from seed.

**Butea frondosa.** *(N. O. Leguminosae).* Canarese, “Muthuga”; Tamil, “Palasu”; Hindi, “Dhak”;) A moderate sized deciduous forest tree of India, unattractive, when not in bloom, on account of its crooked and distorted stem. Leaves are pinnately-trifoliate and are used by the Hindus during religious functions and are stitched together to form plates to eat from, which are used all over India. The tree is gorgeous
in bloom, bearing in great profusion vivid orange-crimson flowers in large showy dense racemes; hence, it is planted in large gardens near the confines, where it is striking in bloom. Economically, the tree is valuable; the lac insect thrives on its branches; the flowers produce a temporary dye; the tree provides the Bengal kino gum, which is largely used in tanning operations and in medicine.

*Callicarpa lanata. (N. O. Verbenaceae). A small tree, native of the Western Ghats, 6 to 12 feet high. Very pretty producing between August and November umbels of charming purplish flowers, which are small and are followed by very ornamental purple berries. C. americana is a later introduction, also pretty.

Callistemon. (N. O. Myrtaceae). *Callistemon lanceolatus is the well known Bottle-brush Tree. Callistemon is derived from two words, meaning the beauty of the stamens, as in most of the species the stamens are brightly coloured, usually scarlet. It is a small erect growing Australian tree with a neat habit of growth. It is well worth introducing into our gardens, for the neatness of its foliage which consists of narrow stiff lanceolate leaves and the beauty of its blossoms. It is very beautiful in April, with its bottle-brush like crowded spikes of brilliant crimson-scarlet flowers with their free stamens produced on the old branches. The tree sometimes, flowers in August-September also. Suitable for planting on lawns. Propagated from seeds which are very small or by layers. C. brachyandrus is suitable only from medium to high elevations and bears yellow flowers.

Calophyllum inophyllum. (N. O. Guttiferae). (Canarese, “Surabinne”; Tamil, “Pinnae”; Hindi, “Sultana champa”)* A beautiful large but very slow growing evergreen tree, with noble foliage of dark green polished leaves, resembling those of Magnolia. Large racemes of delightfully fragrant white flowers are borne in May-June. These are succeeded by round fruits of the size of a lemon. Raised from seed. Called by some The Alexandrian Laurel.

C. spectabile is another handsome species.

Canangium odoratum. (N. O. Anonaceae). The Ylang
Ylang. A tall, quick growing tree with horizontal branches arching down at the ends, giving the tree a stately appearance. Flowers are borne freely, very fragrant, greenish yellow, and they resemble those of Artabotrys odoratisimus. From them, Cananga-oil water or Ylang Ylang of Japan is made. The tree is hardy and thrives in any good garden soil. Easily raised from seed.

Cassia. (N. O. Leguminosae). A large genus comprising of some very ornamental trees and shrubs. Almost all of them are quick growing and easy of culture. They are mostly deciduous and some of them are in full bloom when they have shed their leaves. The blooming period is very long and consequently the trees are valuable additions to the garden. Propagated from seed. The following species are of especial merit and deserve a place in the garden:—

*Cassia fistula. (Canarese, “Kakke”; Tamil, “Sarakkonne”;) A very useful medium sized beautiful tree of very slow growth. Common in Indian forests and has names in almost all the vernaculars. To the Europeans, it is known as the “Indian Laburnum”. The tree is an imposing sight when in bloom, in February-May, the whole tree being enveloped in a mass of large, long, lax, pendulous racemes of bright yellow flowers, which have a delicate fragrance. Flowers are succeeded by long cylindrical pods which become black when ripe. The foliage consisting of pinnate leaves appears only after the flowers are finished. The seeds and the bark of the tree are used in medicine and in dyeing. Propagated from seeds and also from suckers arising from the roots. Seeds are a little shy of germination. Young plants are delicate and do not stand transplanting well.

*Cassia multijuga. A slender quick growing small spreading tree, with leaves smaller than other Cassias; A native of Tropical America. Very beautiful when in bloom with its erect large racemes of very bright yellow flowers which are very freely borne absolutely covering the tree with a mass of gorgeous colour. It can be propagated from cutting and from seeds, which are produced only in dry regions. Blooms in August-September.
Cassia grandis, called by some, the “Pink Shower”, is a spreading, elegant, quick growing tree, bearing a profusion of salmon-pink flowers, in abundant erect ladder-like racemes from the axils of fallen leaves, during the months of March and April. As the flowers fade, new shoots appear covering the tree with rich foliage of pinnate leaves, which are about eight inches in length. The pods are about a foot in length, one inch in thickness, rough and woody.

*Cassia renigera. A middle sized deciduous tree with handsome erect habit of growth. Flowers are bright pink or light rose coloured and they are borne, collected in racemes, from the axils of all the fallen leaves, along the branches, giving the appearance of long erect sprays. The tree is entirely free from foliage when in full bloom in April-May, when it affords one of the grandest floral sights. This tree, which was rather rare, is now planted in almost every garden in Bangalore on account of its great beauty when in full bloom and is tried with success in the South also. A hybrid of C. renigera has been observed in two or three bungalows and in Lalbagh in Bangalore, which surpasses the C. renigera in beauty.

Cassia nodosa. (Pink Cassia). A moderate sized deciduous tree with a spreading habit of growth, the branches being long and drooping and richly covered with green bicompound arching leaves. Flowers are rose-pink in colour and they are clustered in short, dense, round racemes, borne in the axils of leaves or above the scars of the fallen leaves. This tree is attractive with its fresh foliage interspersed with its bunches of flowers in April-May.

*Cassia javanica is another very handsome quick-growing Cassia. It has the most ornamental habit of growth among the Cassias. The tree grows tall like the C. renigera and its branches are long and wavy and gracefully arch down. The blooms come up with the foliage in April-May and it appears as though out of every compound leaf, the terminal leaflet is transformed into a flower bunch. The bunches of rose pink flowers seated erect on the branches for a greater part of their length with the foliage, give the tree really an ornamental appearance, peculiarly its own.
Cassia marginata (Syn. C. Roxburghii). (Tamil, “Vakai”.)
A very graceful medium sized Indian tree with a neat habit of
growth, with spreading and drooping boughs, which appear
overweighted with their wealth of clustering bloom, produced
in April-June and also in August-September. The foliage is
pretty consisting of alternate pinnate leaves of 10 to 12 pairs
of linear-oblong leaflets, about one inch in length and half inch
broad and having the margins coloured, from which fact the
name is derived.

Castanospermum australe. (N. O. Leguminosae). Known
as the “Moreton Bay Chestnut Tree”. A large slow growing
evergreen tree, introduced from Australia. It has an upright
habit of growth with pretty foliage of pinnate leaves of about
nine broad smooth entire leaflets. The tree bears, in the month
of March, axillary or lateral loose racemes, composed of pretty,
large, saffron coloured flowers. The chestnut-like seeds,
enclosed in stout brown pods, are produced in plenty. The
seeds are edible though astringent.

Cerbera odollum. (N. O. Apocynaceae). (Tamil, “Kattarali”.)
A native of the salty swamps and backwaters of the East and
West Coast of India and Ceylon. A middle sized evergreen
tree with shining, lanceolate, bright green leaves, bearing large
cymes of odorous pure white flowers resembling those of
Plumeria Lambertiana. The tree is in bloom throughout the
year. The flowers are succeeded by poisonous fruits. The tree
has a much branching habit, so much so that the lower branches
come down and gracefully sweep the ground.

Citharexylon subseratum. (N. O. Verbenaceae). Popularly known as the Fiddle Wood Tree. An upright deciduous
tree, introduced from America, about 25 feet high, with dark
green foliage of fairly large leaves. The tree looks bare and
ugly when it has shed its leaves. It bears in March-May and
during the rains and occasionally at other times of the year,
drooping racemes, three to six inches long, composed of
numerous small very pleasantly scented white flowers. The
branches of old stumpy trees may with advantage be cut back
once in three years for fresh vigorous branches which are
clothed with pleasing foliage. Propagated easily from large
sized cuttings, inserted where they are wanted to grow. Every
garden should have this tree for the delicate scent of its flowers
which pervades the atmosphere for a long distance from it.
*C. fruticosum is a dwarf species with flowers more highly
scented.

**Clusia rosea.** (N. O. Guttiferae). Commonly known as
the "Balsam Tree". A native of West Carolina. A very
slow-growing, spreading, medium sized, evergreen tree. Leaves
are spatula-shaped, bright, polished green, and Magnolia-like.
Flowers have a resemblance to those of Magnolia, are large and
bright white with a large rose coloured centre and conspicu­
ous sticky stigma projecting a little outside the centre. Propa­
gated from seed and by suckers produced near the tree.
Blooming-period is from March to May.

**Cochlospermum gossipium.** (N. O. Bixaceae). (Canarese,
"Arasina burugada mara"). A medium-sized indigenous
deciduous tree, with three or five-lobed leaves, not attractive
when not in bloom. But, in the hot season, in February­
March, the tree presents a most lovable sight, with its bright,
large, expanded, yellow flowers, which are produced so pro­
fusely that the tree is literally clothed with a mass of yellow
blooms. The diameter of the flowers is 4—5 inches. As the
flowers fade, leaves appear. The flowers are followed by five­
lobed capsular fruits, which are as large as a goose-egg and
enclose cottonlike fibre-and seeds.

**Colvillea racemosa.** (N. O. Leguminosae). An ornamental
tree, a native of Madagascar, with a foliage consisting of large
twice-pinnate leaves with small linear leaflets resembling those
of the "Gold Mohr" (Poinciana regia). It bears in September,
long, large, compact, drooping racemes, which are nearly two
feet in length and are borne principally at the ends of the
branches. The tree is very showy while in bloom with its
orange-red large racemes, which resemble bunches of Orchids.
Propagated from seed.

**Cordia Sebestina.** (N. O. Boragineae). (Hindi, "Bhockar").
A dwarf evergreen tree of ideal habit with handsome foliage
of oval-formed leaves which are large and rough and measure
nearly 6 by 3 inches. Large cymes of very showy orange-
scarlet flowers are produced in plenty at the ends of the branches during the rainy season especially and at other times too. The flowers are succeeded by pure white fruits, which are $\frac{1}{2}$ to 1 inch in size. Very easily propagated by seed, sown while quite fresh. Hardy plant, which will thrive in the open border.

**Couroupita guianensis.** (N. O. Myrtaceae). (Tamil, "Naga­lingam"). Commonly known as the Cannon Ball tree on account of the large round fruits. A big erect tree, a native of Tropical America, very familiar in the Madras gardens. The tree is deciduous and sheds all its leaves in the course of a single week and is followed by very agreeable pleasing light green large leaves. The flowers are borne in long woody racemes, often measuring four to five feet in length and spring­ing from the stem. The flowers are finely scented and are very interesting; they are fleshy, large and possess a curious hood­like structure, made up of united stamens in the centre of the flower, which accounts for the Tamil name. There are three varieties of this species, bearing pink, white, or maroon flowers respectively. The fruits are globular, dark brown in colour, and are of the size of a small cocoanut. They are very foul smelling when ripening. Propagated from seeds sown fresh, or by suckers, which are produced in large numbers even at great distances from the tree.

**Dillenia indica** (syn. speciosa). (N. O. Dilleniaceae). (Tamil, “Uva”; Telugu, “Pedda Kalinga”; Hindi, “Chalta”;) A beautiful, bulky, moderate-sized tree, with dense handsome foliage of pointed elliptical bright green leaves. It bears in the cold season, very large, pure white flowers, which are six to nine inches in diameter and are succeeded by ball-like fruits of the size of a man's fist. The tree is a slow grower, requires plenty of water and a fairly shady situation while young. Propagated from seed.

**Elaeocarpus ganitrus.** (N. O. Tiliaceae). (Tamil and Cana­rese, “Rudrakshi”). An ornamental tree, about thirty feet high, suitable for lawns, avenues, or arboretums, producing compact drooping racemes of white flowers from the axils of fallen leaves. The seeds are made into beads and are worn
round the neck by religiously inclined Saivite Hindus. The flowering period is March-April.

**Erythrina indica.** (N. O. Leguminosae). (Can. Halivana; Tam. Kaliyana-murukku). Erythrina indica is coarse tree with pretty scarlet flowers in erect spikes. The tree is easily propagated by cuttings, inserting one or two in the pit prepared for the tree. It is very useful as a support for climbers, grape vine, etc. The white flowered variety, *alba*, is also handsome.

*E. Crystagalli* is a dwarf tree with crimson long spikes.

*Gliricidia maculata.** (N. O. Leguminosae). (Syn. Lonchocarpus maculata). The Madre Tree of South America. A small, very quick growing, good looking tree, with bright green, feathery, arching, leafy branches. In the dry weather, in March-April, it sheds all its leaves, when the greater part of the length of the branches are studded with light mauve coloured flowers which are clustered into bunches produced from the axils of leaves (leaf-scars). The flowers last for several weeks, making the tree a striking object. Easily raised from seed. Leaves are useful for green manuring.

*Jacaranda mimosaefolia.** (N. O. Bignoniaceae). A deciduous elegant tree attaining to a height of thirty feet or so. The foliage is pretty, with fine Mimosa-like leathery leaves, broken into small pinnae. Large erect showy panicles of bluish-purple, bell-shaped, flowers are borne in March to May, when the tree has shed all its leaves. The mass of this light blue colour enveloping the tree is a characteristic beautiful sight from a distance. Planted in threes and fives, and grown bushy by not allowing the branches to grow as they please, by topping them once in three years, they are very effective. Young plants are often grown in pots for the beauty of their foliage. Propagated from seed.

*Kigelia pinnata..** (N. O. Bignoniaceae). The well known Sausage Tree. It is a spreading, rather coarse looking, moderate-sized shade tree, grown for the peculiar way in which the bunches of dull, purple coloured, tubular flowers dangle from different parts of the branches, at the ends of rope-like stalks, measuring four to six feet in length. The
flowers are succeeded by enormous sausage-like fruits of a dull brown colour. Each fruit measures 12 to 24 inches in length and 3 to 6 inches across. The tree thrives anywhere but prefers cool situations such as the margins of ponds. Propagated from seed. Introduced from Australia. Used often for avenue planting.

**Lagerstroemia.** (N. O. Lythraceae). *L. Flos reginae* (the Queen’s Flower) is rightly styled the “Pride of India”, being one of the most showy trees of the Indian forests. There are two varieties. One is a large deciduous tree, with showy mauve-coloured flowers, borne in very great profusion from the ends of branches in large erect sprays. The tree is one mass of colour when it is in bloom and has no leaves.

*L. Flos regina variety rosea* is a much smaller tree, looking almost like a large shrub, similar to a grafted Guava tree, bearing very bright, rose-coloured sprays of flowers. The foliage soon appears with the flowers, so that the brightly coloured flowers standing erect well over the foliage give the tree an extremely fine ornamental appearance. Both the kinds bloom in April-May. Easily raised from seed. The rose coloured variety is a truly fine tree which no garden should be without.

*L. Thorelli* is a newly introduced very beautiful species with pretty white and mauve flowers on the same tree. Has quite a long season of bloom and is highly commendable.

**Lysidice rhodostegia.** (N. O. Leguminosae). A large tree from China, handsome with its masses of light rose-coloured inflorescence produced erect from the ends of its branches. The flowering period is January to March. The calyx is coloured and does not fall off making the tree very showy for a long time.

**Magnolia grandiflora.** (N. O. Magnoliaceae). Hindi, Him Champa). A delicate, very slow growing, small tree, 10 to 12 feet high, never growing more than a shrub at low elevations. The foliage is very pretty, consisting of broad dark green, shining, laurel-like leaves. Large, terminal, very sweet scented, flowers are produced on the older shoots in May and June and occasionally at other times. The tree prefers a semi-shady to an open situation, requires plentiful and regular
supply of water and deep rich soil. Propagated from seed, which should be sown fresh and protected from red ants. A rare plant, which needs to be popularised.

*M. mutabilis* and *M. pumila* are two other very desirable species which are shrubs.

*Melletia ovalifolia.* (N. O. Leguminosae). Allied to *Pongamia* and looking like it. But, it is of dwarf growth, flowering in deciduous condition in April—May, being covered with small lilac pea-shaped flowers in clusters. The pods are flat and the tree is raised from seed easily.

**Memecylon.** (N. O. Melastomaceae). There are two species of this genus which are worth growing in the garden for their bright green foliage and scented flowers. They are *M. Heyeanum* and *M. edule* with its variety *ramiflora*. They are woody, large shrubs or small trees, with cheerful glossy foliage of small leaves. In March—April, small lilac coloured flowers are produced in profusion, clustered in compact little bunches cleaving to the stems. Propagated from seed or by layers. A native of the jungles in India.

*Mesua ferrea.* (N. O. Guttiferae). (Tamil, “Nagasuram”; Canarese, “Nagasampige”). Called the Iron Wood Tree, as the wood is very hard and reddish brown in colour. A moderate-sized ornamental tree of slow growth, with a straight stem and handsome foliage of lanceolate, leathery, shining, drooping leaves. The young blood-red leaves, fading into pink and green, are by themselves ornamental without flowers. The flowers are large, four-petalled and white, with a large yellow eye, formed of crowded numberless stamens. The flowers are highly scented and fill the air with their delightful fragrance to a great distance. The tree is easily raised from seed, which should be sown fresh, where the tree is wanted to be grown as the young plants do not bear transplanting well. A deep stony soil and an abundant supply of water are necessary for satisfactory growth. The tree furnishes a useful and lasting timber, which is used for railway sleepers and for heavy machinery.

sized indigenous tree, about thirty feet high. A great favourite in Hindu gardens, the flowers being used for puja and by ladies, who are very fond of them. The tree is celebrated for its exquisitely scented cream white or dull red flowers (there are two varieties), which are nearly three inches long, numerous petalled, and have short green peduncles. Blooms are borne freely in April–May, but are borne intermittently throughout the year. Seedling plants take about eight years to flower and make large trees but graft plants are much smaller in size and bear flowers sooner and in greater profusion. Usually, the red variety is available only as seedlings and it takes a longer time to flower than the white flowered kind. The red variety is more strongly scented than the white kind. Propagated from seed and improved by grafting. The new variety *alba* bears pure white flowers and is very handsome.

**Millingtonia hortensis.** (N. O. Bignoniaceae). Hindi, “Akas Nim”). Called the Indian Cork Tree or Tree Jasmine. A tall, graceful, rapid growing tree, with densely packed foliage of bright green, polished leaves. The flowers are pure white in colour, trumpet shaped, three to four inches long, very fragrant like Jasmine and very profusely borne twice a year, in November and June. Propagated from seed and by suckers.

**Mimusops Elengi.** (N. O. Sapotaceae). (Tamil, “Maghadam”; Telugu, “Poghada”; Hindi, “Mulsari”; Canarese, “Pagade”). A middle-sized, handsome, evergreen tree, with crowded, dark green, polished leaves, bearing twice a year, small, white, very fragrant, pale white, star-shaped, double flowers, which are hidden in the foliage. The flowers are greatly in demand in the market, Hindu women being very fond of them. A scent is prepared from the flowers. A great favourite in large Indian gardens.

**Nauclea cadamba.** (N. O. Rubiaceae). A large deciduous tree with pretty yellow flowers, borne in August—November.

**Ochrocarpus longifolius.** (N. O. Guttiferae). (Canarese, “Suragi”; Tamil, “Punaga”). A small, very slow growing tree, about twenty feet high, with dense foliage of laurel-like large leaves, which are 8 by 10 inches long and 2 inches broad, leathery, pendulous and shining, affording a cool shade.
The stem is straight and bears branches, which are opposite and disposed at nearly right angles to the stem. The flowers are white, four petalled, very sweet scented and are borne in axillary clusters, on the trunk and the limbs. The flowers are fragrant even when dry. Raised from seed. The tree is a native of Kanara and other moist districts and it needs protection from hot winds.

**Oncoba spinosa.** (N. O. Bixaceae). A small bushy tree with light green small ovate leaves. It bears during April—May from the underside of the young branches, showy, solitary, scented, white flowers with innumerable yellow stamens. The shrub is somewhat thorny, and is, hence, useful as a barrier on the boundary line.

**Parkia.** (N. O. Leguminosae). Canarese, “Sivalinga maha”. *Parkia biglandulosa* is a large upright stately showy tree, named after the famous African traveller, Mungo Park. The foliage is very pretty, being feathery and consisting of bipinnate leaves, which are a foot or more long; there are 40 to 50 pinnae to a leaf; each pinna is three to four inches long, and each pinna has about 150 minute pumules. The petiole or leafstalk has two small glands, and hence the specific name. The inflorescence consists of axillary pendant globular flower heads, about one and a half inches in diameter, which are suspended by long peduncles. The individual flowers are very small and insignificant. The heads, are at first, of a brown and velvety colour and they become white, as the flowers open. The tree is very interesting with its brown and white balls of flower heads dangling down the branches, supported by the long peduncles. It thrives in any garden soil with slight attention while young. A good avenue and shade tree. Propagated from seed.

**Parkia Roxburghii** is an equally ornamental magnificent tree; very valuable as a shade tree.

**Peltophorum ferrugineum.** (N. O. Leguminosae). The Yellow Gold Mohur. A large quick growing tree with a symmetrical spreading top and fine graceful feathery foliage consisting of pinnate leaves with small leaflets resembling those of the tamarind tree. The tree gives a good shade. Flowers are borne in April-May, in large, erect, pyramid-shaped, pani-
cles of a pale yellow colour. The flowering period is however, irregular, some trees blossoming long after their neighbours have finished flowering. Clusters of dark brown pods succeed the bunches of flowers and adorn the tree for quite a long period. Very valuable for avenues or for shade. Easily raised from seed. Does not kill grass under it and hence recommended strongly.

**Plumeria.** (N. O. Apocynaceae). There are several species of Plumeria (also spelled as Plumieria), bearing handsome odorous flowers. In all the species, the stem is stout and milky. The leaves are large and with a few exceptions, all species are deciduous. Flowers are fragrant, large, waxy and produced in great profusion, clustered in terminal cymes. All are easily propagated from cuttings.

*P. acutifolia* is known as the Temple tree or the Pagoda tree and it is the commonest species, being planted near Mahomedan burial grounds and temples. It is a very hardy medium-sized gouty-looking tree, with stout branches and branchlets, bearing large oblong leaves, which are nearly a foot long and three inches wide. The tree is leafless during a great part of the year but is seldom without blossom. The flowers are white, flushed with yellow, have an yellow centre, are about three inches wide, very fragrant, and clustered in terminal cymes. Rather an uncouth tree for a small garden.

*P. Lambertiana.* A small tree with dark evergreen shining foliage of oblong-lanceolate leaves. This species has evergreen foliage. The tree is in blossom throughout the year, bearing pure white flowers, which are very attractive and highly scented and are arranged in erect clusters at the ends of branches. A very handsome tree, which no garden should be without. Once in four or five years, the lanky branches may be cut back for vigorous fresh shoots.

*P. hybrida* (Sp?). This attains a height of about fifteen feet, spreads very much at the top, eventually becoming umbrella-shaped. The leaves are large, broad and light green. The tree is very pretty in April—May, with its fresh foliage and large terminal bunches of flowers, which are very freely produced. Each bunch measures as much as a foot and a
half across, and is composed of numerous flowers, which are three inches in diameter. The flower is light pink and white in colour, with a shading of fine rose colour towards the edges of the petals, and with a golden-orange centre, shading to crimson; on the underside of the petals, the colour is light pink, with a beautiful band of rose coloured edging, towards the margin. The flowers are very pleasantly scented.

*P. rubra* (Frangipani plant) is a much smaller tree than the two preceding species. It produces bright crimson flowers with a golden yellow centre, in April—May, and remains in bloom for several months. A very desirable plant.

*P. alba* is a large shrub, very handsome with its bright foliage of dark green, large, polished leaves and pure white large, well shaped, highly scented flowers.

*Poinciana regia.* (N. O. Leguminosae). Very well known “Gold Mohur Tree.” Also called the Peacock Flower, the Flame of the Forest, and the Flamboyant. A tree with a large spreading top and fine feathery deciduous foliage of pinnate leaves with small leaflets. The tree is quick growing, easily raised from seed, very handsome and striking when in bloom, being enveloped in a mass of crimson-scarlet or orange-scarlet large flowers, arranged in large erect panicles, between April and May. The tree is very valuable in gardens for shade and near the confines for effect. It makes a very fashionable avenue. The pods are sword-like, 1½ to 2 feet long, are at first green and then turn black and are suspended from the branches after the flowers are over. A native of Madagascar.

*Pterocarpus indicus.* (N. O. Leguminosae). (Hindi, padouk). Called Senna at Singapore. A large Burman tree with spreading rounded top and drooping branchlets. Bears golden, sweet scented flowers several times a year, making it worthwhile growing in a large garden. A valuable timber tree.

*Pterospermum acerifolium.* (N. O. Sterculiaceae). (Hindi, Kanak-champa). An evergreen, small, erect growing tree with magnificent striking foliage, consisting of large (nearly 9 inches long by 7 inches broad), tough, thick, leathery, oblong and heart-shaped leaves, which are dark green above and silvery white on the underside. The tender young stem and young
tree is a mass of colour and hence, the common name. Propagated from seeds. Other noteworthy species are *S. colorata*, *S. villosa*, *S. lanceolata*, *S. alata* bearing orange red or scarlet flowers.

**Stereospermum.** (N. O. Bignoniaceae). *S. chelonoides* (Tamil and Canarese, Padiri) is a large, spreading, popular tree of South India, grown in temples. It is deciduous for a short time in summer, when it bears innumerable light-pink, pleasingly scented, bell-shaped flowers, which are used for puja purposes. There is a brownish flowering variety also. Too huge a tree for small gardens.

*S. xylocarpum* is a white flowering tree.

*Tabebuia.** (N. O. Bignoniaceae). *T. spectabilis*. A small tree which produces a mass of bright yellow flowers in large erect bunches when the tree has shed its leaves in March—April. Strikingly beautiful when in bloom which is only for a short period of ten days or so. Foliage is very pretty too. *T. rosea* is reported to be also very good.

**Thespesia populnea.** (N. O. Malvaceae). (Canarese, "Huvarsi"; Tamil, "Pursa") The Portia tree is evergreen and rapid growing, is usually planted by temples and in avenues. Leaves are cordate-acuminate, forming a dense head of foliage and hence, the tree is sometimes called the Umbrella Tree. It is also called the Tulip Tree by some people, as its flowers resemble tulips. The flowers are hollyhock-like, yellow in colour with reddish blotches at the base passing to rosy violet while withering. Flowers throughout the year. Propagated from seed and by large cuttings. Economically valuable tree.

*Wrightia tinctoria.** (N. O. Apocynaceae). (Canarese, "Bep-pale"). Called the Ivory Wood tree, because its wood is ivory white and used in the manufacture of toys. It is a small handsome tree with slender cord-like branches bearing in very great profusion in March—May, fragrant jasmine-like white star-shaped flowers, half to three quarter of an inch in diameter, clustered in terminal and sub-axillary cymes. A native of India.

*W. coccinea* is very handsome with rose-red flowers.
(B) SELECT ORNAMENTAL FOLIAGE TREES

**Alstonia scholaris.** (N. O. Apocynaceae). An ornamental evergreen small tree, about eight feet in height, with leaves, five to seven in a whorl, having the upper surface glossy and the under surface white. Suited for growing on the lawn as a single specimen.

**Araucaria.** (N. O. Coniferae). Genus of very ornamental Coniferous evergreen trees from South America and Australia, eminently suited for planting on lawns, where they show themselves very effectively. All are immense, tall trees but are very slow growing, hence being well suited for pot or tub culture, for decoration of the verandah, window and the drawing room. The plants can be continued in tubs or pots for several years by restricting their root space and repotting them every year. The trees are remarkable for their symmetrical and orderly growth. They grow with little care in any good garden soil but they prefer a deep, loamy, well drained soil, which is regularly watered. Propagated by seeds. But, they can be raised by gootying vertical shoots; horizontal shoots do not make good straight specimens of plants.

The following species are noteworthy:

* A. excelsa, called the Norfolk Island Pine, is a very handsome species. A very tall tree, conical in shape, with short, slender, horizontal branches starting from the trunk with a certain regularity, resembling a gigantic candlebra; the branches have a graceful fleshy appearance. Thrives very well on the plains.

* A. Cookii is similar to the above but thrives in high altitudes.

* A. Cunninghamii does well in the plains, though it does better between 2000 and 4000 feet above sea level. A rapid grower.

* A. Bidwillii is too delicate for the plains.

**Artocarpus incisa.** (N. O. Urticaceae). (Tamil, Semaipala). The Bread Fruit Tree. A very handsome quick-growing evergreen tree, which attains a great height and spread, and has very large, polished, dark green, palmately-cut leaves. The
tree is strikingly ornamental and provides fairly good shade. The fruit is oval in form and is of the size of a small melon and has the general appearance of the Jack fruit, to which it is very nearly allied. In the superior type, the fruit is practically without seeds and the inside of the fruit resembles the soft inside of a loaf of bread and is used as vegetable. The tree requires a rich loamy soil and plenty of water. It thrives best in coastal regions and in districts where there is a humid atmosphere and equable temperature. Propagated by suckers taken from selected trees and kept in sand till they strike root, by layering, and also sometimes by root cuttings.

**Artocarpus Cannoni** is a small tree which can be pruned low. It is worth having on account of its coloured foliage, its new leaves being beautiful reddish bronze.

**Cinnamomum camphora.** (N. O. Lauraceae). A small evergreen tree, which is bushy and has foliage down to the ground. The tree has a conical shape, especially while young. The leaves are greyish green, lanceolate and finely scented. Economically, the tree is valuable, as by distillation of its leaves and wood, the camphor of commerce is obtained. Bears white panicles of flowers, which are not particularly showy. Propagated by seed.

**Cupresses.** (N. O. Pinaceae). Also called Cypress. Genus of evergreen trees and shrubs, which are grown for the beauty and grace of their fine form and foliage. They thrive at altitudes between 2500 and 7000 feet, in a deep sandy loamy soil. But in the plains or at low elevations, the hardier species as *C. sempervirens* can be grown with success in pots in partial shade, well protected from hot winds. Even at medium elevations, as at Bangalore, the plants unless they are shaded in summer from the severe sun, die, especially when young. Some of the Cypress stand trimming very well and are hence very useful for topiary work. At high elevations, hardier kinds as *C. sempervirens* are used for ornamental hedging. Propagated from seeds which take several weeks to germinate by rootie, or by layers and sometimes by cuttings of the ends of branches planted in sand in August—October. The following species are recommended:—
C. sempervirens, 25 to 30 feet; upright, and conical in form. This is the common and hardy variety which is grown by mosques. Suited for low elevations.

C. torulosa is erect and tall growing.

C. pyramidalis is a variety of sempervirens. A tall erect tree with whippy adpressed branches.

*C. macrocarpa (The Monterey Cypress) is densely packed with ash green fine slender leaves; stands trimming very well.

*C. funebris is called the Weeping Cypress. It is 15 to 20 feet high, has a drooping habit like that of the Weeping Willow. Thrives at medium to high elevations.

C. horizontalis, C. Lawsoniana, and C. arizonica are other species.

Eucalyptus. (N. O. Myrtaceae). A large genus of very tall gigantic trees, natives of Australia, popularly called the Blue Gums. The eucalyptus oil is prepared from the leaves. The breeze from the trees is said to possess anti-malarial properties. Almost all the species thrive only at medium to high elevations. But, E. citriodora and E. rostrata grow well in the plains. E. citriodora is specially recommended as it is particularly suited for small gardens too. It is an upright, handsome, slender, evergreen tree, with smooth white bark and dark green leaves, with a lemon-scented odour. The tree can be cut down to the ground level and the new shoots allowed to grow making a bushy growth.

E. globulus is the typical Blue Gum, which thrives above 4,500 feet.

*E. filicifolius is a showy species, bearing crimson flowers in great profusion. A small tree suitable only for hill stations.

E. marginata and E. crebra are two other handsome species for hill stations. All the species are raised from seed.

*Filicium decipiens. (N. O. Burseraceae). A medium-sized, very ornamental tree of slow growth, with bright green polished, compound leaves, which resemble fern fronds and are used for decoration indoors. In the young state, the plant is equally ornamental and hence is grown in pots for decoration purposes. The tree is very hardy and grows in any good soil; it is easily propagated from seeds, which should be sown fresh.
Grevillea robusta. (N. O. Proteaceae). Popularly known as the Silver oak, is a tall Australian tree, which is very handsome when young, with its evergreen foliage, consisting of deeply incised twice pinnate leaves, which are fern-like and are dark green above and silvery-grey on the underside. The mature trees produce abundantly orange coloured flowers, in racemes. An altitude of 2,000 to 5,000 feet and deep open soil and frequent watering while young are necessary for successful cultivation. Easily raised from seed. Seedling plants, which are about six months old are nearly 2½ feet in height; they are useful as pot plants for decoration purposes. A good tree for planting as wind-break. It is handsome while in bloom in April-May. Pruning is necessary after 5 or 7 years to keep it in shape. There are other more attractive species, which however do not thrive at lower elevations.

Heritiera littoralis. (N. O. Sterculiaceae). Called the looking Glass Tree. Medium-sized, evergreen and distinctly ornamental. Leaves are large, close packed, oval-oblong and rounded at the base, bright green above and silvery beneath, having the appearance of the back of a looking glass. Fruits are brown and are of the size of walnuts. They are borne in clusters and are interesting. Propagated by seed.

Melia azadirach. (N. O. Meliaceae). Called the Persian Lilac tree. Ornamental, medium-sized, growing in any good garden soil without special attention. It bears lilac coloured fragrant flowers in large panicles. The leaves are thrice divided, which characteristic serves to distinguish it easily from the Neem Tree, Melia azadiracta = Azadiracta indica. Propagated from seed. Melia japonica is a much dwarfer species.

*Pinus longifolia. (N. O. Conifereae). A lofty Pine, a native of the Himalayas, thriving from 1,500 to 7,000 feet above sea level. It is useful in large gardens as it is very effective when placed on lawns. The tree is very slow growing and it is remarkable for its needle-like, long, pendulous leaves, which are nearly 14 inches in length. Good specimens of this tree can be seen in almost all public gardens of importance in India.

Pisonia alba. (N. O. Nyctaginaceae). (Canareese, "Sule soppu"; Telugu, "Lanchamundaku"; Tamil, "Lechai kottai or
Chandu ). Popularly known as the Lettuce Tree or the Lady Love. A small evergreen tree, with ornamental, dense foliage of pale green, bright leaves, which are large and have a refreshing appearance. The leaves are alleged to have medicinal properties, being taken internally for rheumatic pains, and they are a good food for cattle. Propagated very easily by cuttings.

*Polyalthia longifolia. (N. O. Anonaceae). (Tamil, "Mara­illupai"; Hindi, "Asok "). Called the Mast Tree. It is an elegant, erect-growing tree, with shining, lance-shaped, bright green, polished leaves, and wavy branches. The leaves are used for decoration with flowers. The tree is specially suited for dry regions and is useful for avenues. If planted close to each other, the trees form a high screen. As the plants do not transplant well, seeds are best sown where the trees are wanted to grow in ready made pits filled up with suitable soil. After one or two years, they need very little attention. The seeds should be sown quite fresh when they ripen, about the end of July. The weeping variety of the above, Var. pendula, is more ornamental.

*Putranjiva Roxburghii. (N. O. Euphorbiaceae). (Hindi, Jalpitri). A medium-sized, evergreen tree with spreading habit. It is clothed with dense foliage of dark green leaves with the general effect of a weeping tree. It is more beautiful than Polyalthia and is good for any garden.

Ravenala madagascariensis. (N. O. Musaceae). Popularly called the Traveller's Tree of Madagascar, because the tree collects water in the sheathing bases of its leaves and this water is alleged to be made use of by travellers in arid regions. But this supposition seems to be not based upon fact, as the tree itself will not thrive in districts where water is scarce and as the water stored up is infested by the larvae of mosquitoes and other insects, making it unfit for drinking purposes. The tree is remarkable in appearance, being tall and evergreen, with its immense distichous leaves, which very much resemble those of the banana and which are arranged in one plane giving the appearance of a gigantic fan, surmounting a thick succulent stem. There are as many as 20 to 24 such leaves on a tree and the stalk of each leaf is about 5 feet in length; the lower ends
of the leaf-stalks are firm and sheath the stem firmly, forming receptacles holding the water collected during the rains. The seeds are blue and very hard. The tree is propagated from seed or by suckers, which are produced under mature trees. To be effective, the trees should be placed in groups of fours and fives, planted 7 to 9 feet apart.

*Schinus molle. (N. O. Anacardiaceae). Called the Californian Pepper Tree. A medium-sized, very ornamental, evergreen tree which attains a height of about twenty feet. The branches and branchlets have a pendulous habit and the foliage is graceful and drooping willow-like; it consists of fine pinnate leaves which are about nine inches long. The tree produces panicles of inconspicuous whitish flowers, which are followed by purplish green berries, resembling pepper corns. The leaves and the berries are resinous and have a strong smell of pepper. The tree is excellently suited for single planting on a lawn. Propagated by seed and by layering.

Schleichera trijuga. (N. O. Sapindaceae). Called the Ceylon Oak. A large tree but of very slow growth. The new leaves are deep carmine-red.

Thuja. (N. O. Pinaceae). Thujas or Thuyas are a genus of very ornamental, very slow growing, evergreen, woody shrubs or small trees, which are grown for their formal habit of growth and their neat fernlike, bright green foliage. They are useful as pot plants; they can be continued in pots for several years by repotting them or top-dressing the soil once a year. Most of the kinds stand trimming very well and several species do not require any trimming at all as they naturally grow to a lovely conical or pyramidal form. The garden forms of Thuja are very bushy and low, the branches being many, horizontal and much ramified. The branchlets are flat, green and frond-like, the leaves being scale-like. For lawn planting, Thujas are excellently suited. *T. orientalis* is the commonest species. It is well known as Arbor Vitae; it is a small bushy tree of conical shape with laterally flattened branches. A native of China and Japan. Propagated from seed or cuttings of erect branches; cuttings taken from lateral branches give plants which have a tendency to grow in the horizontal direction.
T. gigantea is a large growing species.
*T. orientalis* variety *compacta* is the best, being the most ornamental dwarf shrub with thickset foliage.

**Terminalia catappa.** (N. O. Combretaceae). (Canarese and Tamil, “Badami”; Hindi, “Desee Badam”). The Indian Almond Tree. Fairly large tree, about 25–30 feet high, of handsome stately growth with long branches, spreading horizontally and coming from the main stem or axis in whorls. The tree is deciduous and the leaves are large, bright, polished and deep green. It affords cool dense shade. The fruits are edible, a nut similar to almond being enclosed in them, thus accounting for the common name. Propagated from seed.

**Wigandia caracasana.** (N. O. Hydrophyllaceae). A tall shrub or a small ornamental tree, about 12 feet high, with handsome pleasing foliage, consisting of large, wrinkled, more or less downy leaves, which are nearly 18 by 10 inches. Lilac blue coloured flowers are produced in showy terminal cymes. Propagated from seeds, which are very small. A native of Mexico.

(C) SHADE TREES.

Lists A and B contain very valuable trees, which also afford some shade. But, this list includes large trees, which are particularly grown for their shade, and are suitable only for large gardens.


**Adenanthera pavonina.** (N. O. Leguminosae). (Hindi, “Rakta chandan”; Tamil, “Kundumani”). Called the Bead Tree; very common in Southern India, a native of Malaya. It is a good quick growing shade tree, attaining a large spread and good height. The seeds are bright and glossy and red, looking like beads, and used by goldsmiths for weighing small quantities of gold. Propagated from seed. *A. bicolor* is less common and bears smaller but more ornamental seeds which are half black and half red.

**Amoora rohituka.** (N. O. Meliaceae). An evergreen tall spreading tree, belonging to the Neem family.
Albizia. (N. O. Leguminosae). A genus of large quick growing shade trees with thin feathery foliage, which are ornamental and bear scented flowers. *A. Lebbeck* is the Siris Tree. Well suited for roadside purposes. Other species, which are also good are *A. odoratissima; A. Richardiana; A. Moluceana;* and *A. procera.*

Anda gomesii. (N. O. Euphorbiaceae). A tall, spreading, evergreen tree. The flowers are white.

Azadirachta indica. (N. O. Meliaceae). (Canarese, “Bevu”; Tamil, “Vembu”). The Margosa or the Neem Tree. A very useful, medium-sized, evergreen tree, with dense foliage of shining light green, deeply serrated leaves. The flowers are pale white and pungently scented and are borne in loose clusters, which are followed by yellow drupes. The tree is very common in Indian gardens, its leaves and flowers being very greatly in demand. Bunches of leaves are tied in front of the house to indicate that small-pox is prevalent or that some death has taken place or that there is a confinement, in the house. The leaves, bark and root have an astringent and tonic properties and are used largely in Hindu pharmacopeia. The neem oil is used for killing borers attacking plants and in medicine and for making soaps. The tree is very hardy, provides excellent shade, and the breeze from the tree is considered very good for health.


Caesalpinia coriaria. (N. O. Leguminosae). Known as Divi Divi, native of C. America and West Indies. Spreading moderate-sized tree with finely pinnate leaves and sweet scented flowers. Especially suited for places with light rainfall. The pods are a valuable tanning material. It is difficult to grow anything under its shade.

*Cassia siamea. (N. O. Leguminosae). A medium-sized, very hardy tree, bearing yellow terminal bunches of flowers almost throughout the year. It is very easy of propagation from
seed and is very quick growing, which is the merit which induces several persons to grow it.

**Castanospermum australe.** (N. O. Laguminosae). See page 212.

**Dalbergia Sissoo.** (N. O. Leguminosae). The Sissoo is a common jungle tree, useful for planting by roadside, as it grows rapidly and transplants well. The flowers emit a delicate fragrance in the evening. The species *D. lanceolaria* is superior to the latter.

**Diospyros embryopteris.** (N. O. Ebenaceae). Tamil, "Panichchhai". Moderate sized, evergreen tree with spreading branches and brilliant red new foliage. Slow growing.

**Ficus Benjamina.** (N. O. Urticaeae). Known as the Java Fig Tree. It is one of the finest trees in cultivation, with very bright, shining, dark green leaves, borne very thickly in drooping arching boughs. It is slow growing but attains great height and very wide spread. It is one of the finest evergreen trees for large avenues, where plenty of cool shade is desired.

**Ficus retusa** is a species that can be grown in a large private garden.

**Filicium decipiens.** (N. O. Burseraceae). See page 227.

**Kigelia pinnata.** (N. O. Bignoniaceae). See page 215.

**Parkia.** (N. O. Leguminosae). A very ornamental large shade tree. See page 219.

**Peltophorum ferrugineum.** (N. O. Leguminosae). An excellent shade tree with a wide spread. See page 219.

**Pithecolobium Saman.** (N. O. Leguminosae). The Rain Tree. A large, wide-spreading, tree of very rapid growth, very suitable for shade in a large garden. The branches are easily broken by strong winds. Propagated by cuttings or seed.

**Polyalthia longifolia.** (N. O. Anonaceae). See page 229.

**Pongamia glabra.** (N. O. Leguminosae). (Canarese “Honge”; Tamil, “Punga”;). A partially deciduous, medium-sized, useful tree with shining dark green leaves, bearing pendent racemes of lilac-rose flowers. The flowers are used in a well decomposed state for forcing Chrysanthemums and such other plants, which require heavy and rich feeding. A useful oil is extracted from the seeds, and the oil-cake is used extensively as manure.
Leaves make excellent green manure. The trees can be planted close and pruned to form a tall hedge.

**Swietenia Mahogani.** (N. O. Meliaceae). The famous Mahogany Tree; good-looking, tall, large, very slow growing, giving fairly good shade. Easily propagated from seed.

**Tectona grandis.** (N. O. Verbenaceae). The Teak Tree. It is a truly grand and majestic tree with large leaves. In large gardens, it can be planted for shade. The tree is very handsome in bloom with large erect loose bunches of flowers.

**Terminalia catappa.** (N. O. Combretaceae). See page 231.
CHAPTER XVIII

SHRUBS

List A includes select shrubs grown for their flowers. List B includes select shrubs grown for their ornamental foliage or handsome form or both.

For general remarks on shrubs and shrubberies and the care to be taken of them, see pages 152–3. For directions as to planting and transplanting shrubs, see chapter VII. For directions as to pruning ornamental and flowering shrubs, see chapter X.

(A) SELECT FLOWERING SHRUBS

Abutilon. (N. O. Malvaceae). Known as Flowering Maples or Chinese Bell Flowers. A class of showy herbaceous, free growing shrubs, 4-6 feet high, with long-stalked, often maple-like leaves. The flowers are Hibiscus-like but pendulous like ear drops. Some kinds are grown for their variegated foliage, as for instance A. Thompsonii. Abutilons grow but do not freely flower in the plains as at medium to high elevations. Propagated by seed and cuttings. Soak the seeds in water for about two hours before sowing. Sow them thin, to facilitate thinning, as germination is irregular. The time for sowing is October in the plains and March on the Hills. When the seedlings are big enough to be handled, when they are about an inch high, put them into small pots in rich loam, in such a way that the seed-leaves rest on the soil. Ensure thorough drainage. Shift them to larger sized pots as they grow and fill the pots they are in with roots. Pinch back the shoots to bush the plants out. Discard old woody plants and raise new ones each time from seed or cuttings.

Acacia. (N. O. Leguminosae). A large genus of very useful ornamental shrubs and trees, popularly known as "Wattle". They are quick growing but short-lived plants, thriving from medium to high elevations only, except A. Far-
nesiana which grows well in the plains as well. The genus furnishes plants of great economic value. Some species furnish scented flowers from which fine perfumes are manufactured. A. Senegal furnishes the famous gum arabic of commerce. A. concinna furnishes the soap-nut pods, which are powdered and largely used in India. Some other species furnish strong wood, from which furniture is made. The trees, A. dealbata, A. longifolia, and A. decurrens have been mentioned under trees. Pages 204-5. A. Farnesiana, called the Fragrant Acacia, (Canarese, “Kasturi Jali”; Hindi, “Vilayati Kikar or Babool”) is a large thorny, (the name Acacia is derived from a word meaning a point or a thorn, referring to stipules, which are often spinescent), spreading, unattractive bush or small tree bearing very highly scented, globular and tassel-like yellow flowers, in great profusion in the cold season. Flowers retain their smell long after they are gathered. A valuable perfume is made out of the flowers in France. The shrub makes a good fence, if cut and trimmed now and then.

*Acalypha. (N. O. Euphorbiaceae). A hispida = A. Sanderiana is different in character from the other species of Acalypha, which are grown for their variegated pretty foliage. It is a small shrub grown for its long drooping spikes (catkins) of crimson flowers. The leaves are broad and dark green in colour. The plant is a leading horticultural species and it can be trained to a single stem or to a spreading bush form; it is serviceable as a pot plant too. Propagated by cuttings. A. Sanderiana var. alba bears creamy white spikes. Thrives best in semi-shade.

*A. colorata has reddish tinged leaves and bears longer catkins.

*Acanthus. (N. O. Acanthaceae).

*Acanthus angustifolius is a herbaceous perennial shrub, two to four feet high, with pretty shining leaves and rosy Ixora-like trusses of flowers. The plant thrives in semi-shade and is very handsome, being full of flowers in the rainy season. A. ilicifolius is also a pretty shrub bearing light blue flowers and large Holly-like leaves. Thrives at medium elevations.
A. mollis is another species, with white, rose, or lilac flowers; it thrives only in cool places.


*A. Leschenaultii* bears flowers nearly three times the size of the preceding species and has hence superseded it as a garden variety.

**Allamanda.** (N. O. Apocynaceae). An important genus of showy tropical shrubs, chiefly from South America. They are mostly climbers or scandent shrubs, which are evergreen, with dark polished green leaves. The flowers are terminal, large, and funnel-shaped, with a flat spreading or reflexed limb. Allamandas are all very hardy and thrive in the plains and are easy to cultivate. They should be pruned now and then to keep them within bounds and they can be gracefully trained over some support or a "pandal" to effectively show themselves off. Propagated by cuttings or layers.

All the species except *A. violacea* and *A. neriifolia* are varieties of one variable species. *A. grandiflora* is a choice gorgeous climber, which can be trained over a porch, trellis or arch. It can also be grown on the lawn as a shrub with some support for the scandent branches to go up and gracefully come down. Large yellow funnel-shaped flowers are produced in great profusion throughout the year and especially in summer and in August—September. The flowers contrast well with the deep green, highly polished leaves. *A. Aubletii* climbs wildly and flowers profusely. *A. Cathartica* is of less scandent habit than the preceding kind and its flowers are smaller. *A. Cathartica variety Hendersonii* is another pretty kind. *A. neriifolia* is a dwarf bush or half climber. *A. violacea = A. purpurea* is distinct from the other species. It is a slender growing climber, rather less common than the other species, with pretty bright reddish purple flowers, with the tube 2 inches long, and the limb spreading and 2½ inches in diameter. It is not so hardy as other species.

**Ardisia.** (N. O. Myrsinaceae). Flowering evergreen shrubs, which are grown for the beauty of their berries. The
word Ardisia is from ardis, a point, in allusion to the pointed anthers. Propagated by cuttings with bottom heat, or by layering, or by seed.

Ardisia humilis (Canarese, Kantena bodina gida; Hindi Korda-banjam) is an erect shrub, having leathery leaves and bearing pendulous umbels of pink flowers, which are succeeded by blackish berries. A. crenulata is a dwarf shrub which is grown for its pretty large clusters of bright red berries; it thrives at medium elevations. There are other attractive species, bearing rose and pink coloured flowers.

Artabotrys odoratissimus. (N. O. Anonaceae). (Canarese and Tamil, "Manorangini"; Hindi, "Hara-champa"). The word is derived from Artao meaning to suspend and botrys meaning a bunch, the peduncle is so constructed that it holds a bunch of suspended fruit; odoratissimus, means most odorous. A large climbing evergreen shrub, with very pretty glossy leaves and thick fleshy, very strongly scented flowers, which are green and turn yellow on ripening. The shrub is very hardy, thrives in any soil, and is very useful for screen planting in large gardens. It can be trained to an umbrella form like a large standard. Propagated from seeds or by layers.

Asclepias curassivica. (N. O. Asclepiadaceae). A herbaceous milk-juiced perennial shrub, known as The Blood Flower or Milk-weed or Silk-weed. It grows about three feet high, and has downy, lanceolate leaves and bears Lantana-like, terminal erect umbels of bright orange-yellow flowers throughout the hot weather. The shrub self-sows itself and grows like a weed anywhere, especially in dry regions. Propagated by seed or cuttings. Old plants are best discarded and replaced by newly raised plants.

*Asystasia bella. (N. O. Acanthaceae) is a pretty little herbaceous shrub, about 2 feet high, with bell shaped rose-red flowers. Fits into a herbaceous perennial border charmingly. Loves semi-shade.

A. Travancoreana with purple flowers and A. Coramandeliana with white or purple flowers are also handsome species.

Baleria. (N. O. Acanthaceae). (Canarese and Tamil, "Spa-
tika”; Hindi, “Jhate”). Group of attractive small evergreen shrubs, 2–4 feet in height, being loaded with bell-shaped beautiful flowers in the rainy season. The plants bloom almost throughout the year by pruning them back every time after flowering. They are very desirable for mixed borders and for ornamental small hedges. The flowers are largely used for puja purposes. There are several species with pure white, rose, blue, orange, and variegated flowers, and in all of them the dry bracts of the flowers remain long after the flowers are gone. Easily raised by cuttings or seeds. The following species are highly recommended:—

*B. cristata and its hybrids with bracteata bear pure white, pink, mauve, or rose-coloured flowers. *B. Gibsonii, bears azure-blue flowers, which are much larger than in other species. B. strigosa bears pale blue flowers.

**Bauhinia.** (N. O. Leguminosae). (Hindi, “Kuchnar”). A genus consisting of large shrubs and trees. The latter have been considered in pages 206-7. The following shrubs are noteworthy:—

*B. Galpinii is a large spreading shrub from South Africa with small camel-footed leaves. It grows to about five feet and bears very showy, large clusters of brick-red flowers, in very great profusion, covering the shrub in a mass of colour. The shrub is in bloom almost throughout the year but it is particularly handsome in February and April.

*B. candida grows 6–8 feet high; see page 207.

*B. tomentosa. See page 207.

*B. acuminata is a pretty shrub, 6–8 feet high, with white flowers, borne almost throughout the year.

**Beloperone oblongata.** (N. O. Acanthaceae). Also known as Crystanthera oblongata. Handsome small shrub, 3–5 feet high, which is nearly always in blossom with large rosy-purple flowers produced at the nodes. It is allied to Justicia and requires the same treatment. Raised by cuttings or seeds.

**Bougainvillea.** (N. O. Nyctagineae). A genus of South American vigorous growing heavy climbing shrubs; very attractive with their brightly coloured bracteal flowers and growing very easily in any soil with very little attention. The
flowers are small and inconspicuous but the decorative value of the plants consists in the fact that the flowers are inclosed in large and showy brightly coloured bracts. Bougainvilleas enjoy full sunshine, are of rampant growth, and form very attractive hedging and fencing plants. A natural boundary fence of Bougainvillea, kept neat and tidy by regular use of the shears, is a glorious sight when in bloom. Allowed to climb up a tree, it rapidly covers the tree, the whole tree appearing one blaze of colour in the proper season in course of time. As bushes or large shrubs, frequently kept down by severe pruning and trimmed to a certain form, they are very ornamental. Standard Bougainvilleas, 4–6 feet high, planted alongside roads or walks are magnificent in bloom. Bougainvilleas are also useful to cover trellises, porches etc. They are very serviceable as pot plants too, as they make excellent seasonal plants. For this purpose, young plants grown from cuttings are put in 12 inch pots and grown bushy and compact by frequent removal of water shoots and pruning back stragling branches. About three months before the blooms are desired, the plants are very sparingly watered, starving them so that all the leaves wither and fall away. If the plants are again liberally watered, soon new growths appear with a mass of colour. Propagated from cuttings and layers and from seeds for new varieties.

The following species are noteworthy:—

_B. spectabilis_ is a variety, bearing large intensely purple bracts in large panicles. It is usually in bloom from February to April. Mostly in flower during leafless condition.

*B. lateritea_ has large brick-red bracts and blooms thrice a year.

*B. Mrs. Fraser_ has rose-crimson bracts. A recent good hybrid.

_B. Glabra_ is the common pale purple vigorous growing species used for fencing.

*B. The Maharajah of Mysore_ is another recent excellent hybrid with bracts coloured terracotta shaded with light purple. The colour is not so dazzling as in the other species but the plant is best suited for mild effects. It is a hybrid of _B. glabra_ and _B. lateritea_.

*
**SHRUBS**

*B. Scarlet Queen*, one of best of Bougainvilleas; very pretty deep crimson scarlet bracts produced in long loose sprays. The same variety is now called Mrs. Butt.

*B. magnifica* has deep mauve-magenta bracts with reddish tints.

*B. Braziliensis* is a very vigorous grower and a heavy bloomer, bearing red-terracota bracts.

*B. Sanderiana*, *B. Cypheri*, *B. Maud Chettleburgh*, *B. refulgens* are other good species.

*B. Louis Wathen*, bears very bright orange coloured bracts. Very showy, similar in habit to Mrs. Butt, from which it was derived as a sport.

*B. Formosa* one of the prettiest species with rose light magenta bracts, large and showy. In bloom almost throughout the year. Good in pot as well as in the ground, as a standard or a bush.

*B. rosea* is a new introduction with very large rose coloured bracts.

**Brugmansia.** See under Datura.

**Brunfelsia.** (N. O. Solanaceae). Closely allied to *Franciscea*.

*B. americana* is an erect growing showy shrub, 3–5 feet high, with slender branches and dull green glabrous leaves. It is very ornamental, nearly always in bloom, bearing in great profusion long tubular jasmine-scented creamy flowers, resembling the flowers of Achimenes. It is raised by cuttings, layers, or by seed and is easily cultivated, thriving in full sun or semi-shade. *B. grandiflora* is another handsome species.

*B. Hopeana* = *Franciscea bicolor*. See below.

**Buddleia.** (N. O. Loganiaceae). Group of decorative and useful shrubs in the border and the shrubbery. Some of them are of a scandent habit. The leaves of some species are silvery underneath. The flowers are borne in large panicles, composed of very small flowers, which are yellow, white, lilac, or violet in colour. Propagated by cuttings and layers. They thrive well in any good garden soil. Buddleias are shy bloomers in the plains. The nomenclature of Buddleias is very much confused. The following species are recommended:—
B. asiatica is a native of Indo-Malaya. It is a very free flowering shrub, 3—4 feet high, with the branches covered with white or buff tomentum and leaves whitish underneath. Long racemes of small white very deliciously scented flowers are produced in great abundance during February-April. Cuttings of young growth inserted in sand root readily. The shoots should be cut back after flowers are over.

*B. Lindeni* is a very ornamental spreading shrub, 3—5 feet high, with delicately scented lilac coloured small flowers packed in dense racemes, which are four to eight inches long. In the hot season, the racemes of flowers are produced in unlimited profusion. Cut back after flowering to a foot and half from the ground level. Raise new plants every other year.

*B. Veitchii* bears larger racemes than B. Lindeni.

B. madagascariensis is a big rampant shrub with stems covered with whitish tomentum. The leaves are dark green above and whitish underneath. Racemes of small yellowish flowers, are borne in abundance in January and February. The shrub is suited only for large gardens to be planted on the outskirts. Prune back the shrubs severely after flowering.

Caesalpinia pulcherrima. (N. O. Leguminosae). Syn. Poinciana pulcherrima. Popularly called the Barbados Pride or the Peacock Flower, it is a large handsome shrub, 6—9 feet high, with bipinnate leaves. Erect large racemes of flowers are produced in profusion throughout the year. There are two varieties, with pure yellow and orange-red flowers respectively. It is a very hardy plant which thrives with little care in any garden soil. It responds to pruning and makes bushy growth, if the branches are cut back to a third of their length every year or once in two years. Easily raised from seed. A very ornamental shrub suited for hedging and for effective mass of colour in the shrubbery.

Calliandra. (N. O. Leguminosae). *C. haematocephala*, handsome shrub, 5—6 feet high, with very graceful foliage of pinnate leaves. It is very beautiful in the cold season, when it is in full bloom, with its large bright crimson powder pufflike flowers. Propagated by cuttings or seeds. A truly handsome plant.
*C. Houstonii is nearly always in bloom, grows 8—10 feet high bearing scarlet tassel-like flowers.

*Camellia. (N. O. Ternstroemiaceae). Charming slow growing evergreen shrub, bearing exquisite wax-like flowers of great beauty and perfection. The leaves are dark green and glossy. The shrub is grown in the conservatory in large pots, thrives only from medium to high elevations, requires a rich loamy soil and partial shade. It should be pruned after flowering. Propagated by seeds, cuttings or layers. *C. japonica is the commonly grown species with double flowers, white, rose or pink in colour. Being a slow grower, it should be fed well. At medium elevations, Camellias are grown in pots like Hydrangea and herbaceous perennials.

*Cestrum. (N. O. Solanaceae). A genus of ornamental shrubs which are easily cultivated.

*C. nocturnum, popularly known as the Queen of the Night, is a large evergreen straggling shrub, 5—7 feet high, flowering twice or thrice a year. The flowers are small and pale white in colour and are produced in clusters drooping down the plant on account of their weight. The scent of the blooms is so strong that the presence of the plant is felt at a distance of half to one furlong. Very commonly grown for the delicious fragrance of the flowers. Very easily raised from cuttings or by layering. It can also be grown in large pots.

*C. aurantiacum is a very ornamental species. It is a large evergreen shrub, 5—7 feet high, with oval undulated leaves. The flowers are tubular, one inch in length and of a bright orange-yellow colour and produced in showy clusters in great profusion in early summer from February-April. Propagated from cuttings and layers. After flowering, it should be pruned back for abundance of fresh wood which will flower the following year.

*C. elegans = Habrothamnus elegans is another attractive species, 4—5 feet high, similar to the preceding species but bearing purple-red flowers in clusters. Propagated from seed or by cuttings or layers. *C. aurantiacum and *C. elegans do not thrive in the plains, unlike *C. nocturnum.

*C. diurnum bears white flowers in small clusters, scented during the day. Evergreen polished leaves. 5 feet high.
Clerodendron (N. O. Verbenaceae). A large genus including some very ornamental shrubs and climbers, which are very easy to cultivate in any good garden soil. Some species require a little shade. The flowers are produced at the ends of fresh growths and hence the old shoots should be cut back three to six buds from the base. Propagated by suckers or offsets, cuttings, or seeds.

*C. fragrans plena* is a vigorous growing, large, coarse-leaved shrub, bearing almost always erect terminal compact heads which are composed of double, jasmine-like, scented, white flowers, shaded crimson. The shrub should be cut back every year for bushy appearance. It throws out suckers from the roots at long distances from it and hence is not quite desirable near other ornamental shrubs.

*C. Kaempferi* is 3—5 feet high, has large, roundish, rough leaves and bears brilliant scarlet flowers in large clusters surmounting the leaves at the ends of the new shoots. The blooms last for a very long time, as long as two months and a half, and the shrub is worth growing in every garden. Fresh plants thrive well and they are easily made by terminal cuttings.

*C. fallax* is a highly ornamental species, about 3 feet high, with large dark green leaves. The flowers are bright scarlet in colour, 1½ to 2 inches in diameter, produced in clusters, which are often 18 inches or more in length. The plant wants slight shade from sun.

*C. phlomoides*. Very pretty with its erect large clusters of conspicuous white flowers, with prominent stamens. Grows about 3 feet high, forms clumps with numbers of suckers from below. Propagated easily by division of suckers.

*C. Minihassi* from Singapore. Bears long white tubular flowers above fairly large handsome foliage. Grows about 4 feet.

*C. macrosiphon* is another pretty species.

*C. nutans* is an evergreen shrub, 6 to 8 feet high, looking very handsome in August to November with abundant, pretty, tubular, pale white flowers in long drooping racemes.

*C. siphananthus* is a border shrub with leaves in whorls. The flowers are long and white.
C. ugandense is the only blue flowering Clerodendron. It is a pretty evergreen shrub, growing 3—5 feet high, bearing flowers in terminal racemes from July to November.

C. Thomsonae is a twining evergreen shrub, bearing a profusion of flowers clustered in axillary or terminal lax cymes. The flowers are bright red in colour and have snowy white bracts. The plants remain in bloom for several weeks and are eminently suited for covering and growing against the corners in houses and mansions. The species makes an attractive pot plant too. The plants rest from November onwards for two months or so and begin vigorous and active growth again in March. Blooms are produced profusely on young wood.

C. Balfourii is a variety of the above.

C. splendens is a slender stemmed climber. Flowers are closely packed in dense cymes on leafy growths from the ripened wood of the previous year. They are bright scarlet and pass into a yellow colour.

C. speciosum is a hybrid of the two preceding species.

Crossandra. (N. O. Acanthaceae). (Canarese and Tamil, "Kanakambara"). Crossandras are evergreen small border shrubs, 1½ to 2 feet high, bearing spikes of orange-yellow, yellow or scarlet flowers almost throughout the year. The flowers are used by Hindus for puja and are very much liked by Hindu ladies. The old plants can be replaced by fresh ones raised from cuttings or seeds. The orange coloured variety is the commonest and produces seeds in plenty but the yellow flowering variety is less common and it does not seed, hence it is raised by cuttings only. Crossandras are subject to attacks of bugs and scales and hence it is advisable to raise plants which are free from disease once in every two years.

Crotalaria. (N. O. Leguminosae). Crotalarias are indigenous flowering shrubs, which are easily grown from seed without much care. C. laburnifolia; C. madurensis; C. retusa; C. verrucosa are all attractive species. C. juncea is often grown for green manure. If seeds of the latter are thickly sown before the setting in of the monsoon in May in the ground intended to be planted with choice crops, the plants may be dug in when the ground is wanted in August. This will enrich the soil and keep down weeds.
*Daedalacanthus nervosus.* (N. O. Acanthaceae). Hardy evergreen shrub, 2—4 feet high, producing spikes of rich blue colours. The dwarf species *watii* produces deeper coloured flowers. Make good ornamental hedging.

**Datura.** (N. O. Solanaceae). (Canarese and Tamil, "Ummatti"). There are many species of Datura which are indigenous and grow wild but are nevertheless handsome with their large trumpet shaped flowers. But they are not quite so good as to be cultivated in gardens as the following species:—

*D. suaveolens* (*Brugmansia suaveolens*) is the most commonly grown shrub. It is a spreading shrub, three to four feet high, with large elliptical-acuminate leaves, bearing sweet scented, large, trumpet shaped, snowy, white flowers hanging down the branches in great profusion. The shrubs are very pretty when in bloom. Prune after each flowering for fresh growths. Easily propagated from cuttings and grown without trouble. Prefers a little shady situation. Replace the old with new plants once in every two years. There is also a pretty species bearing large double flowers and large leaves.

*D. sanguinea* (*B. sanguinea*) is a smaller shrub than the preceding species, more difficult to grow, and bearing pendulous, brilliant, orange-red flowers, which are about 8 inches long. Propagated from cuttings, which are slow to strike root. Both single and double flowered varieties are available.

*D. chlorantha* bears yellow pendulous double flowers and grows 6—8 feet high.

**Dombeya.** (N. O. Sterculiaceae). Genus of large quick growing dense packed shrubs, very handsome in bloom in November-January, when they are one mass of colour. The flowers are borne in plenty and they are closely packed in erect corymbs at the ends of new shoots. The shrubs should be cut back to two feet from the ground level every year in February or soon after the flowers are over. Easily raised from cuttings.

The following species are important:—

*D. spectabilis* is 3—5 feet high, bears deep pink very handsome flowers. A truly handsome species.

*D. angulata* grows 4—5 feet and bears rose-pink and salmon flowers.
*D. Lancasterii* bears light pink flowers.

*D. Madohensis* bears large white flowers.

*D. Mastersii* grows 3–6 feet, bearing creamy white flowers.

*D. natalensis* bears pure white, large, sweet scented flowers. A dwarf variety.

**Duranta.** (N. O. Verbenaceae). *Duranta Plumieri* is a large, woody, spreading, tall, shrub from the West Indies. It is very attractive with its bright evergreen foliage producing abundant blue flowers in long drooping racemes, which are succeeded by yellow berries, hanging in clusters. *Duranta* is very useful for hedging, as it is handsome and stands trimming well. It is also very attractive in a mixed border of shrubs. Easily propagated from seed or by cuttings. The white flowered, *variety alba*, is very handsome and striking with pure white flowers. There is a variety with very pretty variegated foliage with gold stripes and edges, bearing blue flowers. It is suited for lawn planting or in the Japanese garden.

**Eranthemum.** (N. O. Acanthaceae). Eranthemums are several dwarf shrubs thriving well in shady and semi-situations. Some are pretty in foliage and some in flowers. *E. hyporectiformis*, and *E. laxiflorum* with blue flowers are new introductions.

*Eranthemum pulchellum = Daedalacanthus nervosus* is a small under-shrub, two to three feet high, with handsome green leaves tinged with bluish tint and pale blue flowers borne profusely on large pencilled ears in the rainy season. Blooming period extends over quite a long period. It is useful as a border or a small hedging plant and is easily raised from seed or cuttings.

**Euphorbia.** (N. O. Euphorbiaceae). Euphorbias are a genus of small shrubs, which are succulent in nature as the cactus and require similar treatment. *E. splendens* is a small shrubby succulent plant, about three feet high, with prickly stem. It is perpetually in blossom with symmetrical trusses of scarlet flowers (bracts). The plant thrives well in situations fully exposed to the sun. It is excellently suited for open rockeries. *E. Bojeri* is similar to the preceding species, bearing vermilion coloured bracts. *E. Jacquiniflora* thrives at
Franciscea bicolor = Brunsfelsia uniflora. (N. O. Solanaceae). A very slow growing very handsome shrub, 4—5 feet high, with light green leaves. Flowers are slightly fragrant and are produced in very great profusion in February—March when the plant has shed most of its leaves. The shrub is very ornamental in bloom being one mass of colour. The flowers change colour in 24 hours from violet blue to lavender which bleaches to white and hence the common name "Yesterday, To-day and To-morrow" and the name of the species as 'bicolor'. The plant thrives at medium elevations in light soil which has a lot of leaf-mould and sand incorporated into it. It is propagated easily by cuttings, layers, and by the suckers, which the shrub throws out in large numbers when it is old.

Gardenia. (N. O. Rubiaceae). There are several species of these choice tropical shrubs. They are generally deciduous and flower in great profusion when they are almost without leaves.

G. florida, popularly known as the Cape Jasmine, is a favourite delightful shrub with glossy foliage. It is a very slow grower, eventually attaining a height of about 6 feet. The flowers are large, double, creamy white, and fragrant and they are produced freely in the rainy season. Propagated by cuttings and layers. It is useful as a pot plant for forcing.

G. longistyla grows about 4 feet in height and stands pruning well. It is a pretty quick grower with rough ovate leaves, and it throws out lots of suckers from the base, which should be removed. It blooms when it sheds its leaves, creamy white highly scented flowers being clustered in miniature bouquets. The flowers are bell shaped with long projecting filaments.

G. lucida and G. Fortunei are other handsome species.

Hamelia patens. (N. O. Rubiaceae). A large, slow growing favourite shrub with dense attractive foliage of small green and greenish bronze leaves. It stands close clipping and trimming to any form. Trimmed shrubs grown alongside walks or
roads are of striking beauty. Hamelia makes a very good ornamental hedge. The flowers are small, pipe-like, orange-red in colour and do not contrast well with the foliage. Propagated from cuttings.

**Hamiltonia.** (N. O. Rubiaceae). *H. suaveolens* is a large straggling shrub, 6—8 feet high, with broad lanceolate leaves, three to six inches long, thriving in any garden soil with ordinary care. The flowers are lavender white and deliciously fragrant. The shrub is continuously in bloom for a long time, from November to February, in terminal corymb-formed heads. To keep the shrub neat and tidy, it should be heavily pruned back after flowering every year. Propagated by cuttings in August-September.

*H. azurea* has flowers of a light blue colour.

**Hibiscus.** (N. O. Malvaceae). (Canarese, “Dasavala”; Tamil, “Sembarathi”; Hindi, Jaba). A very important genus of shrubs of great beauty including several distinct types and numerous hybrids. Only the syriacus type grows best on hill stations but it can be successfully grown in the plains too. The flowers are single or double, white or in shades of mauve, borne like Hollyhocks in the axils of leaves: The mutabilis type grows tall with coarse leaf and flowers, which are single or double, and in white, pink, and rose shades, borne in the cold months. The rosa sinensis type comprises a number of single or double flowering kinds of attractive colours as white, yellow, pink, orange, terra-cotta, cerise, and deep red. The drooping forms of Hibiscus, as *H. schizopetalus* have long branchlets arching down and bearing ear-drop-like flowers.

**H. mutabilis** *floro-pleno.* (Canarese, “Bettada Tavare”) is a large bush, four to seven feet high, with large, double, rose-like flowers, changing in colour from light pink to deep rose, borne throughout the year. If the shrub is pruned every year, it keeps a better appearance and produces more blooms. The pruning can be done safely in the month of April.

*H. rosa sinensis* is a wide spreading large shrub, 5—8 feet high, with bright shining thick foliage. It is constantly in bloom with large brilliant rose-scarlet flowers which have pretty columns of pistil and stamens projecting from their centres.
Very effective with its flowers from a distance. The shrub can be used to make an ornamental hedge. Several hybrids with single or double flowers are derived from this species.

*H. schizopetalus* is an interesting ornamental shrub 6–8 feet high, with long slender arching branches bearing drooping orange-red or red or variegated flowers, with their petals recurved and fringed.

**Hiptage madablotra.** (N. O. Malpighiaceae). (Sanskrit, Madhavilata). It is an indigenous shrub of climbing habit, with elliptical-pointed smooth leaves, which are about 5 into 2½ inches. It is very attractive in bloom between August and January, with its fragrant trusses of flowers which have each, five shortly stalked petals, four of them being white and one golden. The shrub thrives with little care and is easily raised from seeds, which are produced in plenty, and by layering.

*Holmskioldia.** (N. O. Rubiaceae). Called the Parasol Flower. *H. sanguinea* is a large shrub, 5–8 feet high, bearing in boundless profusion, peculiar orange-red flowers, nearly along the whole length of the shoots. The shrub is very beautiful while in bloom from February to May. It should be cut back closely after flowering to keep it compact and within bounds. It thrives with little care and is propagated by cuttings or seeds. *H. acuminata* is another handsome species with pale yellow-orange flowers. Both species can be trained as handsome standards.

*Hydrangea.** (N. O. Saxifragaceae). Perennial small woody shrubs with handsome leaves, producing in the rainy season large compact trusses, which are 9 to 12 inches in diameter, composed of bluish or pink or white flowers. In the plains, they seldom flower. At medium elevations, they are satisfactory, and are best on hill stations. At medium elevations, they are grown as pot plants in 12 inch pots. They rapidly fill the pots with their roots; require a free supply of water, rich light soil, frequent administrations of liquid manure and a situation where they get only full morning sun. They should be pruned back after flowering to one or two inches from the base, as blooms are only produced on new shoots. For large heads of bloom, if too many shoots come up, only three are
Suckers should be removed and utilised for making new plants. Also propagated from cuttings. *H. Hortensia* is the commonest species grown and one which can be grown with success at medium elevations. *H. paniculata* is a handsome species which thrives only on the hill stations.

*Ixora.* (N. O. Rubiaceae). (Hindi, “Rangon or Rukmini”). A genus consisting of several species of beautiful and useful shrubs or small trees. Of late, several excellent dwarf hybrids have been introduced, which are loaded with trusses of flowers above the beautiful evergreen foliage, bearing a close resemblance to Hydrangeas. The flowers are packed in large, dense, terminal trusses (corymbs) and they remain very fresh for several weeks. Ixorás are available in a wide range of colours, except the blue and purple; scarlet, rose, white, and orange-yellow are the common colours. They flower best in the hot season and during the rains and in fact throughout the year. The shrubs can with advantage be pruned back every time after the flush of blooms is over. With slight shade and adequate supply of water, they grow best in sandy loam though they are not very particular as to soil. Several species can be grown in tubs or large pots with very good results. Most species thrive best in semi-shade. The following are noteworthy species:—

*I. Griffithii* is a bush, 4–5 feet high, bearing very pretty bright orange flowers in large trusses measuring 6–9 inches across. They are produced so freely that on a bush about two feet high, one can depend upon at least twenty heads. The bunches of flowers last for a good length of time, adorning the plant for nearly a month. This is probably the best of the Ixorás.

*I. macrothyrsa* grows about 5 feet high and is very pretty with its large leaves and large sized heads of a bright scarlet colour, which are very lasting. Likes a sheltered situation.

*I. coccinea* is of a bushy habit of growth, reaching a height of about 6 feet. When in bloom, from the end of the rainy season till the hot weather is much advanced, it is quite an enviable object with its large bright red flowers which are produced very freely.
I. *parviflora* is a large shrub or a small tree bearing pure white flowers almost throughout the year. Very common in the gardens of Madras.

I. *stricta* is a dwarf kind which has small leaves and which is very floriferous.

I. *flava* is of a scandent habit and bears pure yellow blooms.

Among the hybrids of merit may be mentioned the *Dufji* with scarlet flowers, *Prince of orange*, *Singaporensis* with terra—cotta flowers, *aurora* with orange coloured flowers, *venusta* with yellow flowers, *undulata* and *barbata* with white flowers, and *rosea* with pink flowers.

*Jacobina.* (N. O. Acanthaceae). Group of shrubs, allied to Justicias and including them. See under Justicia.

*Jacquinia ruscifolia.* (N. O. Mrysinaceae). A large shrub, 5—6 feet high, of dense habit, with sharp pointed, narrow, lance-shaped leaves, bearing pretty small star-like bright orange flowers in great profusion. The shrub is not handsome to look at when not in bloom. To improve its appearance, it should be trimmed every year. Propagated by seed.

*Jasminum.* (N. O. Oleaceae). Also spelt Jasmine. A much valued genus of flowering shrubs and climbers, well known for the rich fragrance of their flowers. They are well represented in all Hindu gardens, where they are grown for flowers for puja and for the women-folk who love them. There are several species producing double or single, white or yellow flowers of sweet fragrance in great abundance. Several species are coarse looking, except when in bloom. Some, as *J. grandiflorum* have rich ornamental foliage. All the species thrive in rich loamy soil. Their branches have to be cut back after flowering. At that time, manure has to be dug in and the plants copiously watered, when new shoots start out vigorously. Treated this way, the shrubs bloom twice a year. Jasmines can be forced to bloom by withholding water from them till they shed all their leaves and then supplying them with rich manure and copiously watering them regularly to induce side growths. All the species of Jasminum are easily propagated by cuttings in the rainy season. Branches or shoots are made into the form of loops, and inserted in such a way that
one half of the loop is above the soil. The nomenclature of
Jasmines is very much confused; but even if one were not to
know the names of the species, it would be easy to make a
selection of choice plants from any nursery.

*Jasminum Sambac. (Arabian Jasmine) is a very important
species. It is a dwarf spreading bushy shrub, 2—4 feet high,
producing in the hot season, attractive, double, white, very
sweet-scented flowers. There are several varieties, but the
variety known as the Grand Duke (Tamil and Canarese, “Yelu
suttu mallikai”) is the best.

*J. grandiflorum. (Canarese and Tamil, “Jaji”) is a large
twining ornamental shrub with long slender pendulous bran­
ches with very pretty dark green shining foliage consisting of
about eleven leaflets, which are less than an inch in length. The
flowers are produced freely in February—March. They are
pure white above and tinged purple underneath, are very
highly scented, circular and about 1½ inches in expansion.

J. officinalis is also a creeper bearing single white flowers
in great profusion.

J. gracillimum, J. pubescens, and J. rigidum are two other
floriferous varieties, commonly grown.

Of the yellow flowered Jasmines, the only kind which grows
and flowers in the plains is J. primulinum. There are other
species with yellow flowers, which flower freely only at medium
elevations.

Jatropha multifida. (N. O. Euphorbiaceae). Called the
Coral Plant. A large evergreen shrub, 6—10 feet high, with
handsome large palmately cut leaves. Bunches of small coral­
red flowers are borne at the ends of branches in summer. The
plant remains attractive only if kept bushy by cutting back
the branches every year after the flowers are over. Easily
propagated by cuttings and by seed. *J. panduriformis is
another distinct handsome species.

Justicia. (N. O. Acanthaceae). Most of the garden
shrubs known as Justicias are Jacobinas. Other plants allied
to these are Barlerias, Eranthemums etc. Justicias are medi­
urn sized shrubs, 3—4 feet high, with large leaves and clus­
tered heads (dense panicles or thyrses) of flowers of red or
yellow flowers. They are very showy in bloom, for several weeks. As the flowers are borne terminally on young branches or shoots, the shrubs should be cut back after flowering. They thrive in semi-shady situations and are suitable for beds in shade gardens and for shrubbery borders. They can also be cultivated in 12 inches pots. Easily propagated by cuttings.

*J. carneae* (Syn. *Chrysanthera magnifica*) has pretty long, sometimes over a foot long and broad, lanceolate to ovate-lanceolate or oval-obleng leaves and bears dense terminal spike-like thyres of flowers which are brilliant rose-purple or flesh coloured, are long, situtated erect, and have gracefully recurving corolla. Requires a rich soil and plenty of water during growth. A really showy species, flowering almost throughout the year.

*J. coccinea* bears crimson scarlet blooms, which appear only in summer.

*J. chrysosteppana* (Syn. *Chrysanthera chrysosteppana*) is very showy in bloom with its bright golden yellow flowers which are nearly 2½ inches long and are clustered in dense terminal corymbs. A winter flowering species.

*Kopsia fruticana* (N. O. Apocynaceae). Also known as *Cerbera fruticana*. An evergreen light scandent shrub with light green leaves bearing in profusion throughout the year, pale pink flowers with a red-centre. The flowers resemble single jasmine flowers in form. It thrives in a partially shaded situation in any good soil, without much care. Propagated by cuttings and by layering.

*Lagerstronoia* (N. O. Lythraceae). A genus of pretty trees and shrubs. The trees have been considered at page 216. The shrubs are called Crepe Myrtles. They are tall, deciduous, shrubs, 6–10 feet high, with small leaves. They are easily raised from cuttings or by division of the suckers and are very easily grown in any garden soil without care. They are very pretty in bloom with their, soft, fringed, showy flowers arranged in long erect sprays, from May to August. The colours of the several varieties are pink, rose, mauve, or pure white. The shrub is very valuable in the shrubbery or for screen planting or even for a hedge. As blooms
are produced on shoots of the current year's growth the shrubs should be pruned when they are resting, have shed their leaves in January-February. *L. indica purpurea* bears deep purple flowers. *L. indica alba* bears white flowers. *L. indica* bears pink flowers. *L. flos regina* (rose coloured variety) is a small tree which can be trained as a large shrub.

**Lantana.** (N. O. Verbenaceae). A group of common but beautiful large bushes with spiny stem, rapid and vigorous in growth, and requiring to be cut down or trimmed to keep them within limits. They are well adapted for hedging or fencing. Tall standards with large trimmed globular heads are attractive, planted in rows alongside paths or roads at 10 to 12 feet apart. The garden varieties are less vigorous in growth than the kinds growing wild and they are suitable for planting on lawns as single specimens or in groups in large beds. Easily raised from seeds or by cuttings.

The best kinds for cultivation are:—

*L. nivea* bears pure white flowers and it is strikingly attractive. *L. crocea,* with golden yellow flowers is also very handsome. *L. camara* is orange-red in colour. *L. Sellowiaina* is pink-mauve in colour, low growing, trailing in habit, and best suited for hanging baskets.

**Lawsonia alba.** (N. O. Lythraceae). (Canarese, “Goranti”; Tamil, “Maruthani”; Hindi, “Menthi”.) Popularly known as Henna or the Tree Mignonette. It is a large shrub easily becoming unattractive if not pruned back every year. It grows about 9 feet high, has small myrtle-like leaves and sticky branches. The flowers are creamy white in colour, very highly and sweetly scented, and borne profusely in large panicles. The shrub is largely used for hedging in several places, as it thrives with little care and as it is much branched. It is the favourite of Hindu gardens; its leaves are crushed and applied to the nails on the fingers and toes and for colouring them deep red. The flowers are used for puja. At least for the perfume of the flowers, no garden should be without this shrub. Propagated by seeds (the flowers are followed by bunches of berries), or by cuttings.

*L. rubra* bears panicles of pink-rose flowers.
**Ligustrum.** (N. O. Oleaceae). Ligustrums are the Privets. *L. japonicum* is the best species. It is a large, evergreen, robust growing shrub, about 8 feet high, with large coriaceous leaves and gracefully-drooping branches. Bears abundantly, terminal, loose panicles of slightly scented, yellowish white flowers. Easily raised by cuttings. Suited best for medium elevations. *L. ovalifolium* is also a popular plant useful for hedging, as it can be clipped close to any height and shape. *L. robustum* is still another handsome species.

**Magnolia.** (N. O. Magnoliaceae). Magnolias are a group of small trees and shrubs, which are very popular on account of the fragrance of their flowers. They are suited for medium to high elevations. At low elevations, they remain shrubs only and do not grow up into trees.

* *M. grandiflora* is the best species. (See page 216).

* *M. pumila* is an attractive species not growing more than 4 feet high and bearing fragrant white flowers. *M. stellata, M. fuscata* and *M. mutabilis* are other handsome species. All are propagated by seeds or by gootee-layering.

**Malpighia.** (N. O. Malpighiaceae). *M. coccifera* is a small shrub, 2—3 feet high, thickly beset with small, spiny, shining, holly-like leaves and bearing in profusion, small pinkish flowers from August to November or at other times. The flowers are followed by cherry-like berries of the size of peas. The shrub is very hardy, highly ornamental, of slow growth, and thrives in any garden soil, with occasional watering in summer. It is useful as an hedging plant for paths and borders or as specimen plant on a lawn. Propagated by cuttings or seeds.

* *M. glauca* is a shrub, 3—4 feet high, with upright habit of growth and opposite, entire, elliptical, small leaves, bearing in great profusion terminal racemes of bright yellow, slightly scented flowers. Has a very long blooming period from July to October. It flowers at other times too, by timing its pruning. The shrub is very valuable in the shrubbery, for planting in groups in large beds and is suitable for making an ornamental hedge, on account of its tidy habit. Propagated by seeds or cuttings. Also known as *Galphimia nitens*.

* *M. glabra* is the Barbados Cherry, a slow growing small
tree from the West Indies, bearing rose or purple flowers which are followed by beautiful deep red fruits resembling cherries. The fruits are used for jams and preserves and possess a fine flavour. The tree is cultivated for its fruits on a large scale at Gwalior.

*M. panicifolia* is another handsome species.

*Meyenia erecta.* (N. O. Acanthaceae). Also called *Thunbergia erecta.* It is an erect bushy shrub, 3–4 feet high, with deciduous pretty small dark green leaves, bearing large, Gloxinia-like, funnel-shaped, open-mouthed, purple-blue flowers with yellow throat and tube. It is very handsome when in full bloom in February, with its flowers peeping out through the foliage. It is a very hardy shrub, very desirable for a mixed border. It is suited for ornamental hedging, as it stands trimming well. Easily propagated by cuttings. A native of West Africa. *M. erecta variety alba* is a dwarf shrub, about 2 feet high, with pretty white tubular flowers.

*Montanoa bipinnatifida.* (N. O. Compositae). *The Tree Daisy or Christmas Daisy.* A tall large deciduous shrub, 8–10 feet high, with large broad leaves. It bears white, daisy-like flowers in large bunches, in very great profusion in the cold season, from December to February. The shrub is very handsome while in bloom. It should be cut back after flowering. Propagated by cuttings. Thrives at medium elevation. A dry sheltered situation protected from the hot sun is best.

*Murraya exotica.* (N. O. Rutaceae). (Canarese, “Angarakanap gida”;} Bengali, “Kaminia”.)* Known popularly as the China Box, the shrub is an evergreen one, growing up to 10 feet in height. The foliage is very pleasing, being composed of deep glossy green pinnate leaves. The shrub is very handsome when in blossom in the rainy season, bearing large clusters of white flowers, which scent the air with their sweet fragrance. It stands trimming well and can be trained to any shape. Propagated by seeds or cuttings with bottom heat or by layers. No garden should be without this shrub.

*Mussaenda.* (N. O. Rubiaceae). A group of very ornamental shrubs, which are medium sized and grow to about 5 feet. The leaves are evergreen and the beauty of the shrubs is
due to the coloured calyx lobes of the flowers. In each flower or in a few flowers in each corymb, calyx lobe is much enlarged and brightly coloured. Both in the hot and the rainy season, the bracteal leaves make the shrubs objects of beauty. They should be planted in deep soil and watered frequently. Propagated by layering or cuttings.

* *M. erythrophylla* is the most showy species with its large Poinsettia-like crimson bracts. In the plains, it is more difficult to grow than other species. Should be sheltered from western sun and well drained.

*M. lattea* grows 4 feet high, has pretty green leaves and bears small bright yellow flowers in terminal clusters. The bracteal calyx lobe is coloured cream or light yellow.

*M. frondosa* bears terminal bunches of flowers of a bright red colour. The enlarged sepal is large and white and spatula shaped. The latter two species are, both of them, very hardy and thrive without much care.

*M. corymbosa* has like frondosa white sepals.

**Myrtus communis.** (N. O. Myrtaceae). (Hindi, “Belatee mehndee”). Is the famous Myrtle. It is a familiar shrub, 6–8 feet high, with small, polished, green leaves, which are scented and used largely with flowers in garlands and bouquets. It bears pretty, small, scented flowers in the month of March-April, which are followed by blue-black berries. It thrives well at medium elevations. To keep it in good condition, it should be planted in deep soil and watered frequently. Propagated by seeds or layering or by cuttings.

*Nerium.** (N. O. Apocynaceae). (Canarese, “Ganigalu”; Tamil, “Arali”; Hindi, “Kunel or Karubi”). The Oleanders are some of the most delightful of fine flowering shrubs, which no Indian garden is without. They are graceful, large, spreading bushes, 6–9 feet high, with a number of canelike stems starting from the ground, bearing narrow evergreen, lanceolate leaves. The flowers are produced very freely throughout the year in very great profusion in large terminal clusters. There are several varieties, with single and double flowers, of pure white, pink, rose, and crimson colours. The yellow and salmon are recent introductions. They have a delicious fragrance and
are very much valued for puja purposes, and for making garlands. These shrubs grow to perfection in sunny situation, in sandy or stony soils but not in stiff soils. Regular watering keeps them always cheerful and full of flowers. After flowering, say once a year, about April, the shoots if cut back to a third of their length, produce new shoots rapidly, from which more flowers are obtained. By doing so, the plants are maintained bushy and handsome. At the time of pruning, manure should be dug into the soil freely and the shrubs watered satisfactorily to promote fresh growths. Propagated by cuttings or by layers. The juice of the stem and the roots is poisonous. The bark is sometimes used for ring worms in a pasty form.

**Nyctanthes arbor-tristis.** (N. O. Oleaceae). (Canarese and Tamil, "Parijata"). A hardy large shrub or small tree with rough hairy leaves. It is very popular in Hindu gardens where it is grown for the sweet scent of its flowers, which are much valued for puja purposes. Unless the long woody branches are cut back every year after flowering, the shrub easily becomes ugly to look at. The flowers are very pretty having a white corolla and an orange-red tube and centre, are produced in plenty in the months of September, October, and November, spreading their strong scent to a long distance. The flowers open in the night and are cast off in the morning, making a carpet of flowers under the shrub. Easily propagated from seed or by cuttings in the rains. Grows with little care in any garden soil and blooms well in semi-shady situations.

*Ochna squarrosa.** (N. O. Ochnaceae). (Hindi, Ramdhan Champa). A deciduous shrub, five to seven feet high, bearing large, bright, yellow, fragrant flowers early in the hot weather on bare stems. It is very handsome for several weeks being full of flowers. The new leaves are ornamental being tinged with red. Propagated by seeds or cuttings.

**Olea fragrans.** (N. O. Oleaceae). A shrub which delights in semi-shade and blooms several times a year, producing sweet scented small creamy white flowers.

*Pentas.** (N. O. Rubiaceae). *Pentas carnea* is a small herbaceous shrub, about two feet high, bearing very pretty Ixora-like trusses of flowers of pink, mauve, scarlet or white
colours almost throughout the year. The pink coloured variety is the commonest. Thrives with comparatively little care in any garden soil. Is useful as an ornamental hedging plant. Is attractive grown in pots too. Thrives best in semi-shade. Propagated by seeds or cuttings.

_P. lanceolata_ bears pale purple flowers and has larger leaves than the preceding species. There is a variety of this with carmine-rose flowers.

**Philadelphus.** (N. O. Saxifragaceae). (Mock-orange). A family of deciduous flowering shrubs of great beauty while in bloom. Suited for medium to high elevations only. They can be grown in the ground or in pots. As the blooms are produced on old shoots, the shrubs should be pruned soon after flowering. They prefer a semi-shady to a sunny situation.

_P. coronarius_ is a hardy ornamental shrub, about five feet in height, bearing creamy white single or double flowers. Blooms in February-April. Propagated by cuttings or suckers or layers.

_P. Limonei_ and _P. pubescens_ are two other valuable species.

*Plumbago* (N. O. Plumbaginaceae). (Canarese, “Chitramula”; Hindi, “Chitra”). The Plumbagos or the “Leadworts” are useful, flowering, evergreen shrubs of great beauty. The _P. capensis_ is a small bushy shrub, three to four feet high, with small, light green, lanceolate leaves. It bears almost throughout the year a profusion of umbel-like clusters of pale azure-blue, very pleasing flowers. It is a very common ornamental plant in almost all gardens, very serviceable as an edging or an ornamental hedging plant or in the border of the shrubbery along with other undershrubs. It can be trimmed to shape and the edging composed of Plumbago can be kept neat and tidy at a height of even nine inches. Propagated easily by suckers and by cuttings. _P. alba_ is a variety of the above species with prettier, pure white flowers. But it is not as hardy as the blue variety, at low elevations. *P. rosea_. (Hindi, Lal chitra) is a small undershrub, about two feet high, with prostrate stems. It is very pretty in the cold season with rosy-scarlet flowers produced in long terminal spikes. The
leaves of this species are much larger than in *P. capensis.* Propagated by division of offsets or by small cuttings with a heel in the rainy season. *P. rosea coccinea* is more brilliant variety of the above with larger and brighter coloured flowers; but it thrives only 3,800 feet above sea level.

*Poinsettia.* (N. O. Euphorbiaceae). Also styled *Euphorbia pulcherrima.* Large, rapid growing shrubs, 6—8 feet high with large green leaves, and bearing small inconspicuous flowers, which are surrounded by large bunches (whorls) of elliptical, brightly coloured, bracteal leaves, in the cold season. The bracteal leaves constitute the ornamental feature of the shrubs, which are very handsome grown in groups in the shrubbery or in large beds. In pots, Poinsettias make excellent Christmas plants. They can be grown in bush form in large pots or they can be grown in small eight inch pots being prepared fresh from cuttings inserted in sand in the month of August to September. They strike root in five to six weeks and are ready for potting for display during Xmas. The soil used, should be light and porous and the roots should not be disturbed when the cuttings are potted or there will be a set back. The commonest species grown is *P. pulcherrima* with crimson flowers. *P. plenissima* with narrow leaves is the one generally known. There are two other varieties with cream-yellow and rose coloured bracts. After flowering, the shrubs should be cut back severely, six inches to a foot from the surface of the ground, to make compact and large shrubs for the next season. The shrubs do not like water-logging. They require full sunshine.

*Polymnia grandis.* (N. O. Compositae). Very much like Montanoa but with larger leaves and blooms.

*Punica granatum.* (N. O. Myrtaceae). (Canarese, Dalam-bari; Tamil, Madalam; Hindi, Anar). There are two varieties of the flowering Pomegranate, bearing large double balsam-like flowers of white or brilliant scarlet colour. They are hardy bushes, which are easily propagated from cuttings, and grow on any soil without much care. For neat bushy appearance, they require to be cut down once in two years. Useful for hedging. Do not flower so freely in the plains as in the hill stations.
*Quassia amara. (N. O. Simarubiaceae). The name is derived from the fact that it has bitter bark, which is used in medicine. It is a large pretty shrub, worthy of a place in the garden, with its handsome, alternate, unequally pinnate leaves, having seven narrow leaflets and crimson-tinged wings on the leaf-stalks. It bears bright scarlet, tubular flowers, which are an inch and a half in length, in terminal clusters similar to Salvia splendens. Propagated by seeds, cuttings, or layers. The blooming period is usually from July to September.

Ravenia spectabilis. (N. O. Rutaceae). A shrub, three to four feet high, with dark evergreen tri-foliate leaves; very showy when in bloom, from July to November, with bright rosy five-lobed flowers of the size of a four-anna piece. The shrub thrives in moist districts (or in other places with regular supplies of water to keep its foliage rich verdant green) in semi-shady situations. Propagated by seeds, which should be sown fresh, or by cuttings, or by layers.

Rivinia humilis. (N. O. Phytolaccaceae). A herbaceous perennial, weedy shrub, two to three feet high, with small leaves and bearing racemes of inconspicuous white flowers, which are succeeded by clusters of bright red small berries adorning the plant. The plant is well suited for rockeries and grows wild with little care and self-sews itself. Propagated by seeds or cuttings.

*Rondeletia speciosa. (N. O. Rubiaceae). A pretty shrub, bearing orange-red Ixora-like flowers almost throughout the year, but particularly during the hot weather and rains.

Ruellia. (N. O. Acanthaceae). Called "Christmas Pride". A genus of herbs and small herbaceous shrubs. The flowers are showy. Propagated by cuttings. *R. Baikiei* is an under-shrub producing crimson-red flowers which are trumpet-shaped and gathered in racemes, from September to April. *R. tuberosa* bears handsome purplish blue flowers. *R. macracantha* is a very attractive species from Brazil. It is very floriferous, the plant being laden with blossoms for many months. The flowers are rosy purple in colour, about an inch in length, and tubular. It is a good conservatory plant thriving well in semi-shade; it is suited for culture in hanging baskets. To have specimens,
full of branches and leaves, the plants should be pinched back every now and then for nearly four months. The leaves are very handsome, the upper side being purplish green with silvery veins and the under side purple. The plants should be well fed with liquid manure once a week and after flowering, they may be cut back and potted into larger pots. Propagated by cuttings. A really handsome species, very useful for culture in conservatories and hanging baskets. *Russelia equisetiformis, R. amatana, R. rosea* are some other attractive species.

*Russelia juncea.* (N. O. Scrophulariaceae). Weeping Mary. Also called the Coral Plant on account of the bright, coral-red flowers, which are tubular, about 1½ inches long, and borne in plenty along the greater length of the pendulous branches, which are grass-like. The plant is bushy with its green grass-like branches and pseudo leaves. Propagated by cuttings or by division.

*R. floribunda* is very pretty while in bloom during the early hot season. It has a stiff habit unlike the preceding species.

*Scutellaria.* (N. O. Labiatae). Called the Helmet Flower or Skull Cap. Dwarf herbaceous perennial shrubs, about 1½ feet high, bearing terminal racemes of spikes of scarlet, blue or violet flowers in the cold season. *S. mexicana* is a native of Mexico, growing two feet high, and bearing bright scarlet flowers. It is suited for medium elevations and it is a truly showy species. Propagated by seed or cuttings.

*Sophora.* (N. O. Leguminosae). Ornamental shrubs of medium height, which are suitable for planting in the border. At medium elevations, *S. violacea* thrives well, growing to about two feet and a half and bearing large racemes of pretty violet coloured flowers. *S. tomentosa* bears large clusters of yellow or orange, bright flowers of great beauty.

*Stachytarpheta.* (N. O. Verbenaceae). (Canarese, "Uttirani"). Hardy flowering shrubs, which are drought resisting, and bear throughout the year verbena-like, rose, red, or purple flowers on tall spikes. The shrubs are useful in the border and they are easily raised by seeds or by cuttings. *S. rosea* grows about five feet high, with spikes about 16 inches long,
composed of rose-red flowers, which have a pink eye. Nearly always in bloom. *S. mutabilis* bears spikes of pink flowers. *
*S. indica* bears deep blue flowers.

**Streptosolen.** (N. O. Solanaceae). *Streptosolen Jamesoni* is an evergreen choice shrub, which thrives well at medium elevations. In the plains, the plant grows but does not flower freely. The leaves resemble those of *Browallia speciosa major*, from which fact it derives the synonymous name, *Browallia Jamesoni*. It attains a height of about five feet and bears abundant large terminal clusters of bright orange flowers of great beauty, bending the slender pendulous branches with the weight of the blooms. It can be trained as a standard, the central stem being supported by a stake. It makes a bold display in the mixed border and it can be grown in large pots too. Propagated by cuttings or by seed.

**Strobilanthes.** (N. O. Acanthaceae). Evergreen dwarf shrubs with herbaceous stem. They grow with little care, some being cultivated for their flowers and some for their handsome foliage with metallic lustre. They are all effective grown in clumps. The flowers are capitate or in spikes. Propagated by seeds or cuttings.

*Strobilanthes dichotoma* is about 2½ feet high, bears rose-violet tubular flowers. Can be grown either in pots, or in shade gardens in large beds, or in herbaceous borders.

*S. pulcherrimus* is a beautiful plant with bright pink or violet flowers.

*Strobilanthes Dyerianus* has handsome glistening foliage, which is reddish purple in colour and bears pale inconspicuous flowers. It is used for bedding in shade gardens.

**Tabernaemontana coronaria.** (N. O. Apocynaceae). (Canarese, "Nandi batalu"; Tamil, "Nandiya vattai"; Hindi, "Chandni"). A small evergreen shrub, 5–6 feet high, with handsome foliage of glossy bright green leaves. The flowers are single or double and very attractive and are freely produced; they are snow-white in colour and sweetly fragrant. The plant blooms throughout the year. By regular watering, the shrub keeps neat and tidy. It is hardy and thrives in rich soil in sunny situations, and is a great favourite in Indian
SHRUBS

T. coronaria variety flora-pleno (the double flowered kind) is a very attractive shrub for planting in the lawn or for placing in the border. There is a species with leaves, variegated creamy yellow and light green. T. Wallichii is the single white variety.

*Tamarix articulata. (N. O. Tamaricaceae). (Hindi, Pharak or Jhao). Grows into a large shrub and then into a small tree. The foliage is Casuarina-like and distinctive. Flowers are pendulous, pale-mauve and very attractive. Requires plenty of water.

Tecoma. (N. O. Bignoniaceae). Tecomas are a genus of showy, evergreen shrubs, with herbaceous shoots, bearing terminal clusters of brightly coloured, tubular (campanulate), large, pretty flowers. They are very hardy shrubs thriving in the plains and at medium to high elevations as well, and they are very useful for planting in the confines of the garden along with other large shrubs. The climbers, T. jasminoides and T. grandiflora are considered in chapter XXI. The following are the noteworthy species:

T. stans is a large shrub, very commonly planted in all gardens for screening high compound walls or in the shrubbery in front of large trees or for hedging. The foliage is handsome consisting of graceful pinnate leaves. The shrub should be maintained bushy by cutting back the branches every year. The shrub is a very hardy quick grower attaining a height of about ten feet. The flowers are golden yellow in colour, large, funnel-shaped and wide expanded, and clustered in terminal bunches. Easily raised from seeds.

T. chrysanth is similar to the above but has prettier foliage and bears larger bunches of flowers.

*T. Smithii is a hybrid introduced from Australia and it is a smaller shrub than the preceding two species. Large panicles of orange-yellow flowers are freely produced. It is easily raised from seed, from which it comes out true.

*T. capensis is called the Cape Honeysuckle. It is a half climbing shrub with scendent branches and pinnate leaves bearing terminal racemes of tubular, honeysuckle-like flowers.
of a bright orange-red colour. It can be grown easily and it blooms throughout the year.

*T. radicans* is a small sprawling shrub, three to four feet high, with graceful, bright green foliage of pinnate leaves. The shrub is perpetually in bloom with corymbs of large scarlet flowers, which are trumpet-shaped, an inch and a half long, and are abundantly produced. The shrub is excellently suited for planting in the border or in large beds in groups or to be grown as standards about three feet high. A charming shrub, very pretty in bloom. Propagated by layers or by cuttings.

**Tephrosia.** (N. O. Leguminosae). *T. macrantha* is a small sprawling shrub, three to four feet high, with graceful, bright green foliage of pinnate leaves. The shrub is perpetually in bloom with corymbs of large scarlet flowers, which are trumpet-shaped, an inch and a half long, and are abundantly produced. The shrub is excellently suited for planting in the border or in large beds in groups or to be grown as standards about three feet high. A charming shrub, very pretty in bloom. Propagated by layers or by cuttings.

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**Tephrosia.** (N. O. Leguminosae). *T. macrantha* is a tall shrub, eight to ten feet high, with pinnate leaves, having 10 to 12 pairs of leaflets. The flowers are purplish white in colour, and resemble those of Sweet Peas and are borne in large terminal panicles which are often a foot long. A truly showy plant.

*T. grandiflora = T. purpurea* is a much smaller shrub, about two feet high, with purplish red flowers. *T. candida* is known in Tea gardens as Boga Medeloa bearing white pea shaped flowers. It is grown for green manuring.

**Thespesia macrophylla.** (N. O. Malvaceae). Also called Thespesia Lampass or Hibiscus Lampass. It is a large shrub, six to eight feet high, flowers are large, bright yellow in colour with crimson spot in the centre resembling the "Bende" or "Okra" flowers. The plant should be cut down to a foot from the ground level for bushy handsome shrub, in February.

**Thevetia.** (N. O. Apocynaceae). Are handsome large shrubs, sometimes growing into small trees if allowed to do so. They attain a height of ten to twelve feet and possess a light, bright, glossy green, handsome foliage consisting of linear leaves, which are three to six inches long resembling those of Oleander to which they are closely allied. The flowers are funnel-shaped, large, and borne in terminal cymes. They are white, yellow, or light orange-red in colour. *Thevetia neriifolia,* the commonest kind grown, is the yellow flowering variety. It is found in every garden in Madras. It forms a pleasing, bushy, large, evergreen shrub, which is suited best for screen planting. Pruned back every second year, it remains
bushy and attractive with its new bright shoots. Propagated by cuttings or by seeds, which are poisonous.

**Tithonia tagetaeflora.** (N. O. Compositae). Also known as Verbesina gigantia. Perennial Sun Flower. A spreading, coarse looking shrub which is covered with large yellow flowers like single sun-flowers, from November to January. Thrives best in sunny situations.

**Trevesia palmata.** (N. O. Araliaceae). Is a large shrub or a small tree growing up to twenty feet, a native of the Himalayas. The large palmate leaves are crowded at the ends of the branches and the leaves are nearly a foot and a half across, and have long petioles (leaf-stalks) which are nearly 18 inches long. The flowers are produced in long peduncled paniced umbels, are showy, an inch across and yellowish white in colour. The shrub does well in shade gardens at medium elevations, in moist situations. Propagated from seed.

**Turnera.** (N. O. Turneraceae). T. ulmifolia is a pretty flowering shrub about three feet in height, with large yellow flowers, which are almost sessile. Native of Mexico, West Indies, and South America. T. ulmifolia variety elegans grows about two feet and bears almost sessile flowers, which are pale yellow, with maroon eye. Native of Brazil. Propagated by seeds or cuttings.

**Veronica.** (N. O. Scrophulariaceae). Veronicas are showy herbs, shrubs and rare trees, which are easily propagated by seed or cuttings or by division and thrive well in any good garden soil with ordinary care. Some species are suited for herbaceous borders, while larger growing species are fitted for cultivating in mixed borders. Several of them make good pot plants. The flowers are usually produced in terminal or axillary bracteate erect racemes. V. speciosa imperialis is a handsome and free flowering shrub, 1½ to 2 feet high, with purple flowers which are produced in large dense spikes, between July and September. Veronicas do not thrive in hot places.

**Wigandia.** (N. O. Hydrophyllaceae). A large shrub or a small tree. See page 231.
(B) SELECT ORNAMENTAL FOLIAGED SHRUBS

Acalypha. (N. O. Euphorbeaceae). A genus of brilliant tender foliage shrubs of great beauty with very attractive leaves, variously coloured. They are all easily propagated from cuttings, are very hardy and grown easily. Regular watering maintains them in good condition throughout the year, with their bright coloured foliage. Every summer, if they are pruned back in the month of March or so, they shoot up again into more desirable and compact bushes in the rainy season from July onwards, when they are at their best. Acalyphas are excellently suited for screen planting, for the border, and for pot culture. Some species, as A. Godseffiana and A. Hamiltoniana, make good ornamental internal hedges or edgings in the garden. At times, Acalyphas are subject to attacks of mealy bugs and thrips and red spider. The following species are recommended:

A. Godseffiana is low growing with a dense bushy habit and is eminently fitted for making ornamental hedges, one to three feet high. The leaves are pretty with prominent yellowish white margins.

* A. Hamiltoniana, grows three to four feet high; bears small filiform drooping white-and-green leaves; is suitable for hedges and edging. Stands clipping well.

* A. Illustrata grows about seven feet high, is a handsome species with very large leaves which are light green blotched with creamy white.

* A. Macfieana is another notable species with red leaves, blotched with bronze and crimson.

* A. Macrophylla, height, eight to ten feet; leaves, large, cordate-ovate, russet-brown, blotched with paler spots. A truly grand species.

* A. Macrostackiya, also a very handsome species, the leaves are dark brown, splashed with rosy crimson.

A. Marginata, five to six feet high; leaves, large, ovate-acuminate; the centre of the leaf is brown and the margin is coloured rosy crimson.

A. Obovata is similar in colour to A. Marginata and has its leaves inverted and oval shaped.
A. tricolor is a very showy species growing five to eight feet high, having ovate-acuminate very bright looking leaves. The ground colour of the leaf is copper green, which is curiously blotched, mottled, and splashed with red and crimson.

A. Wilkesiana grows four to six feet high; the leaves are twisted and copper coloured.

Acanthus montanus. (N. O. Acanthaceae). A pretty shrub, 3-4 feet high, with handsome, large, oval, pinnatifid, hollylike leaves which are a foot or more in length, with the lobes spine-pointed. Flowers are rosy-white in colour and are produced in long spikes. Propagated by seeds or cuttings.

Aloysia (Lippia) citriodora. (N. O. Verbenaceae). Popularly called the Lemon Scented Verbena. A slender stemmed shrub, 2-3 feet high, noted for the fragrance of its leaves. Bears pretty long spikes of small white fragrant flowers at the beginning of the cold season. As the old plants are ugly looking, fresh ones should be made by layering every year. A loamy soil mixed with leaf mould and regular watering are necessary for satisfactory growth. In the plains, it can be grown as a pot plant but at medium elevations, it does well in the ground.

Aralia. (N. O. Araliaceae). Genus of ornamental foliage plants, shrubs, evergreen and deciduous. Great majority of the species are objects of beauty in the conservatory and in the shade garden. Some are very hardy and they can even be planted in open borders with safety. They thrive in sandy loam; a little addition of leaf-mould and peat to the soil gives better results. Propagated by cuttings, by layering, and occasionally by seed. A large number of species are suited only for medium to high elevations and do not thrive in the plains. In nomenclature, Aralias, Panaxes and Polyscias are confused with each other. They are very much allied to each other, requiring almost the same kind of treatment. They all prefer to be in small pots and should be shaded from strong sunshine.

The following are a few noteworthy Aralias:—

A. papyrifera (Rice Paper Plant); five to seven feet high; an ornamental plant with the stem branching some feet above the ground. Bears a resemblance to the Castor oil plant. The
leaves are smooth, eight to twelve inches long, and five or seven lobed. Though the individual flowers are inconspicuous, the plant is handsome when in bloom with the drooping panicles which are two to three feet long. From the white pith of the plant, the rice paper of China is made. The plant throws out suckers for some distance around, and it can be raised by division of the suckers.

*A. Sieboldii* has fine ornamental foliage rising upon a straight stem, forming an umbrella-like head. The leaves are large, digitate and shining green. This species is suited for the shade garden and for the conservatory.

* A. Veitchii (Most graceful) is a very elegant species, with slender erect stem with handsome, digitate, long-stalked leaves. The leaflets are about eleven in number, filiform, undulated and glossy green above and dark red beneath. Requires a cool climate. Propagated from seed.

*A. Veitchii gracilima* (Syn. A. gracilima) is similar to the preceding species, but the leaves have prominent ivory-white mid-rib. With its erect growing, graceful habit, it is excellently suited for table decoration in the young state.

*A. filicifolia variety variegated* (Syn. Panax filicifolia variety variegated) grows five to seven feet, has very showy leaves which are yellow when young. The leaves and leaflets are variable.

*A. Balfourii* (Syn. Panax Balfourii) is a compact, bushy, handsome species growing four to six feet high, well furnished from base to top with variegated pinnatifid leaves. Leaflets are oval or rotund and blotched with grey and creamy white.

*A. Guilfoylei* (Syn. Nothopanax Guilfoylei) and its forms are similar to the above species but with smaller leaflets and less of variegation. Also a handsome species, being an erect shrub six to ten feet high.

*A. elegantissima* grows five to eight feet high; is a very ornamental species with straight erect stem, clad at short intervals with digitate leaves on long stalks. The leaflets are 7 to 10 in number, filiform, deep green shaded with brown, with a mid-rib of greenish white. A very good species for table decoration. Requires a cool climate.
A. Bonnerpi; A. Messengiana; A. cordata; and A. maculate are some other attractive species.

*Coccoloba platiclada. (N. O. Polygonaceae). Also known as Muchlichenbeckia platiclada. A very curious plant with flattened stems and branches for leaves, growing 4 to 6 feet high.

*Croton. (N. O. Euphorbiaceae). The garden Crotons are variegated Codiaeums. The real Crotons are unattractive. The garden Crotons are evergreen very ornamental shrubs with gorgeously coloured foliage, differing in habit of growth and colour and shape of leaves in the several varieties. They enjoy a great popularity on account of their perennial beauty and ease of cultivation. They are invaluable for screening compound walls, in the shrubbery, on the lawn as specimen plants and as pot or tub plants. There are a number of named varieties of merit, and many more handsome varieties, unnamed yet, which are derived from seedlings and sports. Several of the unnamed kinds are more charming and brighter coloured than the standard kinds and it is the former that figure prominently in horticultural shows. The author has raised several seedlings of exceptional merit, of which he has picked out twenty-five as being worthy of popularisation. They are very bright, of distinct colours and habits of growth and have won him numerous cups and medals in several shows against standard kinds. Latterly some of these have been named by him in consultation with the Mysore Horticultural Society. The following are particularly striking:—M.H.S. Prize Winner; Gopal; Excelsa; Crimson King; Robusta grandifolius; Pretty Darling; Nobilis; Yellow Giant; Yellow Queen; Charm; Splendens; Speciosa; Comet; Gem; Meteor; Surprise; Brilliant and Bangalore Beauty.

The following are a few select standard old varieties:—Acubifolium giganteum and its orange species; Alexandra; Baronne de Rothschild; Beauty; Bergmanii; Black Prince; Challenger; Cupidum; Czar; Day Spring; Euterpe; Golden Kingianus; Gladstonii; Her Majesty; Illustris; Imperator; Imperialis; Indian Prince; Lowii; Maharajah of Durbanga; Maharajah of Mysore; Maharani Regent; Mutabilis; Prince Albert Victor; Prince of Wales; Princess of Wales; Recurvi-
folius; Reidii; Schomburgkiana, three kinds, the ordinary, orange, and golden species; Sir Ashy Eden; Sunrise; Sunset; Triumphans; Trilobus, orange and yellow species; Warenhii, the ordinary kind and the white one; Williamshii; Victoria; Versicolor; Variabilis, etc.

For making new varieties, Crotons are raised from seeds. It takes about two years and a half to make a bushy plant from seed. Female and male flowers are borne in different clusters, which are easily distinguishable. Fertilise female flowers with pollen collected from favoured varieties. Seeds which are the result of indiscriminate natural fertilization yield a very large percentage of very inferior almost green leaved plants. Bag the seed clusters when they are ripe or the capsules burst scattering the seeds. Sow the seeds after drying them for a day or two in the sun. Germination is slow and irregular. When they are six inches high, pot them separately in six-inch pots or plant them out a foot apart in nursery beds or small trenches. Pinch the tops of shoots to bush out the plants. As soon as the plants can be layered or cuttings be taken out of them, make new plants as they grow more rapidly with their fibrous roots than the parent seedlings, which have very few roots. Keep only seedlings which show promise of colour, rejecting the others. New varieties are also derived from sports. (See page 91).

Crotons are ordinarily increased from cuttings or by layering or gootying. Terminal cuttings, 6 to 8 inches long, with the bud not opened out are put each into a 4-inch pot in a mixture of equal parts of sand and leaf mould and the pots removed to a frame over a hot bed. In about three months, they emit roots and could be shifted to 6-inch pots using richer soil containing red earth and horse manure in addition. Cuttings of old wood, cut up into bits of about 6 inches also strike roots but not so quickly as terminal cuttings. The best time for propagation from cuttings is August to September, when one can expect 90 per cent success. Crotons are layered ordinarily like other shrubs as shown in figure 38. Small or large healthy plants are straightway obtained by gootying at the firm portion towards the end of the shoots. For this purpose,
a bamboo receptacle can be used as shown in figure 42. The best method to gootty is to wrap a bit of gunny bag round the portion ring-barked and to put in it a mixture of three parts of red earth and one part of well decomposed cattle manure and tie up firmly. See figure 41.

Crotons thrive best in a warm moist climate, as the one which prevails in Madras and Malabar. They do not thrive on hill stations, where they can only be grown in pots inside conservatories or glass houses. They enjoy full morning sun and develop rich colours only where they get plenty of morning sun and partial shade during the rest of the day. Some varieties, especially the small leaved kinds can stand sun throughout the day. But generally, all kinds can be put into the open sun where they adjust themselves in course of time though their foliage may be scalded to start with. Too much shade results in comparatively large colourless leaves. The soil should be well drained. The compost recommended in page 112 is used for pot plants. Potting should be firm and planting not too deep. Addition of lime to the soil helps to keep it sweet and improve the colours. Bone meal or honge-oil cake mixed along with the compost helps to maintain the plants for a long time. Repotting is best done once a year. Topdressing with a mixture of red earth and horse manure every three months keeps the plants healthy and in vigorous growth. Syringing the plants every other day during the cool hours helps not only to keep the foliage fresh but also to keep in check thrips and red spiders, which defoliate the plants, should they get the upper hand. The only serious pests are these insects and the mealy bugs. Rub off the bugs from the affected parts and sponge them with a solution of fish oil soap to kill young ones. Spraying the plant with fish oil or honge soap solution is a safe remedy against the abovementioned insects.

**Duranta Plumieri variegata.** See page 247.

**Eranthemum.** (N. O. Acanthaceae). Small shrubs, two to four feet high, with attractive foliage, consisting of coloured leaves, thriving in semi-shady situation. Some of the species bear very attractive flowers. For bushy and handsome plants,
the shoots should be frequently pinched back. Propagated easily by cuttings. Do well as pot plants too.

*E. cinnabarinum*, two feet high, leaves deep green, round with yellowish veins. A handsome species.

*E. eldorado*, two feet high, leaves, yellow mottled and veined with green.

*E. goldeana* is very useful for edging.

*E. nobilis* has leaves green, with yellow veins. Useful for ornamental hedging.

*E. tricolor* has olive green leaves, blotched irregularly with greyish purple and salmon-pink tints, more or less varied.

*E. versicolor* is very pretty, the leaves, being variegated white and green.

*E. atropurpureum* has leaves with deep bronze or purplish variegation.

*E. albonarginatum, Moorei, and discolor* are some others.

**Erythrina.** (N. O. Leguminosae). Of its species, which are grown for their handsome foliage, are the following two:—

*E. Parcelli* is a small tree or large, soft, quick growing shrub about ten feet high, with very ornamental, variegated foliage, consisting of trifoliate leaves marked by cream-yellow bands running along the main and central veins. Propagated by cuttings. For shrubby appearance, the plant should be cut back every year.

*E. Vestpertilo* grows three to six feet high, with graceful appearance. Foliage consists of dark green handsome trifoliate leaves. The leaflets are sharply acuminate and small.

**Evodia elegans.** (N. O. Rutaceae). Small ornamental evergreen shrub, three to four feet high, with dark green graceful foliage of large pinnate (three foliate) feathery leaves, which leave an aromatic odour, when bruised. Small whitish flowers are produced in terminal panicles, which are followed by capsules with glossy black seeds inside, from which the plants are propagated. The shrub is a native of New Guinea and it resembles Aralia elegantissima. It is useful for planting in shade gardens or in pots for adornment of the conservatory.

**Exacacaria bicolor.** (N. O. Euphorbiaceae). A moderate
green variegations in broad blotches. Leaves are almost round.

*P. flicifolium; P. Massangiana; P. rotundus; *P. Veitchii; P. elegans and P. crispum are other attractive species.

*Phyllanthus rosea picta. (N. O. Euphorbiaceae). A very ornamental shrub, about 3 feet high, with very attractive foliage consisting of pinnate leaves, which are nine to twelve inches long. The leaflets are small and variegated with green and blotches of white, pink and rosy purple colours. The tender shoots and branches are rosy-purple in colour. The shrub is very attractive grown in semi-shade and it is at its best in August. Makes a very handsome pot plant. Propagated by cuttings and by separation of suckers from the base. Sometimes subjected to attacks of mildew.

P. nivosus has snowy white marbling on new foliage.

Podocarpus. (N. O. Coniferae). A family of evergreen dwarf trees or shrubs, with stiff linear leaves. They are of very slow growth and are useful for planting on lawns as single specimens. Propagated by cuttings or by layering in the rainy season. P. latifolia; P. chinensis; P. neglectus; and *P. taxifolia are some of the attractive species.

Ricinus communis. (N. O. Euphorbiaceae). Castor oil Plant. It grows about 8 feet high. Though it is a common economic shrub, it is ornamental with its large, dark green, palmate leaves. There is a variety with purple-bronze leaves, which is more handsome than the common kind. Grows like a weed in any soil and is easily raised from seed.

*Sanchezia nobilis variegata. (N. O. Acanthaceae). An evergreen, very handsome, spreading shrub, 4–5 feet high, with long lanceolate leaves which are brightly banded or veined with creamy white or yellow and tinged with red occasionally. The flowers are yellow with red bracts and they are produced in dense terminal racemes. The shrubs do well in semi-shady and shady situations, being useful for planting in shade gardens and in the shrubbery under the partial shade of large trees. A native of Ecuador. Easily raised from cuttings.

*Strobilanthes. (N. O. Acanthaceae). Strobilanthes are
dwarf shrubs of easy culture. Some species are grown for their ornamental foliage and some for their attractive flowers.

*S. dyerianus* is a very pretty, herbaceous foliage plant of trailing habit, 2—2½ feet high, with leaves which are reddish purple, shaded with bronze and green and silvery white. The flowers are pale purple and are not much. The plant is useful for filling up beds in shade gardens or for growing in pots for the decoration of conservatories. Propagated by cuttings.

*S. anisophyllus*, called the Gold Fujiia is a native of India; it is a small herbaceous shrub, 2—3 feet high, with unequal, lanceolate, shining, dark green leaves. The flowers are lavender coloured and they are borne in cymose heads. Thrives in semi-shade only. *S. gossypinus* and *S. isophyllus* are other flowering species, which are suited for medium elevations.
CHAPTER XIX

ROSES

Rose, the Queen of Flowers, is a hardy shrub, suitable varieties of which can be grown with varying degrees of success in almost all places in India, from the low country to the hill stations, where they thrive best. Roses vary much in their habit of growth and it is easy to select kinds for several purposes in the garden, as for instance for covering walls and trellises, arbours, pergolas and arches, for massing in beds, for edging, and for pot culture.

Choice of types to grow, Roses are divided into several groups or types according to their origin, habit of growth, scent, form and shape of flowers and flower buds, the season when they bloom and other considerations. Catalogues of Roses usually give the classes to which the varieties belong. One usually comes across only the following types of Roses in India, at low and medium elevations:—(1) Tea Roses, (2) Noisette Roses, (3) Bourbon Roses, (4) China or Monthly Roses, (5) Hybrid Tea Roses, and (6) Hybrid Perpetual Roses.

Of these, the first four types and the hardy varieties of the fifth type can be grown at low elevations. Roses do not dislike a high temperature but they cannot thrive in places where there is both high temperature and excessive atmospheric humidity. It may be mentioned, as a rule, however, that Roses thrive best at places where there is a distinct season of rest in winter and where the minimum temperature does not exceed about 50 degrees. Hybrid Perpetuals, as a class, are unsuited to elevations below 2,500 feet. The Wichurianas, the Polyanthas and the Moss Roses, which do well in temperate climates and on the hill stations cannot be grown successfully even at medium elevations.

Hybrid Perpetuals—Hybrid Perpetuals are, as a class, vigorous growing, producing strong erect canelike shoots from the base and large mostly self-coloured flowers of dark red, deep
rose, crimson, and rarely pink and white. The scent of the flowers is that of rose-water and the shape usually cup-formed or cabbage-like. Hybrid Perpetuals are wrongly termed perpetuals; they are comparatively shy bloomers, bearing generally a single crop of flowers in winter. They thrive in loamy soil, inclined to be heavy, should be heavily manured and pruned severely to induce them to bloom at other periods of the year. On account of their large sweet scented well formed flowers, the best kinds of H.Ps. are still grown in gardens, though the Hybrid Teas are gradually superseding them. The following are 16 best varieties of H.Ps.:

Alfred Colomb.—A famous rose, light red, very fragrant, of faultless form.

Beauty of Waltham.—A large flower, cherry to bright rose-crimson.

Black Prince.—Dark crimson, cup-shaped flowers.

Captain Hayward.—Bright showy scarlet-red.

Duke of Wellington.—Very fine, red shaded with crimson.

General Jacqueminot.—Rich crimson, sweet scented, full, an old favourite.

Grand Moghul.—Deep brilliant crimson, shaded with scarlet and black, massive foliage.

Duke of Edinburgh.—Very large bright scarlet-crimson flowers.

George Dickson.—Very fragrant, immense, dark-red, perfectly shaped flower.

Frau Karl Druschki.—Very large snowy white flowers. Hence called the Snow Queen. A lovable Rose.

Hugh Dickson.—Deep red large flower. Vigorous habit.

Madame Masson.—A fine flower, rich-shaded carmine.

Madame Victor Verdier.—A grand Rose, rich crimson.

Mrs. John Laing.—Large, sweet scented, cup-shaped, soft pink flowers.

Paule Neron.—Deep rose coloured, very large flower of good form, often 9 inches in diameter.

Pierre Seletzky.—Deep purplish red, shaded with violet, large showy flowers.

The Edward Rose.—The Edward, the Pink Rose ("Gulab",...
"Tanjore Rose"). It is a great favourite in Indian gardens, as it bears real rose coloured sweet scented blooms very freely. It is very hardy and serves as the best stock for budding in India. Though for ground culture, some may prefer the Briar or the Rose Multiflora as a stock plant, the Edward is undoubtedly the best stock for pot culture.

**Tea Roses.**—Tea Roses are, as a class, tender bushes with branching and spreading habit, producing the best flowers on lateral shoots arising from rods from the base. Flowers are characterised by delicate shades of colour, neat and attractive elongated form while in bud, and by sweet smell akin to that emanating from a freshly opened tea-chest. Though not continuous bloomers, they are very free flowering. They thrive in loamy soil. The following are 20 best Tea Roses:

- **Alexander Hill Gray.**—Clear yellow, large flowers of fine form and substance.
- **Alexandra.**—A vigorous climber. Flowers, medium sized, pale buff with orange-yellow centre, shaded with apricot and bronze. Attractive form and colour of bloom.
- **Devoniensis No. 1.**—Creamy white, the centre being slightly yellowish or light buff sometimes. Dwarf growing profuse flowering plant unlike the Devoniensis No. 2 which is a good climber.
- **Gloire de Dijon.**—A climber. Flowers, large and full, yellow shaded with salmon.
- **Lady Roberts.**—Rich apricot, fine long bud.
- **Lady Hillingdon.**—Saffron yellow slender pointed buds. Flowers, large and cup-shaped. The creeping sport is good for arches.
- **Maman Cochet.**—Both the white and salmon coloured kinds are good exhibition varieties.
- **Marie Van Houtte.**—An old favourite bearing semi-double flowers, white, tinted with yellow and often edged with rose.
- **Meta.**—With strawberry and bronze shades combined, bearing flowers of apparently different colours on the same plant.
- **Mrs. B. R. Cant.**—One of the best utility roses, bearing almost always large flowers which are deep rose on inner petals and soft silvery rose suffused with buff at the base.
Mrs. Herbert Stevens.—Paper white with distinct fawn shading towards the centre. Very floriferous. Long, distinct, pointed blooms of fine form.

Niphetos.—Pale lemon and often pure white, large, full, globular flowers. Slender branches requiring very little pruning.

Mrs. Edward Mawly.—Large pink flowers. A fine Rose with slender twiggy branches.


Safrano.—Saffron yellow charming buds.

Souvenir de Catherine Guillot.—Copper coloured single flowers produced in great profusion. Large bush clothed with handsome foliage and flowers.

Souvenir de un Ami.—Medium sized, well formed, rose-pink flowers borne in plenty.

Sunset.—Deep apricot colour. Beautiful in bud.

The Bride.—A fine Rose, white, shaded and edged with light rose.

W. R. Smith.—White shaded with pink and buff. A large flower.

Hybrid Tea Roses.—Hybrid Tea Roses are intermediate in character and habit between the Teas and the Hybrid Perpetuals, being crosses derived from them. Flowers are more brilliantly coloured than in Teas and are available in great diversity of colour. The plants are more vigorous in growth than the Teas. Flowers are produced freely. Considered as a class, Hybrid Teas are the best for amateurs who can make a collection of several colours from them. The soil best suited for them is loam tending to be slightly heavy.

The following are 35 best Hybrid Teas:

Admiration.—Pointed buds of salmon-rose; large and exceedingly full fragrant blooms with high centre.

America.—Wonderfully scented, light pink flowers of exquisite form and heavy substance.

Antonie Revoire.—Flesh to cream colour with deeper coloured centre.

Aspirant Marcel Rouyer.—Large and full flowers, coloured bronzy apricot paling to salmon at edges.
Betty Uprichard.—A striking Rose with pinkish carmine semi-double flowers, freely produced.

Captain F. S. Harvey Cant.—Rich salmon-pink, veined with scarlet and suffused with yellow. Flowers, large, of fine form and sweety perfume.

Chateau Clos Vougeot.—Velvety scarlet to dark velvety crimson. A distinct and beautiful colour.

Colonel Oswald Fitzgerald.—Fine double blooms of dark velvety crimson.

Dean Hole.—A large Rose, silvery carmine, shaded with salmon.

Dorothy Page Roberts.—Glistening coppery-pink, semi-double blooms suffused with apricot.

Edward Mawly.—Velvety crimson medium sized flowers.

Edward VII.—Velvety crimson scarlet scented large flowers of fine form.

Etoile de France.—Vivid crimson, large full deeply scented flowers.

General Macarthur.—Glowing scarlet-red large fragrant flowers.

Grace Darling.—Fine coppery Rose, shaded with yellow in the centre.

Grus an Teplitz.—Bright scarlet crimson, a unique colour. Flowers medium sized and very sweet scented.

Jean Note.—Chromo-yellow, changing to cream-yellow, with deeper coloured centre. A fine colour.

Jonker J. L. Mock.—Large well formed flower, dull carmine to pink.

Kaiserin Augusta Victoria.—Creamy white, pleasing large flower.

Killarney.—Semi-double, light pink Rose with very attractive elongated buds.

La France.—One of the best old Roses, light pink, large and full flowers with real rose scent.

Lady Alice Stanley.—Large and full flower, deep coral rose on the outside of petals and pale flesh inside.

Lady Ashtown.—Salmon-pink distinct colour. Long blooms.
Mabel Morse.—Bright golden yellow fragrant flowers of perfect form. Bushy and compact growth.

Madame Abel Chateney.—Large semi-double flower, carmine rose, shaded with salmon.

Mildred Grant.—A very large Rose of good substance, white shaded pink at edges of petals.

Mrs. Alfred Tate.—Coppery salmon, shaded fawn; lovely buds.

Mrs. C. V. Haworth.—Deep red with purple tint, scented and free flowering.

Ophelia.—Salmon pink, shaded with rose, with yellow at base of petals. Fragrant. There is a white Ophelia also.

Pink Rover.—Very fragrant, light pink, medium sized flat flowers.

Shot Silk.—Neat compact habit of growth; medium sized attractive flowers which are coppery rose flushed with apricot and yellow.

Souvenir de President Carnot.—Flesh shaded white. A distinct colour.

Sunburst.—Cadmium-yellow with orange-yellow centre; fragrant and bell shaped.

W. C. Gaunt.—Vermilion, tipped scarlet. Flowers of medium size borne in great profusion.

William Shean.—Very large pink flowers of good form and substance.

Noisette Roses.—Noisette Roses consist of hardy, vigorous growing, free and almost continuous bloomers, most of the kinds being semi-climbing or climbing in habit of growth. Noisettes are distinguished by their flowers produced in large bunches or clusters in terminal or side growths. Flowers are usually white or light yellow shaded with rose or not. The following varieties are noteworthy:

Aimée Vibert.—Pure white, in large clusters.

Celine Forestier.—Pale yellow.

Cloth of Gold.—Light yellow flowers.

Coquette des Alpes.—White flowers with rose shaded centre produced in clusters of three flowers.

Coquette des Blanches.—Large pure white flowers. Vigorous climbing habit.
Lamarque.—Straw coloured flowers in large clusters.

Marechal Niel.—One of the best climbing Roses, bearing large and full deep yellow flowers which are scented, globular and pendent.

William Allen Richardson.—Flowers small, borne in profusion, fine orange yellow, deeper in the centre. A semi-climber.

**Bourbon Roses.**—Bourbon Roses include some favourites. They are plants of compact growth, producing flowers on strong shoots almost constantly. Some of the commonly grown bourbons are:

Bouquet de Flore.—Rosy-pink. Free flowering in large clusters. Highly scented. There is a climbing variety also.

Souvenir de Malmaison (Lavanir).—Flesh coloured with almost white margins. Borne in clusters.

**China Roses.**—The China or Monthly Roses are plants of dwarf habit, producing flowers in great profusion several times a year. Blooms are small but full and not very much scented. The following are commonly grown:

Arch Duke Charles.—Rose with margin almost white when newly expanded and gradually changing to rich crimson.

Madame Breon.—Rose coloured flowers, large and full, tinged with a little salmon sometimes.

**Climbers for plains and medium elevations.**—For low to medium elevations, one’s selection is limited to the sports of Teas, Hybrid Teas and Hybrid Perpetuals, Bourbons, the Noisettes and one or two hardy climbers such as the White Cluster, the Crimson Cluster and the Crimson Globe and Hiawatha. The following are noteworthy:

Alexandra. (T).
Climbing Devoniensis. (T)
Gloire de Dijon. (T).
Reine Marie Henriette (H.T.) Deep cherry red, large pendent flowers.
Climbing Bouquet de Flore. (B).
Marechal Neil. (T) or (N).
Almost all the Noisettes mentioned above.
Hiawatha (Hybrid Polyantha).—An American Rose bear-
ing single crimson pretty small flowers in large clusters very freely.

The White Cluster, the Crimson Cluster and the Crimson Globe.

Propagation.—Roses are propagated in a variety of ways:—From seed, by cuttings, by layering, and by budding. Propagation from seed is seldom tried except with a view to raise new varieties. At low elevations, Roses on their own roots, that is those raised from cuttings or by layering, do best. Budded plants thrive well from medium to high elevations. In upcountry, the best method of increasing one's collection is by budding the favoured varieties on Edward or the Briar stocks. For this purpose, rooted cuttings are planted out in prepared pits and the plants grown into large bushes which bear a number of sappy vigorous canelike shoots. At the required height, this depending upon whether dwarf or half standards or standards are desired, budding is done. When the bud has grown into a good shoot, the budded shoots are layered and separated from the stock plant and grown in pots or planted out in the ground after establishing them. Cuttings are put into a soil composed of three parts of sand, one part of well sifted leaf mould and some charcoal powder. One year old shoots which have flowered furnish the best cuttings. Cuttings with a heel do better than terminal cuttings. Suitable length for the cuttings would be 6 to 9 inches. About four inches of the cutting should be in the soil which should be well pressed round it. It should be shaded and kept moist till new growth is visible, when it may be gradually exposed to more and more sun as growth progresses. Cuttings may also be inserted in well prepared trenches filled with desirable compost. Layering is the most common method of propagation of Roses, as some varieties as Marechal Neil cannot be propagated from cuttings.

Cultivation in the ground.—There is no doubt that Roses make better growth and make a finer display in the ground than when grown in pots. The ideal site for a Rose garden is one which receives the full benefit of the sun and is sheltered from high winds and is free from the robbing roots of trees near by.
As mentioned above under their respective headings, different kinds vary in their exact soil requirements. For best results, the rose beds or the pits should be filled with suitable soil for the intended plants or the original soil improved accordingly.

A mixture composed of three parts of well decomposed horse manure, two parts of red earth and one part of sand suits all kinds of roses. The land should be well drained. The pits or trenches for planting should be about three feet deep and broad. In beds the plants may be spaced 3 to 4 feet apart. Otherwise they may be planted 5 to 6 feet apart. Root-budded imported plants should be planted in such a way that the budded portion is 1½ inches below the surface of the soil. Fresh manure placed in contact with the delicate roots burns and damages them. Hence it is safest not to have any manure in the upper third of the soil. After the plants establish and begin to grow well, manure may be forked into the soil and the surface may even be mulched with half decomposed manure to keep the soil moist and the roots cool and to provide food at the same time to the growing plant. Watering should be regularly and liberally done, once every day or two days. Weeds should be regularly removed. The soil should be scarified after every rain or whenever it begins to cake up and crack. Twice a year, the top soil should be removed and replaced with a rich mixture of red earth and manure and the bushes pruned. In the case of budded plants, a sharp look out for suckers from the base and from the stem of the stock plant is necessary; they should be promptly removed as they grow at the expense of the plant. Frequent syringing of foliage with clear water keeps leaves in healthy condition and keeps the plants free from aphis. If large blooms are desired, only a few shoots have to be retained and disbudding should be done. The best bud should be retained and the others pinched off. While removing blooms, it is best to cut long stems with two or three leaf buds under the blooms. It is necessary to cut at a place where a bud is pointing outwards. This ensures more blooms when the eyes below the cut develop. All faded flowers should be cut away to a point at least three buds below
them. The following is a mixture of fertilizers which has been tried with success by all Rose growers:—

- Superphosphate of lime 12 lbs.
- Sulphate of potash 12 lbs.
- Sulphate of ammonia 5 lbs.
- Sulphate of iron \(\frac{1}{2}\) lb.

This mixture is to be applied at the rate of 2 to 3 ounces for each grown up shrub. Bone meal is very usefully applied too. Half a pound for each shrub would do. When the fertilizer is used, the soil should be irrigated well. The mixture may be dissolved in water and the solution applied after wetting the soil previously; Or, the mixture may be spread on the surface, gently forked in and then the plants watered.

**Wintering.**—To maintain them in a healthy and strong condition and to enable them to furnish large blooms in large numbers, Roses should be wintered, manured and pruned twice a year or at least once a year. Wintering consists in withholding water from or curtailing its supply to the bush for a period of five to fifteen days according as the sun is severe or not and as the plant is young or old, the object being to force the sap to the roots from the weak shoots which have to be pruned away. The soil is removed to a depth of six to nine inches exposing some of the roots of the bush for a day or two if the leaves remain green even after withholding water. The leaves turn yellow and fall off and some of the weak shoots dry up. Care is to be taken however that the plant does not dry up due too drastic a treatment. The soil is then replaced with fresh compost and the bush watered copiously moistening the entire soil. In a day or two, the sap rises up the plant, when it is ready to be pruned.

**Pruning.**—The Rose is a spreading shrub in which branches and shoots of previous year's growth are continually being weakened and replaced by strong new shoots which should be encouraged. Pruning of a Rose consists, first, in the removal of all dead, weak, overcrowding or otherwise useless shoots and secondly, in the cutting back or shortening of the shoots that remain after the abovesaid thinning-out process is completed.
A novice who is to try his hand at pruning Roses may start in a systematic manner in the following manner. Cut out all dead wood, remove all weak and spindly growths, all worn-out and exhausted wood and overcrowding shoots especially at the centre which should be kept open to the influence of sun and air. In cutting away branches and shoots, remove them clean to the base of the plant or to the point of their origin on the stem, as the case may be. If too many shoots are left after the abovementioned thinning-out process, reduce their number, keeping a few strong ones. Then shorten them according to the habit of growth of the particular variety and the type to which the particular plant belongs. Each type of Rose—very often a variety too—has to be pruned in a particular manner, which should be studied by experience. One golden rule to remember is that the stronger a plant or shoot is, the less is the length to which the selected shoots are to be cut back; conversely, the weaker a plant or shoot is, the severer the pruning is to be, thus leaving only a few buds that have to come up later. Always cut back the shoots to a bud pointing outwards, so that the shoots that emerge from them do not cross and overcrowd the centre.

It is to be remembered that more Roses are damaged and killed in this country by too severe pruning than due to want of adequate pruning. All classes of Roses except the Hybrid Perpetuals require to be pruned but lightly in this country. To induce them to bloom, Hybrid Perpetuals need to be pruned comparatively more severely than other types. Their shoots have to be cut back to four to six buds for exhibition blooms from the point of their origin. Strong bushes may be cut back to 18 to 24 inches from the surface of the ground for bushes about 4 feet high while in bloom. Hybrid Teas may be classified under two heads for purposes of pruning, those that take after the Hybrid Perpetuals and those that take after the Teas in habit of growth. The former class of H.Ts. are pruned like H.Ps. The latter class of H.Ts. are pruned like Teas. The shoots of strong growing Teas like Gloire de Dijon may be shortened to two-thirds of their length and those of the moderate growing kinds like Reine de Portugal to a third
of their length. Noisettes and Bourbons require practically no pruning at all, except by way of removal of old and weak shoots and the shortening of the very strong shoots by a few inches. In most kinds of China Roses, which as a class are continuous bloomers, and require very little pruning, it may be enough to pinch off the growing ends. It is enough if the shoots which have flowered are cut back to three or four buds under the fading flowers. Very old shoots may be clean cut off.

Roses generally bloom in 35 to 60 days after pruning. Hybrid Perpetuals generally take the longest time. Old plants take longer to bloom after pruning than young ones.

Pot culture.—Pot culture of Roses is very simple. Well established plants are gradually shifted to larger and larger pots as they grow till they are finally put into 16 inch pots. The drainage should be perfect and the soil should be kept just moist always, without being overwatered. Once a year, the entire soil should be renewed, by removing the ball of earth from the pot, reducing its size after clean cutting back a few of its roots, and then the plant should be put in the same pot after cleaning it well and putting fresh crocks for drainage. In addition to this annual repotting, the soil should be renewed at the top to a depth of about six inches or more, about six months after repotting. After each turn of bloom, the soil is advantageously topdressed to a depth of two inches with rich compost consisting of three parts of manure and two parts of earth. Pots should be kept on stones or bricks to prevent grubs from entering them through the drain holes from the ground. The soil should be examined at least once in two months for grubs. After each such inspection for grubs, the soil should be well pressed down. Pot Roses are only maintained in healthy condition by feeding them every fifteen days with liquid manure prepared from oil cake and with artificial manures in liquid form at intervals. If the surface soil is renewed every now and then, say once a month, or is covered with mulch of half decomposed manure renewing it once a fortnight, there is no need to use any liquid manure at all.

Common Pests.—The following are the more common pests of Roses:—(1) Rose beetles. These attack the foliage after
dark, eating the leaves and making holes in them. They should be caught with the help of a light when they feed upon the plant; they are usually found on the underside of the leaves. If they are picked for two or three nights consecutively, the trouble would cease for the season. But if they come in large numbers, the plants are best sprayed with lead arsenate solution. The grubs of these beetles, the Cockchafer grubs, as they are called, feed upon the roots and kill the plant soon if not picked out and destroyed. (2) There are other larvae and caterpillars that attack the foliage. See page 139 for remedy. (3) Borers and saw flies are kept away by smearing the cut surfaces with a thin splash of tar or white lead. (4) San Jose scales attack the stem sticking to it like brown dots and patches. Rub the affected parts with a paste of red earth, cow-dung and sulphur. See also page 142.

(5) For aphids on shoots and flower buds, see page 141.
(6) For mildew affections, see page 127.
(7) For leaf spot fungus as also mildew, spray with Bordeaux Mixture and pick out affected leaves and burn them.
(8) To keep the plants safe from white ants, remove the soil at the bases of the plants and apply lime sulphur solution on the stem from the level of the roots to a little above the surface of the ground.

Types for Hill stations.—The Rosa multiflora, Wichuriana and Pernetiana types of Roses furnish some best specimens for cultivation on Hill stations.

Rosa multiflora includes the Dwarf Polyanthas, which the National Rose Society styles as Poly-Poms and the large growing Polyanthas which are ramblers.

The Dwarf Polyanthas are of a compact habit of growth, growing 18 to 24 inches high and bearing single, double or semi-double flowers about 1—1½ inches across in clusters. They form a hardy class and form glorious edging to larger growing Roses in beds or are very useful for massing in beds, easily replacing the usual summer bedding plants. They make very handsome pot plants too. They require very little pruning, the shoots being just cut away to form new growths from the base. The following are some of the best varieties (1) Ellen
Poulsen, bright rose-pink, sweet scented, fine double flowerets in large clusters. (2) Mrs. W. R. Cutbush, pink flowers in large trusses, resembling those of Dorothy Perkins. (3) Orleans, bright, Pelargonium—rose coloured, with white centre. Very large trusses. (4) Kirsten Poulsen, vivid scarlet large single flowers with beautiful golden anthers, borne in large loose sprays. (5) Maude E. Gladstone, malmaison-pink flowers of large size, shaded coral and carmine and sweet scented with tea perfume. (6) Superba, rich crimson flowers with white in the centre.

The Climbing Polyanthas are very useful for growing on pillars, arches, pergolas, arbours, and trellises but are not suited for walls. Flowers are borne in clusters and give a mass effect. They are produced directly on ripe wood of the previous year or on offshoots from it. Pruning is confined to a removal of the three—year old canes which have exhausted themselves to give room for new canes from the base or the lower portion of old canes. The following are a few good varieties:—(1) Crimson Rambler, a well known glorious climber with bright red clusters of flowers. (2) Blush Rambler, a good companion to the former with large clusters of apple-pink flowers. (3) Goldfinch, golden yellow flowers, probably the best of that colour. (4) Tausendschon, brilliant pink-white shading to blue. A peculiar colour. (5) Mrs. W. R. Flight, one of the best double flowered kinds, rose coloured. (6) Thalia, large clusters of double white flowers.

Wichuriana Roses have characteristic shining foliage which protects them partially from attacks of mildew. They are useful like the Polyanthas and very striking on arches, pergolas, banks, etc. They are grown and pruned like the latter.

The following are some of the best varieties:—(1) Dorothy Perkins, soft pink glorious trails of flowers. (2) Gardenia, very sweet-scented, canary yellow buds opening to cream. (3) Excelsa, double bright rosy-crimson flowers in large clusters. (4) White Dorothy Perkins, a lovely white sport of Dorothy Perkins. (5) Alberic Barbier, yellowish-white double flowers. Leaves rich glossy green and handsome. (6) Delight is brighter than another favourite, Hiawatha, with larger clusters of larger
flowers which are rich crimson in colour with a central white eye.

Pernetiana are hybrids of Austrian Briar with Hybrid Teas and Hybrid Perpetuals. They were developed quite recently and require almost the same treatment as Hybrid Teas. They may be successfully grown at medium elevations too. The following are of some of the best varieties:— (1) Madme Edward Herriot, better known as the Daily Mail Rose, brick-red terra cotta; buds, coral red, shaded yellow and rosy-scarlet. (2) Sovereign, a colour which justifies the name, deep metallic yellow opening to a golden yellow. (3) Golden Emblem, yellow large cupshaped flowers, foliage glossy and mildew-proof. (4) Gorgeous, deep orange yellow, heavily veined with copper. (5) Gwyneth Jones, brilliant carmine orange, flowers large and moderately full. (6) Golden Ophelia, golden yellow flowers.
CHAPTER XX

ORNAMENTAL FOLIAGE PLANTS

Under this heading, for purposes of convenience, are treated ornamental foliage plants of a miscellaneous character which are not dealt with elsewhere. Mostly, they are cultivated in pots in shade or semi-shade, in conservatories, verandahs, etc. Also, some kinds mentioned in the list, are useful for edging, some for planting on rockeries, some for growing in hanging baskets and some for planting out in shade gardens.

Aglaonema. (N. O. Aroideae). Succulent or shrubby perennial valuable pot plants with leaves, variegated or green blotched with grey. Thrive well in shady and semi-shady situations only, as ferneries or plant-houses. Require a soil composed of loam, leaf-mould, sand, charcoal and old mortar. (See page 113, compost No. 11). Aglaonemas are allied to Arums, Alocasias, and Dieffenbachias and require essentially the same treatment as they do. Daily syringing of the foliage improves their appearance and condition. They are easily raised by terminal or node cuttings of the stem and by division of the basal shoots. Natives chiefly of Malaya and Philippines.

The following are a few noteworthy species:

A. commutatum, a dwarf plant about a foot high, Maranta leaved, spotted and greyish blotched.

A. costatum, a very dwarf and compact very showy species. Leaves are thick, heart-shaped, about 3 inches wide and 4 inches long, dark shining green with ivory white scattered blotches. A native of Perak.

*A pictum, also a dwarf species, 1—2 feet high, with elliptic-acuminate, light green leaves, which are irregularly blotched with broad grey patches. The stems are slender and erect. A native of Sumatra and Malaya.

*A. versicolor is 1½ to 2 feet high and is very similar to the above species but has smaller leaves.

A. nobilis and A. simplex are other important species.
**Alloplectus.** (N. O. Gesneraceae). Are evergreen shrubs. *A. Lynchii* grows about $1\frac{1}{2}$ feet high and has handsome bronze coloured leaves, which are purple underneath. It is a pot plant for the conservatory. Raised by cuttings. A native of Columbia.

**Alocasia.** (N. O. Aroideae). Alocasias rank high among ornamental foliage plants. They are closely allied to Caladiums and Colocasias. They are very useful for decoration of conservatories or plant-houses, verandahs, etc. Many species have large, coloured and variegated leaves with rich metallic hues. Some species have them green or green and white with prominent veins and markings and blotches. They are usually peltate, more or less oval-triangular in shape with a deep sinus at the base. The undersurface is generally distinct in colour from the upper surface. Leaf-stalks are in many species beautifully marked or blotched. The stem is thick, short and densely marked with leaf scars; it is usually tuberous or rhizomatous rooted. Most species rest for a time after a distinct period of active growth.

Alocasias are easy of cultivation, thriving well in open well drained soil, compost no. 9 on page 113 being suited for pot culture. During active growth, which in most species is from April to November, watering should be liberally done. Though in several species, the foliage does not die down completely in winter, it is best the water supply is much reduced to the plants, as otherwise the tubers or rhizomes would rot away. Old plants cut back to the soil-level or to two inches above it, give rise to a number of shoots rich in fresh foliage. Propagation of Alocasias is made by node cuttings of the stem, each piece with a bud being placed in moist sand or by tubers or cuttings of rhizomes. Some species may also be raised from seed. The inflorescence is a spathe and it is unattractive; it should be removed to encourage fresh and handsome foliage. The following species deserve particular mention:—

*A. argyrea.* About 2 feet high with large leaves which are dark green with a silvery sheen. Makes a handsome plant with crowded foliage.

*A. cuprea* has petioles 2 feet or less long, with ovate-pel-
tate blade, 18 by 12 inches, dark metallic green with darker veins and ribs above and rich purple on the underside. Native of Borneo.

A. Johnstonii presents a unique appearance. Leaves are semi-erect, arrow-shaped and peltate, olive green in colour, prettily variegated and strikingly veined with bright rosy-red. Leaf-stalks are furnished at intervals with whorls of stiff spines. Stem is darkly mottled with bands of flesh colour just above the spines.

A. Jenningsii is a handsome species, growing 2—3 feet, with leaves 8 to 10 inches long and nearly as much wide. The ground colour of the leaf is a beautiful shade of glaucous green, which is set off by oblong patches of almost black.

*A. Lindenii grows about 2 feet high and is furnished with broadly arrow-shaped leaves, which are green with yellowish veins, curving off from the pale yellow midrib and vanishing near the margin. Petioles are nearly white. A noble species, native of Papua.

*A. macrorhiza variegata grows about 3 feet high with cordate large leaves, which are pale green with large portions of them blotched with creamy white and white. Some leaves are completely white. Native of Ceylon. A truly handsome species. Propagated by suckers or offsets.

*A. metallica is very pretty with leaves of deep metallic hue. Grows about 1½ feet.

*A. Sanderiana is a native of the Philippines growing about 2 feet high. Leaves are arrow-shaped with scalloped edges and broad prominent white margins and nerves. A very attractive species.

*A. Lowii growing about 2 feet high, very attractive when in full growth. Leaves are cordate-sagitate, 14 to 16 inches in length, olive green with thick white midribs and deep purple underneath.

*A. Thibautiana is a native of Borneo growing 3 to 4 feet high with leaves about 2 feet long by 18 inches wide, of deep olive green above with silvery white nerves branching from the midrib and purple underneath.

*A. zebrina has light green leaves with long prominent peti-
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Ornamental foliage plants which are beautifully marked with zig-zag transverse dark bands. A very desirable species. Native of Manila.

*A. violacea* is a comparatively dwarf species, with leaves rich in metallic hues.

*Alocasia esculenta* is large growing and distinctly tuberous rooted. Leaves are large and green. The species is grown on a large scale by market-gardeners for its tubers, which are used as a vegetable by Hindus. (Called Sanekilangu in Tamil and Same geddle in Canarese).

**Alpinia.** *(N. O. Zingiberaceae).* Genus of hardy foliage plants, with ginger-like roots and attractive foliage, useful for mass effect, planted by swampy corners and in low ground. Propagated by division of clumps of rhizomatous roots. *A. Sanderae* is very popular as a pot plant, used for decoration of plant-houses, with stems about three feet high, covered with lanceolate leaves, which are pale green marked with broad stripes of dark green and creamy white. Requires lot of water while growing. If soil is very rich, variegations do not develop satisfactorily. Flowers are in spikes and are not much.

**Ananas.** *(N. O. Bromeliaceae).* Ananas or Pine-apples are well known fruit plants, the foliage of which is handsome even in the orchard types. There are some variegated leaved kinds which are particularly ornamental. They are grown in pots for decoration of vases and conservatory. They are hardy and thrive in rich well drained open soil. Propagation is from crowns of fruits or suckers from the base of the plant, which should be kept away for two or three days before planting in sand. Rooted young plants are placed in 6 inch pots with the lower leaves removed and only shifted to larger 9 inch pots when they are full of roots. The following variegated kinds are recommended:—

* *A. sativus variagatus* grows about 1½ feet high. The leaves are nearly 2—3 feet long, beautifully arched and variegated and set with recurved spines at the edges. The centre of the leaf is rich green, with occasionally a few lines of white, and it is margined with rich creamy yellow, tinged with red towards
the margin, especially when the plant is exposed to the sun. A very decorative vase plant.

*A. sativus striatifolia* has striped leaves, marked longitudinally with prim-rose, red and green stripes.

*A. Porteana* is another very desirable species, with leaves armed with spines on the margin, deep olive in colour with broad band of pale yellow extending down the centre from base to apex.

**Anthericum.** (N. O. Liliaceae). Dense foliaged herbs, with mostly fleshy, linear-lanceolate leaves, which are gracefully recurved, springing from the short root-stock. Loose panicles of flowers are thrown up from the latter. The variegated species are very pretty and they are largely used in carpet bedding, for edging, for culture in vases and baskets. Grown in pots, they are very useful for adornment of the conservatory. Anthericums require a sandy loamy soil and plenty of water. They thrive in shade and semi-shade. Propagated by division from offsets and from seed. Very often, the ripe flower-stalks carry young plants with a well developed root system, and these may be straightaway potted in 5 inch pots.

*A. variegatum (Syn. Chlorophytum elatum variegatum)* has very handsome foliage of striped, white and green leaves. Thrives at medium to high elevations. A hardy and serviceable plant.

*A. liliastrum* bears large, bell-shaped, fragrant white flowers. It grows to one foot with variegated foliage and thrives only in up-country. Popularly known as "St. Brunoes’ Lily".

**Anthurium.** (N. O. Aroidae). A large genus of tropical aroids. They can be conveniently grouped to fall under two sections. (1) the foliage section with velvety ornamental foliage and (2) the flowering section bearing interesting flowers. The leaves of the foliage section are strikingly ornamental; they are bold in outline, large, suspended from a strong stalk, velvety. They vary in their tints and are in some species tinted with metallic hues relieved by veins and midribs. The flowering group is grown for the attractive inflorescence which consists of a bright hood-like spathe of rich crimson or rose or cream or white encircling the spadix. The foliage in this section too is
handsome but only not so very attractive as in the preceding section.

Anthuriums thrive in open well drained soil, humid atmosphere and a shady situation. Compost no. 12, page 113, suits them best. They should be grown in pots in conservatories. Old ill-looking leaves should be removed to improve the foliage and have more flowers. The young satiny leaves should not be syringed very hard nor bruised. As the plant grows in the pot, roots which are formed on the stem get exposed and harden and cannot sustain the plant in good condition. They should be covered with the compost or neatly mossed up. If the stem grows too long, the plant is best repotted, cutting it back and starting it on fresh roots. Propagation is by node cuttings or bits of rhizomes, or by division of suckers. All the species, the flowering and the foliage kinds, grow well during the rainy season.

The following are the more attractive flowering species:
- *A. Andreanum*. A very pretty species being in bloom for nearly three months, 3-5 feet; large handsome satiny leaves; spadix is 3 inches long; the spathe is open, leathery, 3 to 4 inches across and 6-9 inches long, is scarlet in colour. A native of Columbia.
- *A. Brownii* has rose-tinted spathe.
- *A. Scherzerianum* and *A. Regenellianum* have intense red spatheas.

The following foliage kinds are recommended:
- *A. crystallinum* grows 2 to 3 feet high, with very large leaves, which are ovate-cordate-acuminate, bright rich velvety green, with the principal veins elegantly banded with pure crystal white. The young leaves are very delicate and tender and violet purple in colour and should be protected from coming in contact with rough objects, lest they should be soiled. Native of Peru.
- *A. Veitchii* is a handsome striking species. The leaves are 2 to 3 feet long, obovate-oblong in shape, furrowed transversely, and deep, rich green in colour. Does not thrive in the plains. Native of Columbia.
- *A. Warocqueanum* is also from Columbia, a very orn-
mental striking species. The leaves are elongated, 2 to 3 feet long, 8 to 10 inches broad, are deep velvety green. The mid-rib and veins are of lighter colour and pleasingly contrast with the green portion of the leaf.

*A. magnificum* is very handsome with its large leaves, which are 1 to 3 feet long and about 18 inches wide, cordate-acuminate in shape, with the leaf-stalks, 1 to 2 feet long. The colour of the leaves is velvety green; the veins contrast well with the colour of the leaf.

*A. radiatum*; *A. splendidum*; and *A. pandulifolium* are other desirable species.

**Asparagus. (N. O. Liliaceae).** A large genus of herbaceous perennials, tender woody shrubs and vines, with ornamental foliage. One of the species, *A. officinalis* is used as vegetable. The plants are provided with underground rhizomes, from which the aerial shoots arise in regular order. The roots of several species are tuberous, fleshy and cylindrical. The leaves are reduced to scale-like bracts, usually with a basal spur, which is often spiny. The function of the leaves is taken up by the cladodes, which are leaf-like structures. The flowers in several species are fragrant, but are not much in appearance. The following species are recommended:—

*A. plumosus* is called the Asparagus Fern. It is a very ornamental, evergreen, small climber, with slender smooth stems and numerous spreading branches and graceful needle-like foliage. The pseudo leaves are dark green and very handsomely divided and grouped in tufts, resembling fern fronds. Flowers are very small and insignificant. A light rich soil, good drainage, semi-shady situation and a good supply of water are needed for successful culture. It is an excellent plant for growing in a pot over a balloon or for adorning a trellis on the porch, growing 10 feet or more. Propagated by seed or by division. The seeds are hard and germination is hence slow. In floral decorations, the foliage is used similarly as the fronds of ferns. *A. plumosus nanus* is a dwarf variety of the above and it is a more satisfactory plant for pot culture.

*A. Sprengeri* has elliptic tuberous roots. The stems are numerous and do not climb more than 6 feet. The flowers are
very fragrant, produced in racemes, one to three inches long. This is a very hardy species, very useful for planting in hanging baskets and on rockeries for creeping along the nooks and corners. The foliage is used for making wreaths and in floral decorations.

*The variegated species with white and green leaves is a rare and valuable plant.

A. racemosus is a scandent shrub, bearing very fragrant white flowers.

A. myriocladus is dwarfish in size, growing only about 18 inches, with very short leaves gathered in numerous brushlike whorls. A good pot plant.

Aspidistra. (N. O. Liliaceae). Foliage plants of great merit, with radical, stiff, shining, beautiful foliage, sometimes called the Parlor Palms. Aspidistras are very hardy, withstanding hard usage, dust and heat and they are hence very popular house plants. With cut flowers, the leaves are used for table decoration. They thrive best in rich loam, containing leaf-mould and sand, like plenty of moisture and half-shade. Propagated by division. Shake out the old soil, while repotting, putting several pieces with roots into pots of suitable size. The variegated kinds lose their colour in very rich soil.

A. lurida is the commonest species grown. It is 1 to 1½ feet high, with oblong-lanceolate leaves which are 1 to 1½ feet long and 3 inches broad. Serves as border or edging plant; does well in pots or in the ground. *A. lurida variegata is a variegated variety of the above, the leaves being white and green; a very pretty foliage plant, which is apt to revert to the green type. Native of Japan.

*Beaucarnea (Syn. Pincenectia). (N. O. Liliaceae). Very ornamental, graceful, slow growing, Dracaena-like, Mexican plants, with long, narrow, green leaves and slender woody stems with a remarkably swollen tuberous-looking base. The plants form striking objects in the conservatory or in the open in sheltered situations. They should be potted in a compost consisting of equal portions of red earth, sand, leaf mould and manure and provided with ample drainage. Propagated from seeds imported from their native country (Mexico). The plants are rare and difficult to obtain.
B. recurvata (Syn. B. tuberculata) is a beautiful object, wherever it is placed, with its pendulous bright green leaves.

B. longifolium is a very beautiful species with a stout stem and leaves about six feet in length, which are narrow, pendest, forming a beautiful vase-like centre. Native of Mexico.

*Begonia. (N. O. Begoniaceae) There are some begonias which have very ornamental foliage. They are very useful for pot culture. See under Begonia in chapter XXVI.

Bilbergia. (N. O. Bromeliaceae) Genus of dwarf epiphytic ornamental plants, with thick succulent hard and rigid, stem-clasping, long, convolute leaves. The flowers are usually borne in erect spikes, one in the centre of each plant. The plant or the shoot dies after flowering and fresh suckers are produced which flower later. Bracts of the flower clusters are usually very brightly coloured and showy. The plants are usually grown in pots or on rockeries or like orchids on tree trunks. Perfect drainage, shady situation and friable soil made up of loam, sand, leaf-mould, and manure in equal proportions with addition of charcoal and brick pieces, are necessary for their successful cultivation. Propagated by suckers. The sucker is taken by the hand and is twisted off the stem gently, the base is then trimmed and a few bottom leaves are cut away and the sucker inserted in sharp soil in a small four-inch pot. For raising a number of plants, seeds can be sown; but this method is very slow. Many species are in cultivation:—

*B. rosea; 2 feet high, with erect rigid convolute leaves, banded and blotched with grey and bronze. Flowers are rose-pink on long spikes. Native of Tropical America.

B. speciosa, leaves 1—2 feet long, forming a tube at the base, green above and somewhat striped on the back. Flower cluster is large and loose and drooping. The bracts are rose coloured, the flowers being pale green or whitish, tinged with blue.

*B. zebrina is about 2 feet high, with leaves sheathing for about half their length, forming a sort of a tube. The colour of the leaf is green with zones of grey, deepening with age. Flowers are greenish, and the bracts are very large and bright.
salmon-coloured. The inflorescence is very gracefully turned downwards.

B. escapa is a pretty species, 12 to 15 inches high. The leaves are dark-blackish-green above and purple underneath and tipped with rose colour. The flowers are not much.

B. Sanderiana; B. pyramidalis; and B. thyrsoides; are other handsome species.

Cardulovica. See under Cyclanthus.

*Coleus. (N. O. Labiateae). Small, highly decorative, herbaceous plants, 1–2 feet high, with gorgeously coloured foliage, a source of constant joy. They are very valuable pot plants. Some species can, however, be used as edgings or for filling carpet beds. Propagated easily by terminal cuttings or seeds. Slips strike root in a month. Pot the rooted cuttings singly in six inch pots firmly, using compost No. 1 on page 112. Nip the tops of growing shoots once or twice to make the plants bushy and give them form. Water carefully at first, and then very liberally as growth progresses. Shade the plants from severe afternoon sun. As the small pots are filled with roots, shift the plants to nine inch pots using similar compost. Apply liquid manure of horse dung once in ten days. Firm potting contributes to healthy, strong, close jointed plants. Remove flowers as they appear. In about three months after potting the cuttings, big-sized show specimens are obtained. The plants grown from seedlings are better looking and are larger leaved than cutting plants. Moreover, a large number of differently coloured new varieties can be raised by sowing a mixed packet of seeds. Coleus are attacked by a whitish scale insect which is rather difficult to eradicate. The best thing that could be done is to burn the plants, if the attack is very severe; but if there are only a few insects noticeable, here and there, on the plant, they can be gently washed away with fish oil soap solution. Colours of the plants develop, when they get pot bound. C. Hendersonii with bright red leaves margined yellow is very good.

C. thyrsoides is a beautiful herb bearing large spikes of charming blue flowers.

Cordyline. See under Dracaena.
Cryptanthus. (N. O. Bromeliaceae). Evergreen, perennial mostly Brazilian, epiphytic plants, with stiff leaves in rosettes. They are treated like Bilbergias. Grown in pots, for decoration of the conservatory or on rockeries. Propagated by large sized offsets inserted in small pots singly in sand.

C. Beuckeri is 6 to 8 inches high; red and white flowers are produced in summer.

C. undulatus, 6 to 10 inches high; flowers, white.

C. zebrinus, 6 to 8 inches high; leaves green with transverse brown bands.

*C. Zonatus, a showy species with transverse bands of white on the leaves.

Curculigo. (N. O. Amaryllideae). The species usually cultivated is Curculigo recurvata. It is a stemless Tropical Asiatic foliage plant, with leaves which are long and furrowed and palm-like in appearance. It is hardy and easily cultivated, either in pots or in the ground. The soil should be well drained and watering should be regular and plentiful. Propagated by suckers forming at the base of the stem. A variegated variety of the above species, *Curculigo recurvata variegata, is a very handsome plant for indoor decoration or for the fernery. The leaves, which are upwards of two feet long and six inches broad, are bright green in colour and are banded with stripes of white longitudinally.

Cyanophyllum. See under Miconia.

Cyclanthus. (Syn. Cardulovica). (N. O. Cyclanthaceae). Palm-like plants of Tropical America. They are usually stemless and have large leaves, which are long-stalked and resemble palm-leaves. Cardulovicas are plants suitable for culture in large pots or tubs in conservatories, with an assured plentiful supply of water. Propagated from seeds, which should be imported or by division of suckers at potting time.

*C. Drudei grows about 4 feet high and is probably the most showy species.

C. palmata is a noble species for table decoration when young. It is an ornament to the conservatory. The leaves are very large, the petioles measuring 2—5 feet long, the blade being four lobed and cut into narrow segments; the leaves are
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gracefully spreading and drooping at the margins. It is out of this plant, that the famous Panama hats are made.

C. bipartitus is an effective and singular plant, 4—5 feet high. The leaf-blades are deep green, 18 to 24 inches long, and deeply cleft into two broad segments.

C. cristatus grows about 5 feet high. The leaves are deep green, 2 to 3 feet long by 1 foot broad. When young the leaves are not cleft but they ultimately become bifid at the apex. The leaf-stalks are broad and sheathing at the base as in the above species. Native of Columbia.

Cyperus. (N. O. Cyperaceae). Plants closely allied to grasses, with a number of sedge-like stems rising from the base. They thrive in damp soil and are usually planted by the margins of water gardens. Cyperus papyrus is a large plant, about 5 feet high. It is of great interest as one of the early forms of paper. Propagated by division of suckers or by seed. Only the following species are fitted for cultivation in gardens:—

C. alternifolius, popularly known as the Umbrella Plant or Palm, is a rush-like perennial herb, 3 feet high, with a compact habit of growth, with numerous, erect, dark green, jointless, angular stems supporting a quantity of long narrow leaves, arranged in an umbrella-like manner. Can be grown in large pots in a compost of loam, sand and leaf-mould in equal proportions; a little peat may be added with advantage to the compost. Plenty of water is essential. Native of Madagascar.

C. elegans is a pretty dwarf form of the above.

*C. alternifolius variegatus is very similar to the above but it has the leaves and the stems elegantly streaked with white. The plant grows 1—2½ feet high and makes an excellent ornamental pot plant, very useful for table decoration. The stem with the leaves is useful for cutting.

Dieffenbachia. (N. O. Aroideae). Dumb Canes. Called after J. F. Dieffenbach, a German botanist, 1794-1847. Dieffenbachias are noble, evergreen, erect growing aroids, with very striking, handsome foliage. They are pot plants, and are very useful for decoration of rooms and plant houses. The stems are thick and gouty, becoming crooked and top-heavy when
All the species have handsome foliage; in many, the leaves are broad and variegated with white and yellow streaks and blotches. The juice of the plants is very acrid and poisonous and consequently no part of the plant should be placed in the mouth; the juice benumbs the tongue and causes much swelling and pain and hence the name Dumb-cane to the family of plants.

Dieffenbachias require a liberal supply of water both from the syringe and the water can. Compost No. 11, at page 113 is best suited for them. Firm potting is necessary. Propagation is from terminal and node cuttings. The stem of old plants is cut up into bits, each bit having a bud in it; the bits are inserted in sand in seed-pans, preferably with the buds pointing upwards and covered up with sand and watered regularly, keeping the soil just moist. In about two months, roots are emitted at the joints and the dormant buds grow into shoots emerging out of the soil. When they are about two inches, the cuttings are taken out and separately put into 5 inch pots in light soil, consisting of 2 parts of leaf mould, 1 part each of red earth and sand. When these pots are filled with roots, the plants are shifted into larger pots using the compost recommended above. Large leaved kinds may be potted one in each pot. But, more than one plant, may be put into a pot if the leaves are small. Flowers should be removed as they appear, as they weaken the plant and make the foliage small in course of time. All the species thrive in shade and semi-shade though some are hardy and stand any amount of neglect. The following species are noteworthy:

*D. Bausei: leaves, 12 to 15 inches long, yellowish in colour, margined and irregularly blotched with dark green and profusely spotted with white; the petioles are often white in colour.

*D. Bowenii: leaves are large, deep green, blotched with irregular parallel markings of a pretty pea-green. A handsome large leaved species, the leaves often measuring, 12 to 24 inches long by nearly 12 inches broad. Native of Brazil.

*D. Jenmanii: leaves, shining bright green, with the lateral
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nerves banded milky-white and the surface here and there spotted white. Handsome species, a native of British Guiana.

_D. Leopoldii_ is a very handsome species, a native of South America. The leaves are deep, lustrous, satiny green. The mid-rib is broad and ivory white and bordered on each side with whitish band.

*D. magnifica._ A large handsome species, a native of Venezuela. Leaves are 12–18 inches long and 4–6 inches wide: They are shining sombre green, thickly variegated with blotches or pale yellow or white. The stem and leaf-stalks also are variegated.

_D. Regina_ is a very beautiful species; leaves are oblong-elliptic, of a greenish white colour, mottled with blotches of pale green and having a narrow margin and stray streaks of deeper shade.

*D. Rex_ is a vigorous growing species, handsomely marked. The leaves are closely placed upon the stem. The leaves are of deep green colour passing to paler green near the edge of the narrow unequal side. The whole surface of the leaf is thickly covered with white blotches to within half an inch of the margin.

Prominent among other species grown are:—_D. splendens_; _D. picta_; _D. nobilis_; _D. Chelsonii_; _D. gigantea._

_Doryanthes._ (N. O. Amaryllideae). Called the Australian Giant Lily or Spear Lily. It is a greenhouse plant with ornamental foliage resembling that of Aloes or some Dracaenas. The flowering is long deferred in this country. Useful for adorning conservatories, if grown in pots. Can be planted out in the ground in shade garden. Propagated by suckers removed from old plants and placed in small pots.

_D. excelsa_ is a handsome subject for the lawn in cool localities. The flowers are numerous, brilliant scarlet and are of the size of lilies.

_D. palmerii_ growing 6 to 8 feet high is also good for lawn planting. Flowers are reddish, and funnel-shaped.

_Dracaena and Cordyline._ (N. O. Liliaceae). Dracaenas are very much allied to and are often called Cordylines and vice versa. They are very useful ornamental plants of great
beauty with symmetrical foliage, which is richly coloured and prettily variegated in several species. There are several varieties, a hundred or more; some of them do well in borders and shrubberies and beds in shade gardens; others make excellent pot plants, serving as useful adornments of the conservatory. Some species are well suited for table decoration and for growing in baskets.

Dracaenas thrive in rich loam containing some lime. The compost for Dracaena is made up of 3 parts of horse manure, 1 part of leaf mould, two parts of red earth and 1 part of sand, with a little addition of lime rubbish for augmentation of the colours. Undersized pots, firm potting, plenty of light (not direct sun), regular supply of water, perfect drainage, occasional spraying with clear water and a cool atmosphere ensure elegant looking plants. If the plants are too overcrowded or are so staged that the leaves come in contact with rough surfaces, they are injured. Scales, mealy bugs and thrips are some of the common enemies, which can be easily overcome.

Dracaenas are propagated by division of suckers, which are produced freely in several species, by node and terminal cuttings of the stem and by gooty-layering. Old leggy plants may be cut down to encourage fresh growths which soon come up from the old stem. The shoots cut away may be utilised for making new plants. They are cut up into bits, 1—1½ inches in length, such that there is a node or joint for each piece. These are placed in sand horizontally about half an inch deep in seed-pans and regularly watered, just keeping the soil moist. From the nodes, young shoots soon come up and grow. Each of these bits with the roots as little disturbed as possible, is potted separately, in six inch pots, in a light compost but the potting should be firm. Terminal cuttings also strike roots soon but they do not make as satisfactory plants as those got in the above said manner by node cuttings. Plants got from terminal cuttings are apt to lose their lower leaves, if they are carelessly potted or if they do not establish soon.

The following species are useful for planting in the border, though in their young stage, they are beautiful as pot plants:—

_D. fragrans_ is tall growing, 8 to 14 feet high; leaves are
Dracaena Victoria. (Page 309)
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long, green, lanceolate and very gracefully recurved; flowers are fragrant. Suitable for planting in the shrubbery.

*D. Lindeni* is also tall growing, is very much like the preceding species in habit of growth but the leaves are traversed by a creamy yellow band along the middle throughout the entire length. Very often, only the top-most leaves develop colour. If the plant is cut back and heavily manured, the new shoots that come up, generally put on very bright colour, very similar to *D. Victoria*.

*D. marginata*: The trunk is about an inch thick, and 4—5 feet high and branched. Leaves are ensiform, densely rosulate, 12 to 15 inches long and ⅓ inch broad, spreading, rigid-green margined and veined with red.

*D. reflexa*; and *D. cerculosa maculata* are others.

The following are eminently suited for pot culture:

* *D. albo striata = D. argentio striata* tall and erect growing, very pretty with pale green recurving leaves with bands of white.

* *D. Bausei*: Of striking habit and free growth; leaves are about four inches wide, highly coloured, being dark bronze, margined with crimson.

* *D. Deremensis Bausei* is newly introduced to Bangalore. A strikingly beautiful plant, erect growing, being clothed with foliage from base to top, consisting of recurved dark green leaves with handsome bright band of pure white running along the entire length.

* *D. Victoria* is a very handsome species; it is about six feet high or more, clothed with leaves from top to bottom which are broad, striped green on bright yellow background.

* *D. goldeana* is a magnificent ornamental plant of erect habit with closely set, stalked, spreading, cordate-ovate-acuminate leaves, with yellowish green background, marbled and blotched with dark green and silver grey.

* *D. Sanderiana* is a very showy species, the leaves being white and green, suggesting Arundo donax variegata. The stems are cane-like and produced freely from the base, giving the appearance of a small clump to the plant. A very slow grower
and difficult to grow. It does not like to be shifted or repotted frequently.

*D. umbraculifera* is a peculiar and distinct species. Leaves are 2—3 feet long and ½—1 inch wide, dark green, closely set, horizontal, with ends gracefully drooping down, giving the appearance of an umbrella. Very valuable as a single specimen in a large pot.

*D. rosea ferrea.* Leaves 9 to 12 inches long and 4 inches wide and ovate-oblong in shape; both the surfaces are deep purplish red which makes the plant very striking and ornamental.

*D. gracilis.* An elegant little species with slender stem and leaves, almost standing horizontally, about an inch broad and a foot long, tapering to a point and bright dark green in colour and the margins bordered with dark purple bronze.

*D. thalioides* is a bushy peculiar species, with green arching leaves.

*D. Norwoodensis* has very handsome foliage of broad leaves, which are light green with streaks of rosy, white, and purple.

*D. Godseffiana* has elliptic golden spotted leaves. Grows like a scandent shrub.

*D. draco:* Very handsome symmetrical plant with thick stem and long greenish foliage gracefully arching down.

*D. albicans;* *D. metallica;* *D. Nigra rubra;* *D. Jamesii;* *D. Robinsoniana;* *D. The Queen;* *D. Warrenhii;* are among other attractive species.

*Cordyline indivisa* is arborescent, very slow growing; 10 to 15 feet high; leaves are dark green, densely crowded, 2 to 4 feet long and 3 to 4 inches broad in the middle. Small plants are very graceful and useful for table decoration.

*Cordyline indivisa Veitchii* is similar to the above but the leaves are sheathing at the base and have the mid-rib of a beautiful deep red colour. Very desirable plant. *C. rubra, australis,* and *terminalis* are other desirable species.

From seeds collected from attractive brightly coloured varieties in the garden, one can raise dracaenas, many of which may be new and not true to parent plants. There are many such new unnamed varieties, which are handsome.
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**Fittonia.** (N. O. Acanthaceae). Fittonias are dwarf evergreen plants with trailing habit. They have very pretty, variegated ornamental leaves, with pink and white veins. They are admirably suited for rockeries in shade and hanging baskets. The larger kinds may be grown in pots and trained against some support like a small balloon. The plants are at their best during the rains. They strike roots at the nodes, which come in contact with moist soil; thrive in compost number 9 on page 113. Require a shady situation and plenty of water. Propagated by division or by cuttings. The following species are worth mentioning:

*F. argyroneura* : A native of Peru. A very neat, compact growing plant, 4 to 6 inches high, with broad, flat, oval leaves of vivid green, traversed with a network of silvery white veins. A truly beautiful trailer. *F. argyroneura variety rubra* is similar to the above, with red veins.

*F. gigantea*: 1 to 1½ feet high; leaves, purplish, with network of pink veins; has an erect, branching, sub-shrubby habit. A native of Ecuador.

*F. verchaffeltii*: About 8 inches high; leaves are purplish with pink veins. A native of Brazil.

*Hoffmannia.** (Syn. Higginsia). (N. O. Rubiaceae). Tropical American, handsome-leaved, woody shrubs, 2—3 feet high, grown in conservatories in pots. They are shade loving plants, thriving in rich open soil, containing a little lime, which augments the colouring of the foliage. Propagated by cuttings in sand under glass or frame in the rainy season. Old plants should be cut back to six inches from the surface of the soil for bushy specimens.

*H. Ghiesbrechtii* (Syn. Camphysobotrys Ghiesbrechtii) grows 2 to 3 feet. Is a very handsome shrub, with a straight four-angled woody stem. The leaves are broadly lanceolate, pointed and entire, 3—5 inches long and 2—3 inches broad, with prominent veins. They are dark velvety green above and purple-red below. A handsome foliage plant for pot culture.
**H.G. variety variegata** is similar to the above but is of a more delicate growth; the leaves have white variegation.

**H. refulgens** grows 1—2 feet; has deep bronze leaves, which are smaller than in the above species.

**H. discolor**; ½ to 1 foot high; leaves, bronze, satiny green.

**Isolepis gracilis.** (N. O. Cyperaceae). A favourite hardy marsh or aquatic grass-like plant, 3 to 6 inches high, with pendulous filiform leaves, 6 to 9 inches long. Useful for edging in shade gardens. Increased by division.

**Ledenbergia rosea.** (N. O. Phytolaccaceae). Ornamental leaved foliage plant, 2—3 feet high, with large ovate-lanceolate leaves, dark shining copper green above and bright violet-rose colour underneath. The stem and branches are rosy-purple. The flowers, though they are not much, are suspended from long filamentlike slender threads and are interesting. Propagated by cuttings. Thrives in a compost of rich loam and leaf mould and old manure in equal parts. Requires effective drainage and plenty of pot room. Native of Central America.

**Miconia.** (Syn. Cyanophyllum). (N. O. Melastomaceae). Tropical American genus of shrubs with striking foliage. They are valuable subjects for pots for conservatories. Some of the species may also be effectively planted in the ground in shade gardens. Abundance of water, fibrous open soil, and shade are necessary for success in growing them.

**M. Hookeriana** is a grand ornamental plant, 2 to 3 feet high, suitable for planting in the ground in the shade garden or in pots in conservatories. The leaves are dark green above, with silvery lines running from base to apex, and reddish purple below. A compost consisting of equal parts of leaf mould, sand, and loam with a little peat added gives best results. Regular and careful watering is necessary to keep the plants in good condition. Propagated by seeds or by cuttings, with bottom heat or by layering.

**M. magnifica** is only 3—4 feet high, though it probably grows into a small tree in its habitat. It is a very striking foliage plant of great beauty, with very large, broadly ovate, opposite, pointed, prominently veined leaves, which are nearly 2½ feet long by 1 foot broad. They are of a rich velvety green
above, with ivory-white mid-rib and nerves running from base to apex and reddish purple below. Cultivated and propagated as the preceding species. Does well at medium elevations. *M. flamma* grows 2—3 feet high and has large green rugose leaves.

*Musa.* (N. O. Musaceae). Musas are herbaceous trees, of noble appearance with erect pseudo stems made up of sheathing bases of the leaf-stalks, grown for their fruits, fibre or foliage. They are bulbous and have perennial root stocks. Leaves are gigantic, entire, oblong or elliptic with parallel veins. Flowers are produced in terminal clusters in a conical spike, each cluster being subtended by a large spathe-like coloured bract. In several species, as the Plantain, the plant dies after flowering or fruiting and its place is taken up by suckers that come up from below. The common banana or plantain species are valued for their fruits, and grown in fruit gardens. They are also, to a certain extent ornamental in appearance but they are entitled to a secondary consideration in ornamental gardening. All the Musas are mainly propagated by suckers, though some can be raised by seeds. They require copious supplies of water, shelter from wind, and deep loamy soil. Of the more decorative species, the following deserve particular mention:—

*Musa coccinea* : Height, 4—5 feet; leaves, about 3 feet long, 6 inches broad and bright dark green. Inflorescence, about a foot long and furnished with spathes of brilliant scarlet tipped with yellow. Flowers at various seasons throughout the year. A very ornamental plant, propagated by seed or suckers.

*Musa Ensete,* called the Abyssinian Banana, its habitat being the mountains of Abyssinia, where it grows to nearly thirty feet. But, here, it grows only 8—9 feet. It is one of the finest decorative bananas, with very long bright green leaves, with crimson mid-rib. The pseudo stem is very thick. The plant yields a very good fibre. Propagated by seeds sown in hot beds.

*Musa superba* grows about 10 feet high and is very handsome, with its broad, large leaves, symmetrically placed round
its thick pseudo stem. It grows wild in the Western Ghats, where during the rains, it beautifully adorns the hill sides with its magnificent foliage. The inflorescence resembles a big purplish red globe suspended from a gracefully bent bracket. The plant dies after flowering.

*Musa zebrina*: Height, about 10 feet. Leaves are dark green with broad blotches of bronze red and purple, irregularly scattered. The pseudo stem is slender.

*Nephthytis picturata.* (N. O. Aroideae). Tall herb, about 1½ feet high, with large leaves, handsomely marked with pale green and dark satiny bands. Propagated by cuttings.

**Pandanus.** (N. O. Pandanaceae). (Tamil, Thashai; Cane rese, Gethege). Called the Screw Pine. Pandanaceae are evergreen, mostly thorny, shrubby tropical plants; some of them are valued for the beauty of their long sword-shaped leaves, which in some species are nicely variegated. The roots are remarkable being mostly aerial and stilt-like. *Pandanus odoratissimus* is the well known "Thashai," which yields very highly scented flowers, which are extensively sold in the market and are very much liked by Hindu ladies. It is alleged, that on account of its fine scent, the flower attracts cobras near the bush. A very small type of cobra is alleged to visit the flowers and lie hidden in the inflorescence, so that it is advised that one should not straightaway smell the flower before examining it. The ornamental foliaged kinds are suitable for growing in pots or tubs or on lawns or on the margins of ponds.

The variegated species lose their rich colour if the soil is very rich and growth is very vigorous. In poor soil, supplied with just the requisite amount of moisture, they develop good colour. Pot plants should be potted firm and efficient drainage should be furnished. Shading from the afternoon sun improves the general appearance of the plants. Propagated by offsets or division of the suckers. Remove a few bottom leaves from the offsets or suckers and pot the cuttings in a mixture of leaf-mould, sand and red earth. For decorative purposes, the following species are recommended:—

*P. Veitchii* is a Polynesian species; one of the most decorative plants and very useful for room decoration. The broad
leaves are often two feet in length, somewhat pendulous and slightly spiny. They are pale to dark green in the centre and are margined with clear bands of white, the edges being serrated, which adds to the charm of the plant. If the leaves are occasionally sponged with water, the plant remains fresh and healthy. Grows three to five feet.

*P. Sanderiana* grows 3—6 feet; the leaves are long and arching, 2—3 feet long with very minute marginal spines, and are striped creamy yellow, green, and white in bands throughout their length.

*P. graminifolius* is of dwarf growth, 2—3 feet high, with branching habit; leaves are narrow and greyish green.

*P. gracilis* is also a dwarf species with narrow glaucous spiny leaves.

*P. Baptistii* has broad leaves banded with yellow.

*P. variegatus; P. spiralis* and *P. candelabrum* are some others.

**Pellionia.** (N. O. Urticaceae). *Pellionia Daveauana* and *P. pulchra* are small, trailing, fleshy plants, 5—9 inches high, with scaly stems and variegated leaves, blotched green and grey and violet. The plants are very beautiful in hanging baskets, and as undergrowths in shade gardens and on rockeries. As they trail along, they emit roots at the nodes coming in contact with the soil. By separating and potting them, the plant can be multiplied. Propagated by cuttings as well. Native of Cochin China.

**Peperomia.** (N. O. Piperaceae). Small ornamental herbs, with very prettily marked, mostly succulent, cordate leaves, produced in thick cluster concealing the short root-stock. They thrive only in shady situations in a compost used for ferns. (Compost No. 7 page 113). They do well in pots and are effective on rockery. Easily raised by leaf cuttings or cuttings or by division. Mature but not very ripe leaves are cut with half an inch of leaf-stalk attached to them and inserted in pure sand such that the petioles are well under the soil and the blades are resting on the surface of the sand horizontally. The soil is kept just moist. Soon roots are emitted and new shoots come up. These are then lifted carefully and potted in small
five inch pots in light soil. When these are filled with roots and the plants cover the pots well, they are shifted finally to larger 8 inch pots.

*P. argyreia* grows 6–12 inches; the leaves are oval or round, peltate, variegated, silver striped on green. A very pretty plant, which is easily grown.

*P. metallica* is a dwarf handsome species.

*P. Fraseri; P. magnifica; P. Saundersii* are other attractive species, which are variegated green and white.

**Philodendron.** (N. O. Araceae). Evergreen, dwarf or climbing foliage plants, with green sheathed, coriaceous, satiny leaves, which are heart or egg or arrow-shaped or oblong. Some species have the leaves, characteristically perforated. Philodendrons make valuable plants for decoration of the conservatory in pots and the climbing species appear to best advantage in shade gardens when they are trained against the bare stem of large trees, pillars, or a back wall. They grow in any good soil and require plenty of water during growth and profit immensely by syringing. They resemble Anthuriums in habit and may be treated like them. Propagated by dividing the stems into lengths, consisting of about three joints and inserting them in pots in sand. The old plants, when they grow unwieldy for the pots, may have their tops cut off and these may be used as large cuttings.

For culture in pots, the following species are suitable:—

*P. gloriosum* 2–3 feet high; large handsome broadly cordate leaves, with white veins and pinkish margins; a valuable pot plant. Native of Columbia.

*P. Mamei, 2–3 feet high with large, cordate variegated leaves.*

*P. erubescens and P. squamiferum* are two others.

*P. Selloum* grows 2–3 feet, with large handsomely cut leaves.

*P. andreanum* is a climber, 3 to 6 feet high, with large, beautiful, velvety leaves.

**Pilea.** (N. O. Urticaceae). Called the Artillery or Pistol Plants on account of the fact that the pollen are shed out of the flowers forcibly as could be seen by placing a plant that
has been just watered on the foliage in the sun. Pileas are small herbs, 3–8 inches high, with graceful fernlike foliage of minute leaves. They are very easily propagated by cuttings and they grow like weeds and are often self sown. They serve as moss-like undergrowths under trees in shade gardens and are very effective in pans and in hanging baskets and on rockeries. *P. muscosa* and *P. microphylla* is perhaps the best species.

*Pothos.* (N. O. Araceae). See under Climbers.

*Ruellia.* (N. O. Acanthaceae). See under shrubs.

*Schismatoglottis.* (N. O. Aroideae). Dwarf ornamental foliage plants noted for their variegated leaves, which are oblong or heart-shaped, green or striped with silver grey, purple or yellow, and spring from the rhizomes. Shade, moist atmosphere, abundance of water and well drained soil composed of 1 part leaf-mould, 1 part sand, 1 part loam, 1 part charcoal and 1 part peat are necessary. Propagated by division of rhizomes during the rainy season. The following species are recommended:

*S. picta.* 1 foot; leaves, cordate-ovate, dark green having feathered greyish band running down the middle.

*S. siamensis.* 1 foot; leaves, ovate-acuminate, glossy green, spotted with white. A truly decorative plant.

*S. variegata.* Leaves, bright green, irregularly blotched with pale yellow green or creamy white.

*Strelitzia.* (N. O. Musaceae). Group of ornamental herbaceous perennial flowering plants with a peculiar fan-shaped arrangement of leaves, which are large and resemble those of the plantain. They require a shady situation, well drained, open gritty soil, and plenty of water. Propagated by seeds or by division. Called the Bird of Paradise Flower.

*S. augusta* is 4–7 feet high resembling a dwarf banana plant, bearing well over the attractive foliage white flowers on a scape. Thrives well in the plains and is quite hardy. Known as “Bird of Paradise Flower.”

*S. regina* is a more delicate plant, which succeeds in the plains only with difficulty. It is very pretty in bloom with its flowers, which have bright orange coloured sepals and deep purple petals.
Both the above species come from South Africa and they can be successfully grown in large pots; they are suitable for planting on lawns too. The latter species requires to be shaded from the afternoon sun.

**Tillandsia.** (N. O. Bromeliaceae). Epiphytal perennials, closely allied to Bilbergias and resembling them in appearance and character. They are remarkable chiefly for their foliage which is of varied colours; they are grown like Bilbergias on logs of wood with moss and kept moist, or in pots. The flowers with coloured bracts are showy in several species. Propagated by offsets. *T. splendens*; *T. zebrina*; *T. Lindenii*; *T. muscica*; and *T. pulchella* are showy species.

**Tradescantia.** (N. O. Commelinaceae). Called the Spiderworts. A genus of pretty foliaged Mexican herbs of low growth, useful for covering rockeries and for carpet bedding and for growing in hanging baskets.

*T. zebrina* (Syn. *Zebrina pendula*) has fleshy leaves of a purple colour with greyish streaks on the upper surface. It is a trailer, creeping along the ground and rooting at the nodes. It is known popularly as The Wandering Jew. It is very useful for planting on rockeries and for hanging baskets or for growing in tubs containing other plants for covering the bare surface of the soil.

*T. fuscata* has long leaves, clothed with dark red hairs.

*T. regina* is an upright growing species, about a foot high; leaves are mottled white and have a violet centre.

*T. aureo striata* has leaves, variegated yellow and white.

**Vinca.** (N. O. Apocynaceae). Popularly known as the Periwinkle. *Vinca minor* is a creeping herb with blue flowers. It is best suited for growing on rockeries and in hanging baskets for covering the ground in shade gardens. It thrives well only at medium to high elevations. The variegated variety, *Vinca minor variegata* has pretty variegated foliage of small ivy-like leaves. They are striped and blotched with creamy white and green. *Vinca major* is larger than the preceding species in the size of the plant, the foliage and flowers.

**Yucca.** (N. O. Liliaceae). Yuccas are bold stiff leaved...
aloe-like evergreen plants, which are very suitable for planting on lawns and for massing in large gardens. They are very handsome when in bloom with their usually creamy white cup or saucer shaped large flowers which are borne in long erect panicles. Propagated by offsets or seeds or cuttings. *Yucca gloriosa* is the species most commonly cultivated. It is called the Spanish or Adam's Needle on account of the needle pointed leaves. It is a large aloe-like plant, about five feet in height, producing a number of side suckers. The leaves are long and flattened. The flower stem starts from the centre of the plant like a column and bears panicles of creamy white, large, cup-shaped pendulous flowers, arranged on it. The plant decked with these delightful flowers is of striking beauty. The flowering period is when the S.W. monsoon sets in.

*Y. aloifolia* and its variety variegata are valuable foliage plants of great beauty with long slender leaves.
CHAPTER XXI

CLIMBERS

The word 'climber' is generally used to include (a) a variety of plants which attach themselves to supports by their rootlets as the Ivy, by hooks as the Bramble, by tendrils as the Sweet Pea and Beaumontia and by other sensitive organs as the stem in Convolvulus and leaves in the Clematis and (b) shrubs which have long scandent branches which require to be fastened to their supports, as for instance the Allamanda. A large number of climbers with varying habits of growth and colours of flowers are available, and properly used, they serve to brighten and cheer up a place. Walls, trellises, arches, pergolas, arbours, pillars or large trees are best adorned by growing climbers against or over them. Some kinds of climbers are effectively grown on lawns supported by large balloons of iron. Many light kinds and annual climbers can be grown in pots furnished with balloons or other suitable framework.

Climbers may be generally grouped under two heads for purposes of convenience:— (a) The heavy climbers which require a strong support as an arch, pergola, or a pillar or tree and (b) The light climbers which are best suited for growing against wire netting or jeffrey work and the like or over plant houses. Again some kinds are grown only for their handsome foliage. These generally thrive best in shady and semi-shady situations. Others are grown for their ornamental flowers. These do best generally in positions fully exposed to the sun.

Failures in growing climbers may be traceable to general neglect in preparing pits for them and in watering and manuring them as also to want of proper training at the initial stages of their growth and to unsuitable positions where they are grown. Large climbers should have at least one cubic yard of space for their roots to spread. They should be planted in well drained pits made several days before planting and filled with rich suitable soil. The best time for planting is at the
Climbers

commencement of the rains. During the period of active and vigorous growth, the plants should be liberally watered. Climbers over a pergola or an arch should have one or two leaders taken up to form a growth on the top as is required and some shoots should be trained horizontally to cover the lower portions of the framework. In the case of climbers which are used to cover a trellis, the plants should be induced to branch up from the base to prevent the shoots from running up leaving the basal portions of the trellis bare. For this purpose, when a shoot grows about a foot high, it is pinched back to form two or three shoots, which should be trained horizontally against the trellis wire. This induces formation of shoots from every node of the shoot and these are taken up and trained against other parts of the trellis and so on till the entire framework is covered up. After all the available area is covered, it only remains to prune away the dried branches and twigs, in the generality of cases. Unnecessary suckers from the base, which thrive at the expense of the plant should be removed every now and then. For instance, the Cowslip creeper produces plenty of useless suckers. Climbing shrubs should be pruned with due regard to their habits of flowering. See Chapter X for hints on pruning shrubs.

Iron or metal supports are very desirable on account of their permanent character. They should be painted with tar or green paint to prevent them from rusting. It is best they are then covered with raffia or tape or some such material till the creeper grows and spreads over the support and protects the tender stems from getting injured by the heat of the sun, by its own shade. For growing against walls, the shoots of the climbers should be fastened to nails driven into the walls, with shreds of cloth in between the head of the nail and the wall so that the wall may not be damaged very much; or patent nails with metal clasps may be used with advantage.

There are several annual climbers of merit which are very useful, either for pot culture on balloons or for growing in hanging baskets or for covering jeffrey work or wire netting. Among the noteworthy ones are Ipomea rubra coerulesc, Con-
complete gardening in india

vovulus, Mina lobata, Maurandia Barclayana, Cobaea scan
dens, and Nasturtium Canariensis.

The following are select climbers:—

*Adenocalyyma. (N. O. Bignoniaceae). Adenocalyyma
calyxina. Evergreen slender-stemmed, but nevertheless heavy,
tendrilled climber with trifoliate and conjugate leaves, bearing
yellow trumpet-shaped, Bignonia-like flowers in sprays, a
single flower at a time, and extending over several months from
March to November. Propagated by layering. Native of
Brazil.

A. nitidum. Also yellow flowered.

A. grandiflora and A. Aubletii are particularly recommended.
They are beautiful evergreen shrubby climbers with large pale
yellow flowers, borne throughout the year. They are easy to
grow, very attractive, trained against pillars, arches, or over
other strong supports. Should be pruned every year to about
a joint or two of old wood for large number of blooms. Propa-
gated by layering and by cuttings. Natives of Tropical America.

*Antigonon. (N. O. Polygonaceae). Elegant, handsome,
deciduous, tuberous-rooted climbers of moderate growth.
Flowers are very attractive, being borne freely in large rac-
emes of white, pink, and rose shades. About November, foliage
loses its lustre and begins to fall. Withhold water and cut
down the stem in February—March. Manure and begin water-
ing again. The plants will be in full leaf by June or July.
Antigonons are easy of culture and are suited for arches, ar-
bours, verandahs, screens, etc., and they provide cut flowers
almost throughout the year. They thrive in deep, rich, well
drained soil. Propagated by seeds, by layering and by cut-
tings. The following species are noteworthy:—

* A. amabilis (lovely): Exceedingly attractive and effec-
tive species. Flowers, delicate rose or white, borne in axillary
and terminal racemes.

A. leptopus. The common but lovely slender stemmed
creeper, producing innumerable sprays of beautiful rose-pink
flowers in the rainy season and almost throughout the cold
season. A variety of the above, with white flowers, is also
handsome. Native of Brazil.
*A. insigne* (remarkable): Similar to the preceding species, but is of less extensive growth and bears larger and more attractive flowers of deeper pink. Native of Columbia.

*A. guatemalense* is probably the best of Antigonons. Native of Guatemala. Leaves are larger, the flowers more numerous and larger than in other species. Flowers are deep rose in colour.

*Aristolochia*. (N. O. Aristolochiaceae). The Birth-wort.—Hardy, evergreen and deciduous class of climbing plants, with very peculiar "Duck-shaped" flowers, which by their bad smell attract flies for pollination. Once, the flies enter the flower, they are prevented from coming out immediately until the work of pollination is completed, by the peculiar curvature of the flower and the hairs in its throat. Aristolochias are quick growing and do not usually flower till a good height has been reached. Though the plants are good looking, it is advisable to keep them at a distance, on account of their nauseous odour. Propagated by seed, or by layering, or by cuttings taken off with a heel and put in a propagating frame. The following species are recommended:

*A. Bonplandii*: Brown flowers, which are spotted and have the appearance of a duck. Leaves are large.

*A. Duchartrei*. A desirable species, with pretty flowers, having a brown tube and a limb of cream colour with purple blotches.

*A. elegans*: Is the best for private gardens, as it is very free blooming and the flowers are very elegant and free from the nasty smell of other species. Flowers are saucer-shaped, nearly three inches across, are mottled deep purple and creamy white. Propagated by seeds. Native of Brazil.

*A. gigas* ("Fly Catcher"; "Pelican Flower"): A remarkable plant and the largest flowering species. Flowers are very offensive in smell, rich brown and mottled and much inflated and with tails nearly 20 to 24 inches long. A native of Guatemala.

*A. leuconeura*. Leaves are cordate-acuminate and handsomely variegated with yellowish white veins. Purple-brown flowers are borne on the stalk of the main stem.
A. ridicula; A. saccata; and A. piana are some others.

Asparagus. (N. O. Liliaceae). See page 300. Asparagus plumosus with its slender stems and very finely divided foliage which look like being pressed flat artificially is used for trellis on verandah, and other shady situations.

*Banisteria laurifolia. (N. O. Malpighiaceae). Choice climbing shrub with dark, olive green, rigid leaves, very ornamental when in bloom from January to April, when it is densely covered with large, compact, sprays of bright golden-yellow flowers. Propagated by layering. Grows best in sandy loam. Known as the Oncidium Climber.

*Beaumontia grandiflora. (N. O. Apocynaceae). Very ornamental, strong and rapid growing climber, with a strong and woody stem, attaching itself firmly to anything with strong rope-like tendrils, and reaching to the height of a big tree in less than two years. The foliage is very dense and consists of shining, smooth, broad, oblong-ovate leaves, measuring about 9 by 4 inches. Flowers are large and trumpet-formed, resembling white Lilies and possessing a faint lily-like smell. They are 4 inches long by 3 inches across and are borne in large corymbs, covering the plant in a mass of bloom from January to March. Thrives on any rich well drained soil, which is well watered, and likes a sunny situation. It is exceedingly well suited for large arches over carriage drives or for growing on large trees like Bombax malabaricum. Cut back the shoots after flowering, as flowers are produced on growths of the current season. Propagated by cuttings or by layering. Called The "Nepal Trumpet Flower". A native of India.

*B Jardoniana is a smaller climber, though heavy.

Bignonia. (N. O. Bignoniaceae). Large genus of scandent shrubs and climbers furnished with tendrils. The flowers are axillary and terminal and usually panicked. They are tubular, expanding at the mouth into 5 lobes. The class, as a whole, is suited for plant houses, tennis-court screens, etc., as almost all of them are light, free growers, having a good covering capacity. Propagated by cuttings or layers or seeds. The following species are noteworthy:—

*B. Chamberlaynii is extremely spreading, covering a large
space of trellis or wall in a short time; the green stem or shoots are several feet long, bearing pinnate, shining leaves. Flowers are borne in profusion from the axils of leaves almost throughout the year. They are yellow, thimble-formed, with a tube about 2 inches long, and contrast well with the rich, verdant, graceful foliage.

*B. Cherere: Flowers in cymes; corolla is orange-red and nearly 2 inches long. Blooming period is between February and May.

*B. gracilis: A very beautiful choice climber, exceedingly spreading, attaching itself to the supports strongly by its hooked tendrils. It is the best creeper for covering plant houses, as it is particularly light and has rich, bright, varnished green foliage. Flowers are borne very profusely once a year about March. When in bloom, the creeper is amazingly beautiful forming long festoons of richly coloured yellow, trumpet-shaped flowers, with no leaves to mar the effect.

The climber covers walls like the Ivy without artificial support. It should be planted in deep holes filled with good rich soil and particularly protected from attacks of termites and bandicoots while still young. After it establishes, the plant does not require any particular attention.

*B. venusta (lovely): Rapid growing, tendrilled, gorgeous, rather heavy climber, bearing very freely from the axils of leaves, large attractive clusters of crowded, finger-like, tubular, bright orange flowers about 2 inches long. It is of unrivalled beauty in dry-weather, the entire spread of the creeper being one mass of colour. Little care is required after it establishes itself well. It blooms more profusely at medium than at low elevations.

*B. purpurea is an evergreen ideal climber for a small garden, bearing in great profusion, deep mauve purple, scented flowers, several times a year.

*B. magnifica is a rather heavy and vigorous grower, which is very showy bearing purplish mauve flowers in great profusion in large panicles.

*B. incarnata (venosa) bears pale lilac, striped purple flowers.
*Bougainvillea. (N. O. Nyctaginaceae). See page 239, under Shrubs.

*Chonemorpha macrophylla. (N. O. Apocynaceae). Large, woody, milky climber with stout branches and broadly oval-pointed leaves, nearly 8 by 12 inches in size. Flowers are Plumeria-like, fragrant, white with yellow centre, about 4 inches across in expansion and borne freely in the hot season. Thrives with ordinary care and garden treatment. Suited for heavy arches or for growing on trunks of trees like Palms.

*Cissus discolor. (N. O. Vitaceae). Also called Vitis discolor. Choice, slender, tendril creeper of exquisite beauty, suitable for trellises and for culture in pots over a balloon. Leaves are velvety, oblong-ovate, acuminate, 3 to 5 inches long, having the upper surface of a bright velvety green, spotted and mottled with white and red, and an under surface of a deep reddish purple. Tendrils and leaf-stalks and young stems are also deep reddish purple. Flowers are insignificant. The plant requires a deep, porous, well drained soil, a shady situation and a moist atmosphere. It is susceptible to root-rot and hence drainage of the soil and watering should be attended to with care. A weak solution of liquid manure of cow-dung benefits the plant, if administered once a fortnight. The creeper sheds all its leaves in winter, when it should be cut down to about a foot from the base and watered only sparingly. In March-April, the plant again begins growth after rest, when it may be repotted or top dressed and the supply of water increased as growth progresses. Propagated by cuttings, inserted in pure silver sand.

Clematis. (N. O. Ranunculaceae). Called popularly the Virgin's Bower. Large genus of beautiful, flowering, useful, evergreen climbers. Flowers have bright coloured calyx and no corolla. The plants are adapted for many ornamental purposes and can be trained against trellises, walls, and on roofs. They thrive in a deep, rich, loamy soil. As only new shoots produce the sprays of flowers, the climber should be cut back to five buds of current season's growth, after flowering. Propagated by layering, or by inarching on hardier kinds and by seed. Most of the species, especially the large flowering Jack-
manii type do best only in up-country. The following species are recommended:—

C. Jackmanii bearing large flowers; unfortunately does not thrive in the plains.

C. aristata: greenish yellow flowers borne in panicles; blooms in the rainy season.

*C. flammula: pure white fragrant flowers, borne in the rainy season; has dense small leaved foliage. A vigorous climber.

*C. Gouriana is a tall climber, very hardy and doing well in the plains. Flowers are white, fragrant, borne in cymes along the length of the branches looking like long sprays. Native of the Himalayas.

C. paniculata is like C. flammula.

Clerodendron. (N. O. Verbenaceae). C. Thompsonae, C. speciosum, and C. splendens are three light climbers of small growth, best suited for filling corners and for pot culture. See page 245.

Clitoria. (N. O. Leguminosae). Called the Butterfly-Pea. Pretty indigenous climber, bearing deep blue or purple or pure white flowers. Is a hardy perennial by nature but is raised and grown as an annual, raised from seeds and grown in beds.

*Congea tomentosa. (N. O. Verbenaceae). Very beautiful, extensive, very vigorous-climber, very effective in bloom in January and February. Bears in great profusion, showy, large sprays of mauve coloured blossoms, the blooms lasting for several weeks, like Petrea volubilis. Can be pruned back severely to bush form. Propagated by cuttings or layering. A native of Burma.

Cryptostegia grandiflora. (N. O. Asclepiadaceae). A climbing showy shrub with pink flowers during the hot season.

Derris scandens. (N. O. Leguminosae). A large, heavy, indigenous climber, very rampant in growth, producing in great profusion little pale rose pea-shaped flowers in long sprays. Only suited for large gardens, for heavy pergolas or for growing against large trees. Raised from seed easily.

Echites caryophyllata (clove scented Echites): A grand, creeping shrub, extensively climbing in habit, fastening itself upon and running up tall trees and producing a great profusion of numberless sprays of its fragrant blossoms, made up of white, star-like, medium-sized flowers with twisted and irregular petals. Flowering period is June to September. Propagated by layering.

Echites rubro-venosa (red veined): A handsome plant, suitable for live screens, being a very vigorous grower. Leaves are large, covered with a brilliant net-work of red veins standing out conspicuously from the emerald green background. Flowers are borne in great abundance, are white and sweetly scented. Propagated by layers. Suitable for growing as a large shrub on lawns.

Ficus. (N. O. Urticaceae). Ficus repens is called the Indian Ivy. A beautiful climber, with rich green heart-shaped small leaves. Covers a wall very well by attaching itself firmly to the supports by means of its rootlets, like the Ivy. It is very slow-growing. F. stipulata is another desirable species, similar to the preceding, but having larger leaves. Both the species are best suited for up-country.

Hedera. (N. O. Araliaceae). Hedera helix is the common English Ivy, which does not thrive in the plains but does quite well at medium and high elevations. A serviceable creeper growing in any kind of soil but requiring shade; useful for covering walls, open railings, arbours, screens, and for hanging baskets. Leaves are thick and polished and dark green. Propagated by cuttings and layering.

Hedera helix variegata is a variety of the Ivy with leaves, which are lighter in colour and are marked and blotched with creamy white. Very slow grower. Looks pleasing against an old wall or against a tree.


Honeysuckle. See under Lonicera.

Ipomea. (N. O. Convolvulaceae). The Convolvulus family furnishes many handsome light creepers to the garden, bearing beautiful funnel or wheel-shaped flowers of pure white,
CLIMBERS

blue, rose, purple, crimson and intermediate colours. There are many annuals among them, which are raised from seed very easily. The perennials are propagated by cuttings of ripe wood or by division of roots or by seeds. Ipomea palmata, which is well known as the Railway Creeper, Ipomea Learii known as the blue Morning glory and others are all of rapid growth with dense foliage and hence are useful for covering unsightly places by screens in a short time. The following species are recommended:—

*Ipomea Bona-nox.* Called the Midnapore Creeper or The Good Night Flower, is a strong climber with woody growth, with cordate-ovate leaves, bearing white, large, flimsy, fragrant flowers, which open in the evening and fade in the morning. Propagated by seed.

*I. Brigsii* is a desirable creeper, with dark green shining handsome foliage and bright crimson very showy flowers, produced very freely. Very much like *I. Horsfalleae.* Propagated by layering and by cuttings. Excellent for arches and trellis.

*I. Horsfalleae;* probably a variety of *I. Brigsii,* a very showy evergreen twiner, with flowers of a deep carmine red colour produced in plenty almost throughout the year. Leaves are digitate and polished green. Very well suited for arches. Propagated by cuttings and by layering.

*I. carnea* is strong growing but it is less of a climber than many of its congeners. Leaves are large, cordate, glabrous and deciduous. Flowers are large, campanulate, rose or pale-pink and profusely borne from July to November. Suited for covering waste places and for planting by compound walls. The plants may be cut down to six inches from the ground after flowering and grown as a scandent shrub. Raised by cuttings.

*I. Learii,* called the Morning Glory or the Blue Dawn Flower, is an old established favourite. It is an evergreen quick grower forming a screen very rapidly. Flowers are dark blue and turn purplish red as they fade. Continuously in bloom throughout the year, bearing the lovely flowers very freely. To keep the plant in good condition, young shoots coming near the roots should be taken off with some roots attached to them.
and planted several together in fresh soil once a year, and old plants replaced every year as they become weak. Propagated by division.

*1. paniculata* (Batatas paniculata). An extensive, strong, free growing, tuberous rooted twiner, easy of culture and well suited for trellis work and for covering pillars. It thrives best in rich, open, loamy soil and should not be watered during its period of rest. Large purple flowers are produced in great profusion in large trusses from June to August and onwards. The leaves are ornamental and finger-formed. Propagated by cuttings.

*1. tuberosa* (Called the Spanish Arbour Vine). Handsome vigorous grower, bearing large beautiful golden yellow flowers, between July and September. Increased by tubers or seeds.

*1. palmata*, called the Railway Creeper, bearing purplish flowers, is useful for covering screens, etc. It is very rapid growing and thickly covers large areas in a short time.

*I. semperflorens* is synonymous with *Jacquemontia violacea*.

*Jacquemontia violacea*. (N. O. Convolvulaceae). A small, very free blooming creeper, with neat habit of growth suitable for covering trellises or arbours or for growing in pots or tubs with a balloon-frame work. Leaves are small and oblong-cordate. Flowers are small, of the size of an eight-anna piece, bell-shaped, bright blue in colour and borne plentifully in all seasons, and hence called *I. semperflorens*. One of the best tropical climbers, which covers well without rushing to the top quickly. Propagated by cuttings and by layering.

*Jasminum*. (N. O. Oleaceae). See page 252. There are some named Jasminums, which are good climbers. They are useful only for their flowers, as there are prettier climbers for use for general purposes in the garden. Of the climbers, *J. grandiflorum* (Canarese and Tamil, “Jaji”) is the best. It is a large straggling shrub, very pretty with its dark green pinnate leaves. It bears very freely, single flowers with twisted petals, which are pure white above and pinkish red below, in the hot and rainy seasons. *J. officinalis* is another valuable climber bearing white single flowers in terminal clusters. There
are other kinds, which are not properly identified and named and which are sold by local nursery men; they are free bloomers, and are worth growing in gardens for the delicious fragrance of their flowers.

*Cimicifugas.* (N. O. Valerianaceae). The Chinese Cimicifugas, *C. foetida* and *C. tuberosa*, are the most popular and are grown for their fragrant flowers and aromatic leaves. *C. foetida* has white flowers and afragrant scent, while *C. tuberosa* has yellow flowers and a pungent odor.

*Lonicera.* (N. O. Caprifoliaceae). Popularly called the Honeysuckle, Loniceras are great favourites in many gardens. The tall growing kinds are well suited for covering arbours and small trellises and for covering open railings. All the species are easy to cultivate but it is only *L. japonica* (chinensis) that thrives in the plains. It is a light grower, bearing clusters of very fragrant tubular flowers which are white and turn yellowish as they become old. Propagated by cuttings of young wood of firm texture and by layering.

*Les caprifoliurn is deciduous and its flowers are yellowish with a bluish tube, two inches long and highly fragrant. Blossoms from August to November.

*L. coccinea* is a less vigorous grower and a more delicate species than the preceding. Flowers are light scarlet in colour and scented.

*L. sempervirens*, known as the Trumpet Honeysuckle bears orange red flowers.

*Maurandia.* (N. O. Scrophulariaceae). *M. Barcleyana.* Is a small herbaceous perennial climber, which is easily raised from seed, with slender shoots and small leaves, bearing Snapdragon-like flowers in purple, white, magenta and pink shades of colour. Useful for baskets and for balloons.

*M. scandens*—*Lophospermum scandens* is an annual.

*Passiflora.* (N. O. Passifloraceae). Group of well known tendrilled climbers of rapid growth, requiring a strong trellis for support. Flowers are peculiarly shaped and formed, and are interesting and beautiful. For successful culture, Passifloras require a rich open soil, containing a large quantity of lime, and a liberal supply of water. The branches must be cut back and thinned out every year after flowering as the plants produce flowers on wood of the current season. The blooming period is generally between July and November. The following species are recommended:
**P. caerulea** and its hybrids (the Common Passion flower) are handsome, slender but strong, vigorous growing climbers with bright three to five lobed leaves, covering a great space of trellis in a short time. Peculiar purplish blue faintly scented flowers are borne plentifully almost throughout the year. They grow readily from seed and may also be propagated by suckers, which they send out round the spot where they grow.

*P. kermesiana* (Syn. *P. Raddiana*): A slender stemmed, very beautiful extensive climber, with trilobed, dark green, shining leaves. Flowers are solitary with very narrow distinct sepals and petals of a bright crimson red, are freely produced in the hot and rainy months, on long slender branches, which gracefully hang down an arch or tree. Rather a shy bloomer in the plains.

*P. laurifolia* (called the Jamaica Honeysuckle); a rampant climber with dense foliage of laurel-like rich green glossy leaves. Flowers are large, sweet-scented, and violet-purple in colour.

*P. quadrangularis*, called Granadilla, is a rapid growing extensive climber, bearing brownish yellow, ovoid fruits, which are about six inches in length. The fruits have a hard skin and contain a gelatinous pulp and sub-acid juice, with a fine flavour. It can be used raw, being boiled and used as vegetable; when ripe, the pulp and the juice can be eaten directly from the fruit by scooping them out with a spoon, after putting some salt or sugar, if necessary. Propagated by layering or by seed. Suited best for lower elevations.

*P. edulis* bears much smaller fruits, which are egg-shaped and dull purple in colour. The pulp has a very fine flavour and eaten directly from the fruit. Sherbets, confectionery, and jams are prepared from the fruit, which is extensively grown in Australia for that purpose. Both the above two species, grow well on trellises and produce two crops a year, if well manured and looked after. Suited for medium elevations.

*Pergularia odoratissima*. (N. O. Asclepiadaceae). Popularly known as the Cowslip creeper. An elegant climber having cordate-acuminate leaves of a dull green colour about three inches long and broad. Flowers are greenish yellow and
very highly scented and produced freely in bunches, several times a year; but the blooms do not show out at all. Propagated by suckers or by layers. Thrives in a slight shady situation in a rich loamy soil, kept open by broken brick pieces. It is a great favourite in Hindu homes, where the flowers are used for puja and are very much liked by ladies.

*Petrea volubilis. (N. O. Verbenaceae). Scandent or twining lovely plant, requiring a strong support, bearing bright blue and purple star-like flowers in large elegant wreathlike sprays; hence called the Purple Wreath. Racemes of flowers, which are 7 to 8 inches in length crowd the plant, covering it up in a mass of colour, in February and November. Propagated by layering. A very showy plant suitable for planting on lawn, as a large shrub, with a framework to support it.

Philodendron. (N. O. Araceae). See page 316. A genus of mostly climbing plants with ornamental heart shaped large leaves of a metallic lustre, which are often more or less perforated, adhering to trees and walls by their roots. They thrive in rich, loose, well drained, regularly watered soil. Several species are very decorative in pots and almost all of them require to be just shaded from the sun to prevent the foliage from getting scorched.

*P. pertusum (perforated) also named, Monstera deliciosa, is a heavy root-climber, with very large, perforated, bright polished green, handsome leaves, bearing edible fruits, which have the combined flavour of the banana and the pine apple. The flower is large and peculiar, consisting of a large white boat-shaped spathe which encloses the spadix. The fruit measures about eight inches in length, is greenish yellow in colour and looks like a conical breadfruit. The plant is useful for covering the bare stems of large trees. It can be grown in large tubs for adornment of conservatory or it can be grown against pillars in shade gardens. Propagated by division of the growing stem into bits, with two to three joints on them, and inserting them in sand like node cuttings.

*Poivrea coccinea. (N. O. Combretaceae). Also called Combretum coccineum. One of the most delightful climbers, a handsome ornament of gardens. It is thin-stemmed and has
a foliage of luxuriant, dark green, glossy leaves. Small star-shaped flowers are abundantly produced almost always in large, compact, brush-like, flat sprays of a brilliant scarlet colour. Propagated by layering, which usually takes a very long time, or by inarching on vigorous growing species of Combretum. Raised from seed also.

Porana. (N. O. Convolvulaceae). *Porana paniculata*, popularly known as the Bridal Creeper, because of its snow like masses of tiny flowers. A large climber, with cordate-acuminate grey-green leaves about 3 inches long by 1½ inches broad, producing large sprays composed of small, pure white, funnel-shaped, slightly scented flowers. Very handsome in bloom. Propagated by cuttings or by layering. Well suited for covering a wall or trellis as it covers well and seldom gets bare at the base.

*P. volubilis*, called the “Horse-tail Creeper”. Vigorous climber with cordate-acuminate, shining leaves; very handsome while in bloom with dull white flowers crowded in large dense panicles. Flowers are delicately scented. Raised by cuttings or layering.

Pothos. (N. O. Araceae). Evergreen climbing, ornamental leaved shrubs of epiphytic growth. Leaves are roundish or lance-shaped, green or variegated with cream yellow. Pothos are grown in conservatories in pots while young or allowed to climb up a pillar or against the trunks of large trees, which they cover handsomely. Syringe the foliage freely all the year round. Treat similarly as Anthuriums. Shade from sun. Propagated from cuttings.

*P. argentius*: Beautiful silvery grey leaves with deep green margin and midrib. Climber of dwarf growth.

*P. aureus*: Large leaves, variegated with yellow. A very handsome extensive climber, growing up large trees.

Other species are not much.

*Quisqualis indica*. (N. O. Combretaceae). Poplarly known as the Rangoon Creeper. A scandent, quick-growing, showy climber requiring a large trellis for support. Bears all the year round, in constant succession, numberless, drooping clusters of very pretty flowers, which are pale pink or white when fresh
but change to crimson next day. The creeper is very hardy and thrives in any good soil. Easily raised by cuttings or by layers.

*Rhyncospermum jasminoides.* (N. O. Apocynaceae). A choice, slender evergreen climber, with oval, pointed, dark green, smooth, leaves, bearing freely in the hot season and at other times of the year, large corymbs, full of pure white, pleasingly fragrant, silver-shaped, jasmine-like flowers, nearly one inch across with twisted corolla. It does well against a trellis or an arch. Grows without much care. Propagated by cuttings or by layering. Should be pruned after flowering.

*Roupellia grata.* (N. O. Apocynaceae). A large woody climber or scendent shrub with glossy, bright, elliptical, opposite, entire, large leaves, bearing in the hot season, large terminal clusters of very sweet-scented, showy, pale, rose-coloured flowers, nearly two and a half inches across. Propagated by layering or by cuttings with difficulty.

*Smilax.* (N. O. Liliaceae). Genus of economic and ornamental creepers. Most of them have prickly stems. Roots of some species, known as Sarasaparilla, are used in medicine and in making cool drinks (syrups). The garden species are trained against sunny walls, arbours, trellises or banks. They thrive in shade and climb against trees; require a loamy, well drained soil. Propagated by division of roots at planting time. *S. argyrea* and *S. oregata* are two favoured kinds.

*Solanum.* (N. O. Solanaceae). Solanums are best suited for upcountry.

*S. jasminoides,* called the Potato Creeper, is a large, shrubby, heavy climber, reaching several feet in height and hence suitable for growing against large trees. Bears small, star-shaped, pretty flowers, which are white and tinted with light blue.

*S. jasminoides variety grandiflorum* bears very large trusses of flowers. Both the above do not thrive in the plains but do well from medium to high elevations.

*S. Seaforthianum,* called the Blue Potato Creeper, is a small climber, with pretty clusters of white and blue flowers,
which are succeeded by crimson berries. Can be successfully
grown in a pot, furnished with a support.

*S. Wendlandii is a vigorous growing species, a magnificent
climber, with prickly stem and branches and slightly prickly
leaves, which are deciduous. Flowers are nearly two inches
across, lilac blue in colour, and are borne for several weeks in
large pendulous cymes, which are 18 inches or more across.
Requires severe pruning after flowering. Enjoys full sun-shine.
Is moisture loving. For best results, restrict the flowering to
only a few leaders, about half a dozen on each plant, which
may be cut back 4 to 6 feet of previous year's growth. Remove
all old wood. Propagated by seeds, cuttings or by layering.

Stephanotis floribunda. (N. O. Asclepiadaceae). Called the
Clustered Wax Flower or the Creeping Tube-rose. An ever­
green, very popular, choice climber with thick, glossy leaves,
bearing freely, strongly scented, tuberose-like, waxy-white,
tubular flowers in large clusters. Does well in a north-east
aspect, in rich loamy soil, rendered porous by broken bricks
and old mortar or lime. Perfect drainage and regular water­
ing, just keeping the soil moist, are necessary for success. Fre­
quent syringing of the plant does good. For established plants,
stimulants may be applied once a month. Straggling shoots
should be pruned and weak ones should be thinned out. Suit­
able for arches or for growing in large pots with balloons.
Propagated by layering.

Stigmaphyllum aristatum. (N. O. Malpighiaceae). Choice,
small, evergreen, very handsome climber, having glossy leaves
and bearing bright yellow flowers, with fringed petals. Suited
for a small trellis or archway near the house. Thrives in sandy
loam containing much humus. Propagated by layering.

*Tecoma jasminoides. (N. O. Bignoniaceae). Graceful,
evergreen climber, with bright, polished, dark green, pinnate
leaves, flowering throughout the year. Flowers are very
attractive, have a tubular corolla, are white and much expand­
ed and streaked with rose purple in the throat and are clustered
in large, compact, terminal bunches. Suited for archways or
for growing in large tubs or pots furnished with suitable frame­
work.
T. grandiflora bears very large bunches of terra-cotta Bignonia-like flowers. It is furnished with pretty foliage.

T. rosea produces sprays of pink trumpet-shaped flowers, which are useful for cutting.

**Thunbergia.** (N. O. Acanthaceae). The genus includes a large number of climbers which are very vigorous growing and free flowering. They are like Allamandas, great favourites, useful for growing on porches, arbours, verandahs, old trees, trellises, arches etc., but as a class are, unlike Allamandas, subject to bug and scale pests. Vigorous pruning is harmful and may prevent free production of flowers. The following species are recommended:

*T. grandiflora* is a large, extensive, climber with heart-shaped leaves, about six inches long. It is a very vigorous grower, rapidly covering an entire tree with rich foliage. But, it can be kept down within proper limits by judicious training and use of shears. Flowers are large, widely expanded, two to three inches long and broad, of a pale blue or lilac colour; they are solitary or in short stout racemes in leaf axils, borne in all seasons, but principally in the cold season. The plant is easy of culture; thrives in rich stony soil and requires a free supply of water. Suited for trellis of tennis courts. Native of Bengal. *T. grandiflora alba* is a white flowered variety of the above. It is very handsome in bloom.

*T. mysorensis.* (Syn. Hexacentris mysorensis) is a good climber of good covering capacity, not so heavy as *T. grandiflora.* Leaves are about six inches long, elliptic-acuminate and rounded at the base. Flowers are coloured yellow, red and purple and are borne in chainlike pendulous racemes, gracefully hanging down from the slender shoots, being orchidlike in appearance. An arch or a pendal, covered with this creeper with its drooping long pedicilled racemes, presents an enjoyable sight from January to March. It is known as the Manjarabad Creeper, as it is a native of that taluk in Mysore State. Propagated by layers.

*T. coccinea* (Syn. Hexacentris coccinea) is similar to the above but has smaller leaves and bears smaller racemes of red flowers.
T. alata includes light creepers of many forms, including the "Black-eyed Susan" which is orange coloured with dark centre.

T. fragrans is another light creeper with snowy white flowers. T. Gibsonii bears orange coloured dazzling flowers. All the above three climbers can be treated as annuals of the cold season in the plain country.

*Tristellateia australis. (N. O. Malpighiaceae).* A very handsome, woody, small climber flowering very freely throughout the year. Flowers are bright yellow, in axillary and terminal racemes. Propagated by seeds or by layering. Can be grown in a large pot, furnished with a balloon.

*Vallaris Heynii. (N. O. Apocynaceae).* Twining shrub with pretty light green foliage, bearing creamy-white, cup-shaped sweet scented flowers in cymes of about ten flowers, twice or thrice a year. Propagated by suckers, which it produces in plenty or by layering.

*Vitis discolor.* See Cissus discolor.
CHAPTER XXII

PALMS AND CYCADS

PALMS

There are as many as about 150 genera and several hundred species of Palms, though the amateur gardener is familiar with only a few which interest him. Palms and their allies form a very extensive group of plants, truly noble and majestic and of tropical grandeur. They are, excepting one genus which is a native of Europe, natives of the tropics. They have a marked general appearance which makes it easy to recognise them. But, there are wide variations in form, size and habit in the several species. Most species have an unbranched, erect, tall, cylindrical or columnar stem, which is called the caudex. In some species, however, as in Attalea Cohune, the stem is very short and the leaves look as if they originate direct from the ground. Others like Calamus, have long canelike slender stems armed with hooklike spines, enabling them to climb large trees. While in some species, the caudex is smooth, it is marked by scars and depressions left by fallen leaves or their stalks in others. Leaves also vary much in form and size. Palms are generally grouped under two heads, the fan-leaved and the pinnate or feather-leaved kinds. In the former class to which belong Chamaerops and Latania, the chief veins of the leaf-blade appear to rise from the top of the leaf-stalk and to radiate like the ribs of a fan through the leaf-blade. In the pinnate-leaved section, which includes the Phoenix or the Date Palm, the chief veins run out of the sides of a long midrib, the leaf being very often divided into long and narrow segments. All Palms are endogens, the stems of which grow by additions developed from the inside, do not increase much in thickness, and do not show any distinction into bark, wood and pith. Flowers are produced in spikes but they are not much, though in some kinds, as in Caryota urens, they hang down gracefully, clustered in large trusses.
Palms are of great ornamental value. For decoration of conservatories, verandahs, stair cases, for avenue planting, for decoration of shade gardens etc., Palms present a number of species to choose from. Though a majority of Palms attain great heights when planted out, they are grown as "dwarfs" in pots or tubs in restricted root space. On account of their very slow growth, they can be kept in pots, remaining in beauty for many years. Certain Palms are of great economic value, some of them affording shelter, food, clothing, fibre, timber, oil, sugar, starch, wax, wine, resin, tannin, dye-stuffs and many other products of great utility. The importance of the Date Family and the Coconut is well known.

Palms are easy to cultivate. They are tropical in nature and thrive in a warm humid atmosphere in light loamy soil containing a large quantity of humus. They grow both in shade and sun and rapidly recover if they have suffered from heat or cold. At medium elevations, they are not so rapid in growth as in coastal regions where a salty and warm humid atmosphere prevails. They can be grown under glass in Hill stations. There are very few diseases and pests to which Palms are subject. Scales and mealy bugs are often noticed on the veins of leaves and at the bottom of the stem hidden under the bases of leaves. The stem should be kept clean and old leaves and leaf-stalks should be removed carefully without injuring the stem. Parts of the stem infested may be sponged and sprayed with fish oil soap. Rhinoceros beetle attacks young shoots boring holes and making way for weevils which may kill the plant in course of time. The beetles are best killed by transfixing them with wires thrust into the holes. Caterpillars are often seen attacking foliage of Cycads. Palms should be regularly and liberally supplied with water. Palms which suffer by neglect in watering seldom recover.

Palms are propagated from seed. Some kinds as Raphis, which produce a number of suckers from the base, are increased by dividing the clumps into several pieces, each having some roots. Propagation of Palms from seed is very slow, taking some years before plants of desirable size are secured. Seeds vary in size from the size of a pea to the size of a coconut.
Palms and Cycads

or larger, in the several species. They are covered with a thick coating which makes germination very slow. They should be sown in well drained fine soil and covered to the thickness of their diameter. The seedlings should be lifted as soon as the first pair of leaves appear and potted off singly in small pots; the pots chosen should be just sufficient to accommodate the roots and the fruit with some little soil. Seeds may be sown at any time of the year, but it is best done in the Spring. As the plants grow and fill the small pots they are in with roots, they should be shifted to pots of the next larger size, holding about one inch more of soil all round the old ball of earth. As Palms emit long roots, the seedlings would suffer much if they are not removed early and potted.

A few points require to be emphasized in the cultivation of Palms in pots. They prefer to be pot-bound and thrive in under-sized pots. They are best allowed to remain in the same pots till the roots increase and fill them, almost to the point of breaking or forcing the pots open. At the time of repotting, the fleshy large roots are best not injured. After removing the crocks at the base, the plants should be repotted with the ball of earth intact, using a pot of the next larger size allowing fresh soil all round to a distance of 1½ inches. Planting should not be too deep. The collar, that is the point where the roots emerge from the caudex should just rest on the soil surface. Top dressing once or twice a year is necessary. The foliage is kept fresh and green by feeding the plants with weak liquid manure. Oil cake water may be alternated with weak ammonium sulphate solution (¼ oz. per gallon of water) once in fifteen days. Regular supply of water, overhead watering once in two or three days by syringing, good drainage and periodic supply of weak liquid manure conduce to healthy specimens.

The following are the more attractive Palms for the garden:

**Areca.** Genus of elegant pinnate-leaved palms, widely distributed over the world. The commonest economic species is *Areca Catechu*, The Beetle Nut Palm, which is commercially grown. The following are the more ornamental species:
*Areca alba.* Native of Mauritius. Handsome species very useful for table decoration in the young state. The stem is slender and attains a great height. In the palmery or the fernery, it is beautiful only till its stem is 6—8 feet high. Leaves are four to eight feet in length.

*Areca lutescens—Chrysalidocarpus lutescens* is a native of Madagascar, forming large clumps, twenty to twenty-five feet high. A very popular graceful species, with arching leaves; very ornamental in pots or tubs and useful for planting out on lawns or in shade gardens. Propagated by suckers or from seed.

*Areca triandra variety Banca.* Native of Assam and Burma. Similar to but prettier than the Betel Nut Palm.

*Areca rubra.* Areca rubra is synonymous with Acanthophaeae rubra.

*Areca madagascariensis* is the same as Dypsis madagascariensis.

*Arenga.*—*Arenga saccharifera,* called the Sugar or Sago Palm. A beautiful and magnificent tall species, with enormous shining dark green pinnate leaves, 20–25 feet long with a graceful curve towards the summit, thrown up erect from the sides of the trunk. Effective if planted at the entrance of the garden. Excellent for forming a grand avenue. A native of Moluccas. The medulla of the trunk is used as sago and from its juice, an excellent sugar is made.

*Calyptocalyx spicatus.*—A nice palm for pot culture. Has got the appearance of Chamaerops excelsa.

*Caryota.*—Caryotas are quick growing large palms with large broad leaves, which are finely cut up. The small divisions or the leaflets are delta or fish-tail shaped, and hence Caryotas are popularly called Fish-tail Palms. They are good for avenue purposes. They are striking in bloom, the large flower-spires very gracefully drooping down from the axils of leaves. Flowering proceeds from top downwards, a spike issuing out of the axil of each leaf and the plant dying when the lowermost axil is reached. Caryotas yield toddy, hence also called Wine Palms; from the wine a sugar is obtained. Best species are:
C. sobolifera is an elegant species with slender stem, bipinnate curious leaves and bright light green leaflets. It is a comparatively dwarf species, producing suckers from the base, from which it can be increased.

C. urens. (Canarese, Bhagini), called the Malabar Sago Palm or the Wine Palm, is the largest species of the genus, attaining a height of about 60 feet in its native home, with leaves 18 by 12 feet, the pinnae being 5 feet long, curved and drooping. A healthy plant with its long drooping spadices is a handsome object in the garden.

*C. mitis and C. ochlandra are other handsome species.

Chamaerops.—Mostly slow growing plants of medium height, with fan-shaped leaves. Very easily grown and highly ornamental. Propagated from seed and sometimes by suckers.

C. excelsa. Plants three to four feet high are very handsome. The large broad fan-shaped leaves are cut up deeply into segments. The leaf-stalks are armed with spines at the edges.

*C. elegans is similar to the above.

*C. humilis (dwarf) is a very fine species. Produces suckers at the base, which should be removed, if a tall plant is desired, retains its health for several years without growing large.

C. filamentosa and C. tomentosa are other handsome species.

Cocos.—Genus of graceful palms, to which the Cocos nut palm, Cocos nucifera, belongs. Most of the species are very tall growing but some are medium sized and fit for the plant house.

C. nucifera is the common Cocos Palm. For ornamental purposes, the King Cocosnut, with yellow or green fruits, (there are two varieties) is eminently suited. The fruits are borne early; the plants start fruiting when the stem is barely three feet high, the long graceful bunches touching the ground.

*C. plumosa is an attractive palm, a native of Brazil. In its young state, it is a splendid decorative plant in any situation.

*C. Weddellana is a very elegant and graceful palm, smaller than the other species. Very difficult to grow.
*C. Romanzoffiana* is very handsome, when young. Fit for ground culture.

*C. cornuta* is another graceful ground palm.

**Corypha.**—Genus of fan-leaved palms, growing to a great height in their native home, but striking when young, with their immense leaves. They are of very slow growth.

*C. Gebanga* is a noble, extremely slow-growing palm, retaining its beauty in a pot for many years.

*C. australis* and *C. umbraculifera* are other handsome species.

**Dictyosperma.**—*D. alba*. A fine palm; a hardy, strong grower. Makes a good, bold, beautiful, specimen plant.

*D. rubra* is another handsome species.

**Elaeis guineensis.**—Economic ground palms, called the African Oil Palms. They are handsome for pot culture too. *Elaeis guineensis* variety *abepa; abedam; ewakwa; Banga;* and *Lisambe* are all desirable kinds.

*Geonoma gracilis.*—This and the other members of the genus are small elegant palms, suitable for medium elevations. They are like Kentias and come from Tropical America. Useful for table decoration.

**Heterospathe elata.**—A fine species, resembling *Cocos* in appearance.

**Howea.**—Called after Lord Howe's Island, where the two species grow. They are known as Kentia in trade. Very attractive and popular and useful for decorative work.

*H. Belmoreana* and *H. Fosteriana*. See under Kentia.

**Hyophorbe.**—Genus of massive, elegant palms with bottle-shaped caudices, attaining medium height surmounted by a crown of beautiful bi-pinnate leaves.

*H. amaricaulis* resembles a *Cocos* or an *Areca*, but the stem is stout and swollen at the base. Leaves are four to six feet in length, spreading and red veined. Known as *Areca speciosa* also. Is ornamental in pot and in ground.

*H. Verschaffeltii*, also called *Areca Verschaffeltii*, is a slow growing very ornamental palm, with leaves four to six feet long, arching gracefully at the top and white veined.

**Kentia.**—Handsome genus, resembling the *Areca* to some
extent but differing from it in the plants having a decumbent growth in the young state, while the Arecas are upright from their young state. Kentias are very handsome, hardy palms with pinnate leaves, and with quite smooth and spineless stems and leaf-stalks. They are very valuable in pots for decoration of plant houses or shade gardens. The two species of Howea are commercially included in Kentia. The following are noteworthy species:

*Kentia (Howea) Belmoreana* is an extremely graceful palm with long large gracefully arching pinnate leaves.

*Kentia (Howea) Fosteriana* is similar to the preceding and is a very graceful beautiful species.

*Kentia Canterburyana* is another very beautiful species.

*Kentia Sanderiana* has a very slender stem and gracefully arching leaves. A very beautiful graceful species.

*K. Lindenii* (Syn. Kentiopsis macrocarpa) is a handsome vigorous growing species.

K. Mc. Arthuri and K. Wendlandiana are also handsome.

Korthalsia.—Mostly climbers, allied to Calamus or Cane palms; only one or two species are worth cultivating in gardens.

*K. Junghuhnii* is a spiny climbing species, with pinnate leaves.

Latania.—Handsome family with large fan-like leaves. In the young state, they are splendid objects for decoration.

*L. rubra* = *L. Commersonii*. A striking, very handsome, distinct species with a smooth and slender red stem and rich shining, brown-green, red-veined, deeply incised, gracefully recurved leaves. Leaf-stalks are long and smooth and are coloured bright crimson, as are also the ribs of the fan-like leaves.

*L. aurea* = *L. Verschaffeltii*. Also a beautiful species, with stout stem and erect deeply incised, somewhat-spreading light green leaves, with ribs of golden colour. The leaf-stalks are 2–4 feet long, slender, smooth, and orange-yellow in colour.

Licuala.—(Prichardia). Tropical very ornamental fan-leaved palms. Some species are also called Prichardias. The following are recommended:
*L. grandis* (Prichardia grandis); *L. elegans; L. gracilis; *L. horrida; L. peltata;* and *L. spinosa.*

**Livistonia.**—Fan-leaved, very ornamental palms. Suited very well for pot culture.

*L. rotundifolia; L. mauritiana; *L. altissima; *L. Jenkinsii; L. australis* and *L. chinensis* are all very good palms for decoration. *L. Chinensis* is the best known and it is also called *Lantana borbonica.*

**Martinezia.**—*Martinezia caryotaeifolia* and *M. trynca* are both from South America and highly ornamental. The stem and leaves are spiny.

**Oreodoxa.**—A small genus of elegant Tropical American palms, with slender rigid swollen stems bearing large terminal pinnate leaves, with long sheath-like stalks forming a cylinder around the summit. They should be sheltered from winds to maintain them in a beautiful state. They are fit for ground culture and are unsurpassed for majesty and grace.

*O. regia,* called the Royal Palm, Bottle Palm, is a tall and stately growing species, with the stem usually barrel-shaped, attaining a height of about 30 feet in Bangalore. Suited for garden avenues.

*O. oleracea,* called the Cabbage Palm, is also effective in avenues. The stem is slender and swollen at the base. Leaves are four to six feet long with gracefully arching leaflets.

**Phoenix.**—Genus of ornamental and economic palms including the Date palm and the Toddy or Sugar palm. The following species are very useful in pots for decorative purposes.

*P. Roebelinii* is a highly ornamental species, with graceful light feathery arching pinnate leaves, almost hiding the pot from view.

*P. rupicola; P. cycadifolia; P. Zeylanica; P. reclinata and P. spinosa* are all good looking. Even the common Toddy palm, *P. sylvestris,* is handsome while young.

**Pinanga.**—Dwarf slender stemmed palms, admirably suited for table decoration while young. Have the appearance of Areca.

*P. patula* and *P. Kuhlii* are worth cultivating.
**Pritchardia.**—A small very ornamental genus, with flabelate (fan-shaped) plaited leaves.

*P. grandis* is a very elegant palm, very beautiful with its immense rounded lace-edged leaves of bright polished green, growing out of a base and forming a cluster.

*P. pacifica* is also a very ornamental species, with large broad flabelate plaited leaves, often 4½ feet and 3½ feet broad.

*P. filifera* and *P. robusta* are other attractive species.

**Ptychoraphis augmanta.**—A very ornamental palm, like the Cocosnut palm when young.

**Ptychosperma.**—Allied to Seaforthia and Kent*a*. Have comparatively slender stems and pinnate leaves.

*P. Macarthuri (Syn. Kentia Macarthurii)* is a very handsome palm, for pot culture.

**Raphis.**—Dwarf, rattan-like palms with slender stem and fan-shaped leaves, deeply cut into segments. They are excellent for bushy clumps in shade gardens or for pot culture. They produce very freely large number of suckers and are mainly increased by division of these.

*R. flabelliformis* (Ground Rattan Palm) is a native of China and Japan. Elegant slender growing plant, very useful for planting in shade gardens and growing in tubs.

*R. humilis* is a more elegant species, with larger leaves, than the preceding.

**Seaforthia elegans.**—A striking palm, resembling Areca alba. Has a somewhat stout stem. Fit for growing in the ground. Called the Bungalow Palm.

**Stevensonia grandifolia.**—Is one of the finest cultivated palms. Leaves are between the feather-veined and the fan type. It is a magnificent stemless palm from the base of which spring the copper-coloured stalks, studded with black spines. When young, the leaves are very handsome, being of a rich-cinnamon-brown colour. Difficult to grow.

**Thrinax.**—Dwarf fan-leaved palms including some very beautiful kinds.

*T. argentea* is a well known species with large fan-shaped leaves. They are shorter than the petioles and silvery-silky beneath.
T. barbadensis; T. parviflora and T. elegans are all handsome.

CYCADS

Order of small palm-like trees or shrubs, closely related to the conifers in fructification and having stems marked with leaf-scars. Leaves are unbranched and pinnate, surmounting a stout stem and resembling those of Palms in aspect. The soil suited for their culture is the same as that required by palms and the method of treatment too, is the same. Propagation of Cycads is chiefly by the large bulb-like buds, which appear at intervals on the stem; these grow freely when taken off the tree and planted in well drained soil in a moist shady situation. Cycads are also increased by seeds and suckers. Male and female flowers are borne in separate plants and the female flowers should be pollinated by hand to insure fertilization; seeds should be collected on ripening and sown within a month. All cycads are very slow growing; they may be either grown in the ground or in large pots or tubs. When growing, they should be given partial shade. Of the nine genera, only three, namely, Cycas, Zamia, and Microzamia are suited for cultivation in gardens.

Cycas: A genus of hardy palm-like plants of great beauty, useful for planting out on lawns or growing in large tubs, for decorative purposes in the young state. The stem is short and cylindrical, and is usually unbranched and terminated at the top by a fine crown of deeply cut pinnate leaves varying in length from two to six feet. When young, the leaves are pale green but the mature leaves are dark shining green. The plants are very slow in growth and they have a tendency to throw out suckers, from which they are increased. Propagation is also effected by seeds. *Cycas circinalis = C. Rumphii and *C. revoluta are the species worth cultivating, especially as ground plants.

Zamia: this genus differs very little in general appearance from Cycas but the leaves are more feathery and fern-like. The leaf-stalks have the appearance of growing out in a tuft from the summit of the stem. Zamias require partial shade
for successful growth. They do well in the ground. Propagated by seeds and offsets.

*Z. integrifolia* and *Z. Lindenii* are desirable species.

**Macro-zamia**: Genus closely related to Zamia, growing in swamps near the sea. They are moisture loving and succeed very well in damp places. They rarely seed or throw out suckers in this country and hence have to be imported from Australia. *M. spiralis* is from Australia. It is a handsome species.

**Encephalartos** *Hilbrandii* and *E. cafra* are two other ornamental Cycads.
FERNS AND SELAGINELLAS

Ferns are a very extensive family of plants, comprising of several genera and thousands of species, remarkable for the beauty and gracefulness of their foliage. There is a wonderful variation in the size, habit and appearance of the several species. Ferns in pots are greatly used as groundwork for groups of flowering plants. Cut fronds are mixed with cut flowers in bouquets and vases. Many kinds are useful as subjects for wire or hanging baskets and verandah and plant-house embellishment. On account of their extreme popularity, plant-houses, called ferneries, are exclusively devoted to them.

Ferns are naturally found growing on hills and dales, luxuriating in shady spots overhanging a sheet of water, a running brook, or waterfall; they are found attached to soil mainly composed of light fibrous mould, formed of decayed moss and leaves; they exhibit a greater luxuriance, wherever they grow on lime-stone rocks. It is to be seen thus, ferns are not ardent lovers of bright sun-shine; they luxuriate in a still, moist atmosphere; and they thrive in a well drained light porous soil, with a fair quantity of lime in it. If the above conditions are provided for, there won't be any difficulty in growing them. There are several hardy kinds however, as Nephrolepis exaltata which would grow in any good garden soil and in situations exposed to the sun.

Most ferns thrive in moderate sized pots. 7 to 8 inch pots would do ordinarily but for specimen plants, larger but shallow pots are to be used. Those in small pots are to be repotted every year and those in large pots to be top-dressed every year and repotted once in two or three years. The best time to repot is when the plants begin growth in Spring—from February to April. All dead stems and roots are removed without disturbing the roots much and the clumps are divided into two parts one larger than the other, the larger one being put...
into the same pot and the other put into a much smaller pot; for ferns grow and spread rapidly filling the pots with roots soon. Care is to be taken not to bury the crowns or growing points under the soil. Compost no. 7 recommended on page 113 is the best for general use. Extra drainage is provided for as the plants require to be continually moist at the roots. The atmosphere all round is kept cool and moist by syringing the ground and the sides of the pot with water. This is particularly necessary in summer. Periodical overhead syringing benefits most ferns; but, there are some ferns, as Maiden Hair Ferns and the Silver and Gold Ferns, which dislike overhead watering.

Ferns, in general, are best increased by means of their spores, the dust produced on the back of the fronds. Spores are minute seedlike bodies, developed in spore cases (sporangia), produced in lines or clusters on the underside or the margins of fronds and rarely on their whole surface. The spore arrangement in different species and genera vary and that is the basis of fern-identification. For propagation of ferns from spores, the fronds should be carefully examined frequently so that the spores may be collected as soon as they are ripe. When the sori turn brown, the fronds are cut and allowed to dry in paper bags. Though some kinds germinate even when kept for several years, sowing is done when spores are still fresh. Sowing of spores is done in broad well drained seed pans, half filled with crocks and the remainder, up to half an inch from the top, with a mixture of small pieces of brick, fine, sifted loam and leaf-mould; the soil is firmly pressed and watered through and the ripe spores scattered over it and immediately covered with a plate of glass. The pan is then placed in a warm, shady situation and placed in a saucer containing water. The spores germinate, throwing small peculiar leaves (prothallus). When these are fit to be handled, patches of them are lifted with the end of a flat stick and pricked out one inch apart in well drained seed pans filled with fine soil mixture of equal parts of leaf mould and sand. The pots are carefully watered and kept moist in shade. As the plants become large enough, they are potted singly in small pots. Until fronds are well developed, it is advisable not to water the foliage from above. Propagation by spores can be effected at any time of the year.
Ferns are also increased in a variety of other ways, depending upon the habit and mode of growth of the kinds concerned. Amateurs invariably increase their stock of plants by division of the clumps, whenever possible and rarely resort to propagation by spores, though new varieties are obtainable by the latter method. Those ferns, which have creeping rhizomes, such as Davallia, are propagated by cutting them into bits with roots and potting them. In such kinds, the points of the rhizomes can be laid over and layered too into small pots. The best time for propagating creeping rhizomes is Spring at the repotting time. Some species such as Asplenium bulbiferum and A. viviparum produce a veritable multitude of youngsters on their fronds; in some kinds these new growths, drop off when mature, when they are collected; in others, they are carefully removed from the fronds and planted in moist sand, with their crown uncovered. After they have struck roots, they are potted singly. It is advisable in some cases to lay the entire frond with the buds on them flat in sand and cover the frond in such a way that the buds peep out of the soil. In course of time, the buds strike root, giving rise to as many plants as there are bulbils. Some kinds as Woodwardia radicans produce a solitary bud at the apex of the frond which is rooted by pegging the tip of the frond into the soil. Caterpillars and a scale insect, similar to the San Jhose scale, at times attack ferns. Caterpillars of a usually green or brown colour, lie hidden in the foliage and should be carefully picked out. Plants badly infected with scales are better destroyed by fire, as scales are difficult to be treated satisfactorily. If the plant is too valuable to be destroyed, it should be removed far away from the healthy plants lest the infection should spread to them.

Space permits only the following short list of choice ferns, which might however be extended:—

*Adiantum.—Called popularly the Maiden Hair ferns. A very extensive genus with remarkable similarity in general aspect. Leaves have usually polished black or purplish stalks and thin delicate blades, simple or divided into fan-shaped segments, with the outer margins revolute, covering...
The fronds cannot be wetted, even by dipping them in water, and hence, the generic name adiantum is derived from the Greek word meaning 'unwetted.' Adiantums are easy of culture and they flourish in the general compost for ferns recommended above, growing on an average about a foot or more high. They do not like being watered or syringed on the foliage and they do not thrive in direct sunlight. Amateurs increase them by division of clumps. When large quantities have to be grown, spores should be sown in well drained pots, supplied with plenty of moisture. In about ten weeks real fronds make their appearance. When these are about an inch and a half high, the young plants are potted individually in six inch pots. In a year these get filled up by the growing plant.

The following species are recommended:—

*A. Victoriae, *A. Farleyense and *A. tenurum, best for specimen plants; *A. concinnum and its varieties; *A. cuneatum, variety grandiceps; *A. gracillimum; *A. Lawsonianum; *A. La-grande; *A. macrophyllum; *A. Mooreii; A. ciliatum; (for basket); *A. pectinatum; A. trapeziforme; *A. veriegatum; *A. venustum; A. formosum; A. decorum; A. pedatum; *A. peruvianum (for specimen plant); *A. villosum; and *A. Pacotii.

*Asphila.—Called the Grove Fern; Norfolk Island Fern. A genus of ornamental tree ferns, fit for growing in large conservatories, where plenty of space is available. The term "Tree Fern" is usually applied to ferns belonging to the order, Cyatheaceae. Tree Ferns generally have an erect tall stem or trunk, resembling that of a tree. The leaves are large and borne from the trunk at the apex forming a palm-like crown. As the leaves fall, they leave scars on the stem. Tree ferns exist in nature as undergrowths under large trees in large forests, where there is good rain fall. Hence, they love moisture and partial shade. *A. excelsa and *A. australis are handsome. Give plenty of water and syringe frequently and tie up moss all round the stem to keep it cool. Only suited for up-country. *A. latibrosa is another handsome species.

*Anemia.—Called the Flower-Fern or the Ash-leaved Fern. Group of small-growing ferns, suitable for pot culture or in
baskets. Propagated from spores like Adiantum. *A. rotundifolia is a very desirable species.

**Angiopteris.**—Called the Turnip Fern. Large growing with long fronds, often 4 to 5 feet long; very well suited for growing by cisterns in the ground in ferneries or shade gardens. Propagated by offsets. *A. evecta grows about 8 feet high. Suiited only for up-country.

**Aspidium.**—Not a very ornamental group of ferns. *Aspidium aculeatum* is a well known species, called the "Hard or Prickly Shield Ferns". Its fronds are about two feet long, stiff and twice pinnate. *A. curvatum* is another hardy species. Suited for up-country only.

**Asplenium.**—Genus of attractive ferns, the different species, varying in aspect. Some have simple entire leaves; others have fronds, which are finely divided. Propagated by spores, which are produced in great abundance. The following species are important:

- *A. nidus avis* is the Bird's Nest Fern, with large shining green undivided fronds, which are nearly four feet long in a well developed plant and form a cuplike cluster. A very decorative specimen plant for growing in large tubs.
- *A. bulbiferum* (2–3 feet); *A. formosum* (dwarf growing). *A. caudatus*, superb basket plant with drooping long fronds. *A. lamatifolium* and *A. dispermum* are others.

**Blechnum.**—Brazilian Tree Ferns. Genus of low growing tree ferns, useful for decoration indoors, resembling *Lomarias* and bearing palm-like leaves. *B. occidentale* with deeply divided and *B. cartilagineum* with pinnate fronds are very desirable species.

**Davallia.**—Called Hare's Foot Fern or Bear's Foot Fern. One of the most handsome group of ferns with scaly creeping rhizomes, bearing some fancied resemblance to a hare's or a squirrel's foot. Some of the species are suited for growing in tubs for decoration indoors and some species are excellently suited for growing in baskets. *D. bullata* is well suited for training round fancied frames as birds, animals etc. Some handsome species are:—*D. bullata* (known as Squirrel's Foot
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*D. fijiensis* and its variety *plumosa*; *D. strigosa*; *D. tenuifolia*; and *D. canariensis* (known as Hare's Foot Fern).

*D. fijiensis* has fronds 18—24 inches long and divided four times into very fine segments. It is capable of being grown as a specimen plant in a large pot or tub.

*Drynaria.*—Allied to Polypodiums. An extensive genus, some species being very hardy and suitable for outdoor work in pots. *D. quercifolium* has large leaves, resembling those of the Oak and it is suitable for growing in seed pans.

*Gymnogramma.*—A group of singularly attractive ferns, noted for their elegance. The undersurfaces of the finely cut leaves of some species are densely covered with yellow or white powder or farina and hence the popular names, the Gold and Silver Ferns respectively. These ferns should not be subjected to overhead syringing at any season. They thrive in moderately small pots. Some handsome Golden Ferns are *G. sulphurea* (tall and dwarf varieties); and *G. chrysophylla.* Some of the Silver Ferns are *G. tetrataea* and *G. pulchella.*

*Lomaria.*—Closely related to Blechnum, being smaller Tree Ferns, interesting and useful. *L. Gibba* is a handsome hardy species.

*Lygodium.*—Genus of climbing ferns, with slender twining fronds and divisions, tongue or hand-shaped. *L. scandens* is a native of Mysore; it is slender and graceful with exquisite filigree-like fronds; it thrives very well in the plains and can be made use of to cover pillars of a portico or inside ferneries with great effect. Lygodiums are useful for pot culture over balloons. *L. japonicum*; *L. palmatum*; and *L. circinatum* are other attractive species.

*Nephrodium.*—Large genus, midway between Aspidium on the one hand and Nephrolepis and Polypodium on the other hand, with pinnate or compound fronds. As a class, Nephrodiums are very hardy and handsome, being very useful for decoration of verandah and some even outside. There are several beautiful species, with an average height of 18—24 inches, varying in texture, cutting and venation. All the species are easy of culture. *N. cuspidatum*; *N. molle*; *N. decurrens*;
*N. patens cristatum; *N. polymorphum; *N. setigerum are some of the more attractive species.

**Nephrolepis.**—An extensive genus of highly attractive hardy tropical ferns. Several species are suited for growing in baskets. The plants are distinguished by the slender runners or stolons produced freely from the old stems, by the pinnate fronds, free veins, roundish spore-clusters arising from the apex of the upper branch of a vein, usually near the margin, and by the kidney-shaped or roundish indusium. Of the more attractive species, the following are noteworthy:—*N. acuminata;* and its variety furcans; *N. cordifolia* and its varieties, *N. davalliodes furcans;* *N. exaltata* and its varieties such as elegantissima and compacta; *N. rufescens* variety tripinnatifida; *N. mucosa;* *N. Marshalli* and its variety compacta resemble bushes of moss about a foot or less high, the fronds being very finely cut and dense, with spongy and soft feeling to the touch.

**Onychium.**—*Onychium japonicum* is a small fern growing about a foot high, with fronds which are four times divided, light and graceful. Fine for indoor decoration.

**Osmunda.**—Small genus of attractive ferns, remarkable for their distinct appearance. The fronds are feather-shaped, plain or crested. The fertile portions are contracted. *O. regalis,* well known as the Royal Fern or the Flowering Fern is the best species. It grows five to six feet high, having twice pinnate barren fronds and cylindrical trusses of fertile fronds thrown up in the centre.

**Pellaea.**—Called the Cliff Brake-Fern. Almost all the following are good species, being mostly low growers and suited for growing in baskets. *P. cordata;* *P. falcata;* and *P. geraniaefolia* are useful.

**Platycerium.**—Called the Stag horn Fern or Elks horn Fern. The fronds are more or less broad and divided like the horns of a stag. Platyceriums are epiphytic and hence can be grown on logs of wood like orchids. They can also be grown in hanging baskets, like Orchids. *P. alicorne* is the common Elkshorn Fern; it will make specimens 1—2 feet in diameter when suspended in a basket.
Polypodium.—A section is known as Drynaria. (See under Drynaria). A large genus with many ornamental plants. Many of them produce strap-shaped or tongue-shaped, undivided fronds, more or less of a leathery character. *P. quercifolium, oak-leaved (Drynaria quercifolia); P. verrucosum; and P. aureum (Phlebodium aureum) are handsome.

Pteris.—Large genus of several attractive species, some of them having handsomely variegated fronds. The following are noteworthy:—*P. argyreae has a white band running down the centre of the pinnae; P. cretica; *P. cretica, variety albo-lineata has a broad central white band; P. geraniefolia; P. longifolia; P. ludens; P. Mariesii; P. palmata; *P. quadriarita and its variety argyreae; P. serrulata and its variety cristata; P. tremula; P. tripartita; and *P. Victoriae. All are excellent pot plants.

Selaginella
Called the Club Moss or the Creeping Moss or Lycopodium. A large group of mostly tropical plants, with fern-like foliage, the fronds being creeping or erect and branched. In some species, the foliage is variegated. The plants are easily recognised by the stems bearing four rows of scale-like leaves. Selaginellas are shade loving plants and are grown like ferns. They are useful in more ways than one: some are grown in pans as semi-aquatics; some are grown on rockeries, making a carpet of emerald green; some again are used as edging for beds in shade gardens and for covering the surface soil of large tubs etc.; and the foliage is also used in bouquets in place of Asparagus and fern-fronds. Selaginellas are at their best in the rainy season and the best time to propagate them, which is usually done by division or cuttings, is during the rains. The following species are noteworthy:—S. caulescens; S. denticulata; S. erythropus; S. Emiliana; *S. serpens and *S. Wilde-novii. The last is also known as Lycopodium caesum- arboreum. It is very useful for pillars, for covering walls in a moist warm house and should be planted in fibrous peat.
Grasses. (N. O. Graminae) are one of the most useful families of plants to man. Many of them are ornamental and are well represented in our gardens. The section of annual grasses, the seeds of which are much advertised, do not, excepting a few, satisfactorily thrive in the plains of India, though on the Hills, they make a good show. They are not only ornamental while growing but their flowers are useful for cutting, being often used in vases with everlasting flowers or independently of them or with other subjects. The seeds are sown thinly in damp weather in six inch pots and covered lightly. The seedlings are thinned out an inch apart. In six to eight months, the plants develop into fairly large specimens and bear panicles of flowers. Some of the annual species of grasses make good pot plants, while some thrive well on rockeries. Of the perennial kinds, the large growing species such as the ornamental Bamboo, the Pampass, and the Gynnerium look pretty, when planted in clumps or in avenues or by the margins of ponds. The smaller growing perennial species as Tricholaena rosea, Lagurus oratus (Hare's tail grass), are eminently fitted for pot culture and rockeries.

Most of the grasses are hardy and are easy of culture. They grow in any ordinary garden soil which is not waterlogged, in shade or sun. They are propagated from seeds, by division of root stocks or by cuttings.

The following is a list of select grasses for cultivation in gardens:

**Agrostis.** (Cloud Grass; Spear Grass). Hardy annual flowering grasses, with inflorescence, which is light and graceful and is valuable for cutting and for mixing with flowers, or for drying and decoration, when no others are available. *Agrostis elegans*, *A. nebulosa* and *A. pulchella* are some of the good species, growing from 12 to 15 inches high. Suitable for
borders or pot culture. Sow the seeds where the plants are to remain.

Andropogon.—A. citriata. (The Lemon Grass). It has a bushy habit, growing in a clumpy fashion, with long narrow green lemon scented leaves. Height, two feet. Propagated by division.

A. halepensis is very strong growing requiring to be kept in bounds. Produces lovely sprays nearly all the year round.

*Arundo donax variegata. A bushy reedlike variegated grass, growing six to ten feet high, forming a huge clump, the clumps enlarging year by year, throwing numerous cane-like shoots from the ground. The plant is of very great ornamental effect with its variegated green and white foliage, which is very pretty. In a poor soil, the variegation is better developed than in rich heavily manured soil, which is well supplied with water. If a bush has its shoots all green, it can be cut down to the ground level; the new shoots that come up within a short time being highly variegated. A clump, planted on the lawn in an open sunny situation and trimmed occasionally by cutting away straggling shoots, looks superb and grand. Propagated by division of root stock and by cuttings. Better suited for up-country.

Arundo conspicua. Grows ten to twelve feet high, bearing large drooping racemes of silky white flowers. Suited only for hill stations. Thrives in light sandy soil in open sunny situation.

*Arundo metallica. A grass with bronze leaf, grows to about four feet and loves shade.

Bambusa. (Bamboo).—Bamboos are a very useful class of grasses. The tall and thorny kinds serve as barriers along the boundary lines in spacious gardens. The dwarf ornamental species are of high decorative value, planted in groups or along the edges of ponds and streams. The taller species, being very bushy and large, are kept at a distance from the residence. Some of the Japanese dwarf species may also be grown in tubs or pots. Bamboos thrive in any kind of soil and require plenty of water for quite satisfactory results. The following are a few select species:
B. aurea, ornamental with yellow stems and light open foliage. Native of Japan.

*B. aurea variegata; nine to twelve feet. Stem richly ornamented with bright golden stripes. The foliage is light and open and the bush with its light green foliage and the golden yellow and green stems is very ornamental. Propagated by stem layering. The species is well suited for cool places.

*B. Fortunei argentia variegata is a very graceful conservatory pretty little plant about a foot high, having leaves striped with green and white. Flourishes in the open in cool places.

*B. Fortunei aurea is a foot in height, being a dwarf variety of B. Fortunei; the foliage assumes at certain seasons a bright golden yellow colour. Thrives better in cool localities than in hot plains.

B. japonica is about five feet high, making a splendid plant in a shady situation.

B. nana grows 6 to 8 feet; it is a pretty Chinese bamboo; can be used for hedging where water is plentiful. Propagated from seed and by division of stems.

B. nigra (Black Bamboo) is an interesting species, growing 20—25 feet high, with lower portions of stem coloured purplish black.

B. siamensis is very graceful, growing to a height of about 20 feet. The foliage is light and feathery and are borne in dense graceful plumes.

B. tricolor is a dwarf variety of variegated bamboo, about two feet high, with bright green leaves striped with creamy white and edged with red.

*B. vulgaris, (Golden Bamboo) is a very handsome species, nearly 25 to 30 feet high, with stems, streaked with bright bands of gold and green, and three to four inches in diameter. Thrives best on the banks of streams and in hollows where there is lot of moisture in the sub-soil.

Briza maxima. (The Quaking Grass).—Thrives better at medium elevations than in the plains, bearing large flower spikelets suspended by delicate hairlike stalks and moving gracefully with the breeze. Mainly grown from seeds, which
ORNAMENTAL GRASSES

are sown when the monsoon is nearly over. The inflorescence is useful for cutting.

_Eragrostis elegans_. (Feather Grass; Love Grass). An annual with small spikelets, which are light, feathery and graceful, and are useful in making flower bouquets. Seeds are sown during the monsoons.

*Eulalia japonica*, a Japanese graceful grass growing 3—5 feet. The variegated form with white and green leaves is very pretty. Variety gracillima has narrow leaves with white midrib. Variety zebrina has transverse yellow streaks. They are suited for culture in the open on hill stations and for pot culture in conservatories at medium elevations.

_Gynerium argentum_. (Pampass Grass).—Called by some _Cortadeira argentea_, a tall grass, very ornamental with its large terminal panicles of silver white feathers and long ribbonlike leaves. Propagated by division or from seed. Thrives better at cooler places.

*Oplismenus Burmanni variegatum_.—Also called by some _Panicum variegatum_. Very ornamental creeping grass with pretty variegated leaves, striped rose-pink, green and white. Thrives better in shade than in exposed positions. Very useful for hanging baskets and for covering the surface of large pots and tubs. Propagated by runners.

*Phalaris arundinacea variegata* (Ribbon Grass; Gardener's Garter).—A small variegated grass, suited for pot culture, edging, and rockeries. Grows 12—15 inches high. The leaves are longitudinally striped with silvery white. Propagated by division. Protection from afternoon sun is necessary.

_Pennisetum longistylus_.—A native of Abyssinia, handsome, growing 4—5 feet high, bearing pink bulrush-like flower heads.

_Phyllostachys_. (Whanggee Cane).—Ornamental foliaged grasses like Bamboos, from Japan, about 5 feet high with graceful habit of growth.

_Thysanolaena agrostis_. (Bouquet Grass).—A large bushy spreading reed about eight feet high, with leaves 12 inches long by 3 inches wide, producing flowers in large, very graceful terminal plumes, which are at first purplish and then turn
to brown colour. Requires plenty of water. Very ornamental when placed in the centre of small shrubs.

*Tricholaena rosea. (Natal Red-top Grass).—Known also as the Ruby Grass. A very handsome plant, easily raised from seed, growing 1½ to 2½ feet high, bearing masses of purplish crimson flowers.
CHAPTER XXV

SUCCULENTS

Succulents comprise of many kinds of plants with fleshy leaves and stem, forming a cultural group by themselves. Most of them have thick condensed stems and are devoid of verduous character of foliage; some have thick fleshy leaves; some bear attractive and interesting flowers. Succulents are natives of arid and semi-arid regions of Africa, Asia, and America and they are so constructed that they can withstand exposure to severe sun and drought. Their leaves and stems are covered with a thick epidermis containing very few transpiring pores (stomata), which enables them to preserve the moisture stored in them by allowing only the minimum quantity of it to be given off. Succulents manufacture their food mainly from the atmospheric air and require very little moisture in the soil for their growth. Hence, they have very few roots.

Plants belonging to several natural orders are included in "succulents". A majority of them belong to Cactaceae. Cereus, Echinocactus, Epiphyllum, Opuntia, Mamillaria and Phyllocactus are all Cactus plants. Amaryllidaceae is represented by the remarkable genera of plants as Agaves and Furcraea. Liliaceae provides excellent genera as Yucca, Aloe and Gasteria. Crassulaceae furnishes such important groups as Bryophyllum, Cotyledon (Echeveria), Crassula, Kalanchoe, Sedum and Sempervium. Other natural orders as Euphorbiaceae, Bromeliaceae, Asclepiadaceae, Ficoidae and even Compositae add numbers to the list of succulents.

There are a number of succulents which attract the interest of the plant lover by their peculiar form or grotesque appearance, or pretty flowers. Several kinds are of high ornamental value, being effective in groups of the same or different kinds or as single specimens in pots or planted in the ground. Large kinds, as the variegated forms of Agaves and Furcraeas and Yuccas are very effective as single specimens on lawns.
Yuccas with their beautiful symmetrical evergreen foliage and the long and showy panicles of large snow-white waxy flowers serve as excellent border plants with a shrubbery background. Epiphyllums make one of the most interesting and beautiful pot plants grafted on stems of Cereus. Out of curiosity, enthusiasts collect Cactus plants from all over the world. Some of the globular and cylindrical species are useful for pattern or design work. A permanent planting of several kinds of succulents on a sloping ground or in raised beds or on rockeries, is a source of perennial interest.

As a general rule, succulents require an open sunny situation, porous sandy soil, perfect drainage, comparatively dry atmosphere and very moderate watering. Certain individual plants and species however vary in the quantity of water, atmospheric humidity and temperature required by them.

Succulents are propagated in a variety of ways. Though vegetative means may be more desirable and quicker in several species, almost all kinds may be raised from seed. For sowing seeds, a 3 to 4 inch fresh pot, one which has been sterilised by soaking and washing it in a solution of copper sulphate is used. As seedlings will have to remain in the pot for a considerable time before they are pricked off, sterilization of the pot is necessary to prevent algae or moss covering it. The soil used should be very sandy with very little leaf mould. The pot is filled to at least one-fourth full with bits of crock for drainage and the soil is put on the drainage till it comes to three-fourths of an inch from the top of the pot. After levelling the soil, the seeds are scattered thinly and pressed down and covered with a quarter-inch layer of very fine gravel. The gravel serves to prevent the seedlings from damping off in their young stages. The pot is then watered through the drain hole as shown in figure 31. The pot is to be kept on a bench insulated in a vessel of water to keep off ants which are fond of Cactus seeds. Seedlings may appear in about ten days or more. When they show spines, they may be pricked off into soil in seed pans containing a little more organic matter than before, and left in them till they grow big enough to be individually potted. Some species as Agaves are increased
from the bulbils, which drop off the mature plants from the mature column of flower-stalk. Epiphyllums and Phyllocactii can be increased by cuttings. The cuttings are to be kept by till they form a corky layer over the cut-surface and then inserted not too deep in sand. Some kinds as Bryophyllum, Kalancho and Echeveria are multiplied easily from leaf-cuttings. Epiphyllums and Phyllocactii are herbaceously grafted on Cereus stocks for durable plants.

The following are some select succulents, which are cultivated in gardens:

**Agave.** (N. O. Amaryllidaceae). Called the Century Plants. Agaves are evergreen massive growing plants, with no stem or very short stem and leaves, mostly in a close rosette. Leaves are usually stiff, more or less fleshy and persisting from year to year. The margins are mostly armed with teeth and the apex tipped with a usually pungent spine. Agaves are very slow growing and do not become large rapidly. After a number of years, the period varying with the species, the flower stalk is shot up like a column from the terminal bud of the plant bearing innumerable flowers arranged on it. These flowers last for several days and months and form seeds or young bulbils. Propagation is from seeds or bulbils or suckers. Plants of many species die after flowering but once. Agaves are a useful class of plants, many of them furnishing fibre. Species of *Agave* vary so much in size and form that they can be used in a great many ways. There are several highly ornamental kinds variegated or otherwise, which are very effective in tubs, vases, large pots, or on lawns as single specimens or in groups or plunged in rock-work. Some are serviceable as fencing plants, growing 6 to 8 feet high.

Agaves come from arid regions where they have a hard struggle to exist and so they can be grown with little or no care. They are very hardy and drought resisting, thriving on well drained soil, inclined to be sandy. For compost for potting, loam and sand can be mixed in equal proportions and to the mixture may be added some leaf-mould. Potting should be firmly made.

Some select large sorts of *Agave* are:—*Agave americana*
variegata is handsome, with leaves measuring 6 feet or more in length, and 6 to 8 inches in breadth. They are dark green in the centre and are broadly margined with rich yellow and are armed at edges and at apex with stout spines. The rosette of leaves is 6 to 10 feet wide and 4 to 8 feet high. *Agave americana mediotincta is similar to the above but has yellow leaves edged with green. *A. Franzosoni is a large bluish green kind, with large broad recurved leaves.

Some select medium sized sorts having a spread of 2 to 4 feet and attaining to a height of about 2 to 3 feet are:—

A. densiflora; A. dasyliroides; *A. filifera has erect leaves, 12 inches in length and 1—1½ inches in breadth, tapering to a point and armed with a stout spine and clothed densely with white filaments; *A. Ghiesbrechtii is a fine plant with leaves which are slightly curved inwards, and are bright green in colour and bordered with red and armed at edges and point with bright red spine; A. hetaracantha is very similar to A. densiflora; A. Schidigera is similar to A. filifera but is a looser habit; *A. Woodrowii (Syn. Angustifolium marginata variety Woodroo­wii) is a very pretty species with dwarf compact growth and creamy leaves with pale silver-grey stripes running down the middle of the leaves; *A. Verchaffeltii is another handsome species.

Some compact growing Agaves, which have a spread of about 1—2 feet and growing to a height of 1—2 feet are:—

A. crucifera Jacobi; A. ensiformis is a beautiful plant, dense with numerous leaves, which are glaucous green in colour and which are 6 to 12 inches long and one inch or less broad, flat on the upper side and rounded below, and armed at apex with bright red spine.

Aloe. (N. O. Liliaceae). Aloeas are a genus of foliage plants, which are evergreen with ornamental thick leaves, often prickly or spiny and often arranged in a rosette. They resemble the Agaves very much. Some species bear attractive tubular flowers. There are three or four species having variegated foliage and hence suitable for pot culture. Aloeas require much the same treatment as Agaves. If exposed to rains, aloeas are apt to perish from water collecting between the
leaves and causing them to rot at the junction with the stem. Propagation is from seeds or suckers. They are useful on rockeries where Cactus and other succulent plants are grown. Some of the larger attractive species are:—*A. abyssinica is showy when in blossom in January and February, with its large flower stems bearing small bright vermilion coloured flowers. A majestic looking plant with dull green leaves, which are 2 feet by 6 inches, the edges being clothed with blunt distant spines; *A. arborescens and *A. ferox are handsome. Some of the small sized attractive species are:—

* A. brevifolia depressa; *A. saponaria; and *A. variegata.

*Bryophyllum calycinum. (N. O. Crassulaceae). The name is derived from bryo, to sprout, and phyllon, a leaf, alluding to its leaves giving out buds; and calycinum, alluding to the remarkable calyx of the flowers. Bryophyllum is an erect growing succulent herb, with thick fleshy simple or tripartite leaves, bearing terminal panicles, with opposite branches bearing pendulous flowers, having a long inflated calyx with four valvate lobes. It is easily cultivated and makes good pot plants and serves well on open rockeries. The compost best suited for it is a mixture of two parts of sandy loam, one part old mortar rubble and leaf-mould. Is easily propagated by leaves, simply laid on the surface of moist sand. Requires thorough drainage.

Cereus. (N. O. Cactaceae).—Cereus are curious looking, long stemmed, vigorous growing, thorny, very hardy plants. C. grandiflora; C. triangulaflora; C. quadrangularis are all grand night blooming leafless climbers, reaching the tops of tall trees and blooming at the beginning of the monsoons. They are too large and too coarse to be admitted into any but gardens of great extent. Flowers are large, white and scented. The flower-bud with a slice of the stem cut off with it and taken indoors begins to open after it gets dark and expands to its full beauty by midnight. Large cuttings, 1 to 2 feet long, are inserted in sand and after they strike and establish themselves as independent plants, they are grafted on with Epiphyllum or Phyllocaactus.

Cotyledon = Echeveria. (N. O. Crassulaceae). Called by
some "Oyster Plant." Echeverias are small succulent herbaceous perennials, 3 to 6 inches high, with dense rosettes of small leaves, producing racemes of flowers, which should be removed. They are natives of the Cape of Good Hope. They do not thrive in the plains but do very well from medium to high elevations. Protection from severe sun is necessary in hot localities. They are propagated from suckers and by leaves taken with the dormant bud in the axil of the leaves and rooting them in sand. The cuttings should be very sparingly watered or not at all till roots are formed. Echeverias are intolerant of too much wet in the soil. They are very useful for edging flower beds or for planting on rockeries, or in carpet beds, in hill stations. There are several species, which are found in Indian gardens such as *E. metalica; *E. secunda; E. glauca; E. agavoides and *E. sempervium.

*Dasyliron. (N. O. Liliaceae). Dasylirons are a genus of very ornamental evergreen remarkable looking plants, suited for planting on lawns and as pot plants for decoration. The leaves are glaucous green, grass-like and symmetrically arranged all round the short thick stem drooping gracefully all round. Flowers are produced after many years on a long stalk, 10 to 12 feet high. Cultivated just like aloes. *D. graminifolium and D. recurva are attractive species. Propagated from seed.

Echinocactus. (N. O. Cactaceae). Popularly known as Hedge-Hog Cactus. They are small unbranching, ovoid or globose, succulent, prickly, very curious looking plants. There are numerous species. *E. echidne is very curious, resembling a ribbed melon of the size of a cricket ball with starlike arrangement of thorns along the ribs. Bears, in February and March pretty delicate pinkish white flowers in little groups near the summit of the plant.

Echinopsis. (N. O. Cactaceae). Also called Hedge-Hog Cactus. Small spiny succulents, suited for growing on rockeries and in small pots for their interesting flowers. *E. multiplex is an erect unbranching plant, with numerous spine covered angles. Propagated by offsets.

*Epiphyllum. (N. O. Cactaceae). Epiphyllum is a large
genus of plants with flattened succulent stems, resembling a combination of straps or ribbons growing out of each other in succession. Epiphyllums are popularly known as Christmas Cactus or Crab Cactus. The plants are spineless and bear usually large attractive flowers, with white or red or yellow petals. There are several species and varieties of Epiphyllum, the best known species being E. truncatum. It is a delicate, fragile, dwarf perennial pot plant, bearing in great profusion in the cold season large white, pink, or rose flowers. It is raised by cuttings; bits are broken off the plant and inserted in sandy soil, which should be kept on the dry side till the roots are well developed. The rooted plant may be potted in a small six inch pot, which is immersed in a larger pot which should be filled to the brim with gravel on a level with the edge of the inner pot to support the plant and thus prevent it from being blown over by wind. The soil best suited is a mixture consisting of three parts of silver sand, two parts of well rotten sifted leaf-mould, and one part of red earth. They thrive only in partial shade and have to be sheltered from wind. They are best grown as dwarf standards grafted on Pereskia or Cereus grandiflora. A rooted stem of Cereus, about 18 inches long, is grown in an eleven inch pot. When it is sapy, its top is sliced away by a clean horizontal cut and a slit is made in the centre of the top so cut, just large enough to admit the wedge shaped end of the flat cutting, which is introduced about an inch deep into the slit. The cutting is fixed in place by passing a thin wire or a thin stick through the stem of the Cereus and the cutting, holding them together. The top portion of the stock is tied round with raffia or plantain fibre to close the slit. The portion operated upon, is then covered over with grafting wax or grafting clay to exclude air and water. If the grafting is successful, the graft unites with the stock and in the course of a year, one may be able to secure a plant with a head covering about two square feet of space. The plant, which grows on the stock, should be supported below preventing it from bending down and thus breaking, by a neat circular frame or bamboo "thattie".

**Furcraea.** (N. O. Amaryllidaceae). Ornamental foliage plants
resembling Agaves, with long fleshy leaves, armed with spines. They are cultivated like Agaves. The variegated species are very effective on lawns and on open rockeries with Cactus plants.

*F. Watschianana* assumes giant proportions, growing 6 to 8 feet high and attaining a spread of 6 to 8 feet. The leaves are nearly 4 to 6 feet long and are very beautifully variegated yellowish white, white and light green. The flower stem resembles that of an Agave and bears innumerable bulbils, from which the species is propagated. A very ornamental and noble plant, very well suited for lawn-planting and an open rockeries. *F. Linderi* is also a good species with green, cream edged leaves. *F. gigantea* is a very large growing species, being very useful as a hedge plant. It is cultivated for fibre.

*Gasteria.* (N. O. Liliaceae). Gasterias are Aloe-like small evergreen succulent plants with thick, fleshy, often prickly, distichously arranged leaves, which are green, spotted with white or purple. Cultivated like Aloes. Propagated by offsets. Are good plants for rockeries in shade. *G. brevifolia; G. trigona; G. verrucosa* and some others are attractive.

*Kalanchoe.* (N. O. Crassulaceae). A genus of dwarf succulent, flowering shrubs resembling Bryophyllum, with thick fleshy leaves from which they are propagated in the same way as Bryophyllum. Flowers are produced in terminal clusters and are very showy. The colours are scarlet, yellow, or orange or white. Are easily cultivated, requiring open sunny situation and through good drainage and sandy soil, similar to that recommended for Bryophyllum. Useful as pot plants and on rockeries with cactus plants. The noteworthy species are *K. Kirkii; K. flammea; K. floribunda; K. crenata; K. coccinea.*

*Mammillaria.* (N. C. Cactaceae). Popularly called, “Nipple Cactus or Elephants Tooth Cactus.” They are dwarf plants with leafless cylindrical or globular stems, bearing evenly over their surface, small tubercles somewhat resembling the teats of animals, each tubercle being crowned by a rosette of stars of hairy spines. Propagated by offsets. *M. glauca; M. megacantha; M. nobilis* and some other species are pretty.
Mesembryanthemum. (N. O. Aizoceae). Mesembryanthemums are called popularly Fig Marigolds. They are low growing succulents, with thick leaves, which are three angled and have more or less spiny margins. They are allied to cactaceous plants though bearing true leaves. They are natives of arid and semi-arid regions covering the foliage with plump foliage and bearing small daisy-like pink, crimson, white, or yellow pretty flowers, which open only in sun-shine. Fig Marigolds are easily raised from seed sown in October in the plains and in March on the hills, in wide shallow pans containing good soil below and a layer of sand above. They can also be propagated from cuttings, which should be dried in the sun for two or three days, before they are potted in sand. Care should be taken that water does not lodge by the collar of the plants. A well drained, open soil, mainly consisting of sandy loam and small broken bricks suits them best. All the species thrive at medium elevations.

Phyllocactus. (N. O. Cactaceae). Phyllocacti are among the most beautiful of cactus plants which are small shrubs with flattened leaflike branches, looking similar to Epiphyllum. They bear large brilliant flowers in long succession. Flowers are produced from July to September and in summer. Propagated by cuttings or by grafting on Cereus stocks. Grown in the same way as Epiphyllums. P. rosea; P. crenatus; P. amabilis; P. cocinea; and P. grandiflora are some of the pretty species.

Sedum. (N. O. Crassulaceae). Sedums are popularly known as “Stone Crops”. They are showy succulent herbs, about four inches in height, useful for rockery, baskets, vases, and carpet bedding. Propagated from seeds. There are both annual and perennial species. Thrive at cool places at medium and high elevations. Sedum sexangularis seems to be a species, which can be satisfactorily grown at low elevations.

Sempervium. (N. O. Crassulaceae). Popularly called “House Leek”, Semperviums are thick, fleshy, usually stemless perennial herbs or sub-shrubs, with leaves mostly in rosettes. They are very useful for planting on rockeries, carpet-beds etc. The plants increase by rosettes or offsets which are sent out by the parent plant, thereby suggesting the other popular
name "Hen-and-Chickens." Flowers are produced in panicules, in shades of rose, purple, white, and yellow but the plants are grown only for their attractive foliage and fine form. *S. soboliferum;* *S. Tectorum;* *S. arachnoides* are some of the pretty species. Closely related to Sedums and like the latter thriving only at medium to high elevations.


*S. gigantea—purple and yellow flowers.*

*S. grandiflora—purple and grey.*
ANNUALS, BIENNIALS AND HERBACEOUS PERENNIALS

Annuals belong to that class of plants, which attain their full growth from seed, flower and die in one year or one season. Mostly, they complete their life history in 3 to 6 months. They comprise of several of the most beautiful and easily grown plants, widely varying in form, habit of growth and colour, furnishing a good show of blooms for comparatively small cost and amount of labour involved in raising them. Annuals are very effective, grown either in pots or in ground and hence they deserve extensive cultivation though they may not be of lasting interest as perennials. Annuals by themselves without the aid of other plants can keep the garden full and gay all the year round if they are raised by sowing seeds at regular, well-timed intervals. Many annuals have quite a long period of bloom, extending over several weeks; and the duration of this period is invariably lengthened if they are not allowed to seed, by regularly picking off fading flowers. There are special qualities possessed by annuals, which befit them for certain purposes. Where one lives in a rented house or his tenure of stay in any place is short or uncertain, annuals come in handy and offer an easy, quick, and economical way of furnishing the plot of ground to feast the eye. Again, where one starts a new garden with permanent plants such as shrubs and trees, the garden can be kept interesting and full of flowers by annuals till the more permanent features are getting established.

There are quite a large number of annuals which are suited for almost all situations and purposes in the garden. For instance, for edging and for bordering walks and beds, among others, Ageratum, Candytuft, Lobelia Erinus, dwarf Nasturtium, Phlox Drummondii nana compacta, Torenia, and dwarf Marigold are very effective; for hanging baskets, Alyssum, Lobelia gracilis, Petunia, Torenia asiatica, trailing Nas-
turtium etc., are useful; for covering trellis, Cobaea scandens, varieties of Convolvulus, tall Nasturtium, Mina lobata, etc., are serviceable; for massing in beds, there are Asters, Phlox Drummondi, Pinks, and too many others for detailed mention here; for planting in shrubberies in vacant spaces, Sun-flower, Hollyhock, tall growing species of Amaranthus, Spider-flower, Tithonia, etc., do quite well; Kochia is a beautiful foliage plant, making beautiful plants having the appearance of clipped Cupressus; several species of Amaranthus have very handsome coloured foliage, for which they are grown.

Annuals, with very few exceptions, thrive better and look more natural and effective in the ground than in pots. Each kind of annual thrives best in a particular part of the year and it is advisable to grow it then only. But, there are many, which can be successfully grown throughout the year with little difficulty. Generally, it may be mentioned that annuals fall under two groups; those which are sown in April—May and October—November respectively in the plains and on the hills; and those which are sown in October—November and April—May respectively on the Hills and the plains respectively. Seeds may be sown in seed pans or seed-beds as the case may be, according to the quantity of plants required and the nature of the seeds themselves. Some annuals like Calendula, Gypsophila, Poppy and Larkspurs, which do not transplant well, are sown broadcast in the beds themselves, where they are wanted to grow. The method of 'sowing seeds of different sizes is already explained in pages 58-61. The preparation of ground or beds in which annuals are grown is explained in pages 156—7. How young seedlings are looked after is described in pages 61-62. Those annuals which profit by constant shifts are sown in seed-pans or seed-beds and pricked at suitable distances apart in prepared soil in pans or nursery beds and then planted out in places where they are grown finally when they are large enough. For the soil best suited for sowing see page 58 and compost 1 or 2 on page 112, suits most annuals. Certain annuals as Nasturtiums make vigorous leafy growths and produce but a few flowers if the soil is very rich; in the case of such plants, a happy medium condu-
ANNUALS, BIENNIALS AND HERBACEOUS PERENNIALS

cive both to flower and leaf production should be struck at; generally, if they are planted in beds heavily manured for a previous crop, satisfactory results are obtained. Such of the kinds as require supports, should be staked properly, the material generally used for the purpose being split bamboo, agreeably painted green if necessary. Staking should be as unobtrusive as possible.

The essentials of success in the cultivation of annuals may be summed up as follows:—(1) Thin sowing of seeds. There is danger of "damping off" if young seedlings are overcrowded. (2) Before they overcrowd, seedlings should be promptly handled by pricking them off to pans or boxes or nursery-beds, or placing them singly in small pots or thinning them if sown in places where they are wanted to grow. (3) Overcrowding at all stages of their growth should be avoided. Plants should be placed at suitable distances apart, so that they may grow all round. (4) Supply of liquid manure and cutting away of fading flowers will prolong the blooming period considerably.

Biennials are plants which grow in one season, flower and die in the next. Generally, the period of growth is six to nine months. Canterbury Bells and Scabiosa are biennials. Biennials are grown in the same way as annuals and put to same kinds of use.

Herbaceous perennials are those plants with soft stem, which are not shrubs in the strict sense. They are propagated by seeds, by offsets, or by division of clumps as the case may be. Herbaceous perennials are very useful for herbaceous or mixed borders or for pot culture. Chrysanthemum, Michelmas daisy, Solidago and Gerbera are herbaceous perennials.

Below are enumerated select annuals, biennials and herbaceous perennials. The following abbreviations are used:—

C—to denote cold season plants, the seeds of which are sown from September to October in the plains and April to May in the Hills.

R—to denote rainy season plants which are sown in April—May in the plains.
S—to denote plants for the hot season, which are sown in December—January in the plains.

H—to denote the height which the plant attains.

D—to denote the distances between plants while planting.

B—to denote the period the plants take to bloom from the time of sowing seed if grown according to the cultural notes suggested.

**Acroclinum.** (N. O. Compositae). Easily cultivated, "Everlasting" annual, producing single or double daisy-like flowers, which keep their form and colour even after they dry up. Seedlings resent disturbance and hence sow seeds where plants are wanted to grow and then thin out 4—6 inches apart. Makes a dainty pot plant; H. about 18 inches. *A. roseum* bears pretty rose coloured flowers and *A. album*, pure white flowers. *A. grandiflorum* bears very large flowers. Suited for medium to high elevations. (C).

**Ageratum.** (N. O. Compositae). (Floss Flowers). Free blooming, very hardy; H. 6—18 inches high. Can be maintained for two seasons by frequent trimming. Useful alike for edging and for massing in beds, and for mixed borders. Flowers borne in tassel-like clusters, remaining fresh and in beauty for quite a long time and hence the name, ageratum, meaning ever young. Can be grown throughout the year, as easily as a weed. Rich sandy soil gives best results. D. 9—12 inches. Should be pinched back a number of times for dwarf bushy growth. B. 2½ months. Blue shades and pure white colours are the best. (R & C).

*Althaea.** (N. O. Malvaceae). (Hollyhock). Stately growing plants, one of the finest ornaments of the garden, producing large, single or double flowers, in pyramidal spikes nearly 2—3 feet long. H. 4—6 feet, the height attained depending on particular soil and weather conditions. Imposing plants for screens, borders, and for backgrounds. The double flowering kinds do not bloom in the plains but on the hills they make a splendid show; they are by nature perennials but are treated as annuals being grown from seed each time, taking about 9 months to bloom after sowing. Hollyhocks are available in several brilliant colours; the "eyed" varieties with the
centre of the flowers differently coloured from the rest of the flower, are very pretty and are becoming more popular than the “selfs.” Seeds which are small circular discs are sown in well prepared seed-beds, well enriched with manure. The seed-beds are kept moist and in a month’s time, the seedlings are ready for transplanting, which should be done carefully, not injuring the roots. D. 15–18 inches. As they require a lot of root space, should be grown in well dug rich friable soil in the ground; to prevent them from being blown over by wind, should be staked as they grow tall. B. 3–4 months from acclimatised seeds and longer from imported seeds. (R & C).

*Alyssum.* (N. O. Cruciferae). (Sweet Alison). Dwarf unpretending annual, 3–9 inches high, bearing conical heads of pretty white honey-scented flowers. The blooms resemble miniature Candytufts and to be effective, the plants should be grown in masses. Useful for edging larger plants in flower beds. Broadcast seeds in light soil, having a small quantity of lime in it. Thin out seedlings 6 inches apart. B. 6 weeks. Can be sown in succession from October to January in the plains and March to June on the Hills. (C & R).

*Amaranthus.* (N. O. Amaranthaceae). The Amaranthus family includes several garden species with striking foliage or blooms or both. In the foliage kinds as the *A. tricolor*, *A. salicifolius* and *A. melancholius ruber*, the plants are hardly in need of blooms to enhance their beauty. All the species are annuals and are very easy of cultivation, requiring a deeply worked soil and sunny situation. If the soil is very rich, the plants will not colour freely. Rainy season is best suited to their growth as they need a lot of moisture as they grow rapidly and large. Seeds may be sown very thinly where the plants are wanted to grow and the seedlings thinned out later on. Or, seeds may be sown in seed beds and the seedlings transplanted, when they are sufficiently grown, at proper distances apart, in beds or borders as the case may be. The plants, it must be remembered, should be given sufficient space to develop on all sides. They are suitable for a border of tall plants or for the centre of large beds. Very often, some species as *A. salicifolius* are attacked by red ants, which eat into the
plants, injuring them irreparably. (R & S). The following are a few noteworthy species:

*A. tricolor splendens*: (Joseph’s coat). H. 18—36 inches; very beautiful in borders, alone or in groups; leaves are brilliantly coloured and variegated in red, yellow, and green. B. 6—8 weeks. Grows only about 12 inches high in cold season.

*A. salicifolius*. (Fountain Plant). Called so, on account of the thin wavy long gracefully drooping and arching leaves, which give the appearance of a fountain playing. H. 2—3 feet; ornamental with a neat pyramidal habit of growth; Leaves bronzy green, changing to bright red and banded and tipped with yellow and orange; a native of Philippines; makes a good pot plant.

*A. melancholicus ruber*. Leaves dark, blood-red. H. 2—3 feet. Good for bedding or border.


*Angelonia*. (N. O. Scrophulariaceae). Herbaceous perennial suited for growing in beds, borders and in pots, bearing pretty terminal racemes of sweet-scented bluish purple or white, showy flowers, which are irregularly two-lipped, the upper lip being two-lobed and the lower being larger and three-lobed. The plants are in bloom throughout the year; the old shoots, which have grown lanky by continuous blooming should be removed for fresh growths. Angelonias are particularly attractive in the rainy season. Propagated easily from seeds or by cuttings. *Angelonia grandiflora* bears lilac flowers and grows about 24 inches high. The variety *alba* bears white flowers and grows only to about a foot or a little more.
Antirrhinum. (N. O. Scrophulariaceae). (Snap-dragon). A great favourite, very serviceable as a bedding or pot or border plant. Naturally a perennial but treated as an annual and grown from seed every time. Flowers, remarkable for their gorgeous colouring in all shades of pink, rose, apricot, orange, crimson, carmine, white, yellow, mauve etc. Recently improved variegated and "eyed" kinds, bearing large spikes of large finely shaped flowers of brilliant colours with beautifully marked throats are very pretty. H. 6-30 inches. Three distinct strains are available:—(a) 'tall' H. 2-3 feet, (b) 'intermediate', H. 12 to 18 inches and (c) 'dwarf' or 'Tom-thumb', H. 6 to 9 inches. All of them and especially the semi-dwarf kinds are excellent summer bedding plants.

Easy to grow, thriving in any good garden soil. Prefer a certain amount of dryness at the roots and hence are preferably grown in summer after the rains. Mix the fine seeds with about six times their bulk of sand before sowing to ensure uniform distribution. When seedlings are large enough to be handled, prick off two inches apart in well drained porous soil in seed pans. When about 3 inches high, finally plant in beds 12-15 inches apart or pot singly in six inch pots, and shift to 9 inch pots later on. Liable to rot if overwatered. Pinch back top to stimulate side growths and nip these again when they have grown 4-6 inches. Treated this way, each plant becomes a miniature under-bush and produces a number of flower-spikes, about four months after sowing. To keep the plants for flowering a second time, fading flower-spikes should be cut back scrupulously.

Aquilegia. (N. O. Ranunculaceae). (Columbine). One of the most beautiful garden plants, but they seldom thrive in the plains in South India. Pretty herbaceous perennials with delicate handsome foliage; suitable for growing in borders. H. 2-2½ feet. Need to be shaded from afternoon sun. Bloom in the second season after sowing. Propagation can also be made by division. (C).

above the foliage. Flowers close at night and reopen next morning and last only for about four days and are good for cutting. Arctotis is a summer plant but it can be grown in the cold season too. It is best suited for medium to high elevations. B. 3½ months. D. 10—12 inches. (C).

*Aster. (N. O. Compositae). One of the most popular, showy, free-blooming annuals, very effective in beds, very serviceable as pot plants and invaluable for cutting and for making bouquets. The present day “Florist’s” asters have been derived by a long process of evolution from a single flowered kind, introduced from China in 1731 by a Jesuit missionery. We have now asters, widely varying in habit of growth, colours and forms of flowers. There are the compact growing and the branching kinds ranging in height from 9 inches to 3 feet; except the pure yellow, almost every conceivable shade of colour is represented in asters. (C).

There are some well marked types or races of asters, each of them having its full range of colours. It is impossible to classify the varieties only by their stature or habit of growth, as several of the distinct types run into both tall and dwarf forms. Following are the noteworthy types of asters:—

Comet. These have long and narrow petals strongly recurved. They have a light, charming, feathery appearance.

Ostrich-plume and Hohenzollerii kinds resemble very much the Comet asters but the flowers are larger and prettier and the plants are a little more branching.

Victoria. These are upright in bloom. The flowers are compact and handsome with a neat form though they may not be so large as in the preceding types.

Globe. The flowers are very attractive and have a nice globular form with the petals curved upwards and bent towards the centre. The Paeony-flowered Perfection (Truffaut) has strongly incurved petals making globular flowers.

Needle or Hedge-hog. These have needle-shaped petals.

Branching asters. The typical branching aster is pyramidal in form, grows large and vigorous with many lateral branches. This is a hardy type, having long and broad irregularly arranged petals. The Queen of the Market has the same
general characteristics as the branching aster but the flowers are smaller.

*Chrysanthemum-flowered.* This type of asters is very pretty, bearing Chrysanthemum-like flowers.

*Bouquet asters.* These make small plants studded with flowers, resembling bouquets.

*Giant of California.* A tall vigorous growing (2—2½ feet) late flowering new class with huge flowers of the Comet type borne on long stems.

For exhibition purposes, the Chrysanthemum-flowered, Hobenzolern, Ostrich-plume, Comet, and Victoria asters are preferred to others.

B. 3½—4 months; but Giants of California take 4—5 months. All types are easy of culture requiring a well drained light porous soil. Can be grown at any time of the year at medium elevations with rainfall of about 30 inches per year. Seedlings are to be pricked when they have about six leaves.

D. 9—12 inches, H. 9—36 inches. Red ants, an orange coloured beetle and a larva which eats into the stem, are the chief enemies. Water-logging brings on root-rot.

For Perennial asters, see under Michaelmas Daisies.

*Balsam.* See under Impatiens.

*Begonia.* (N. O. Begoniaceae). A group of very beautiful popular plants, grown for their constant profusion of bloom, or ornamental foliage or both. There are no plants, which can more worthily seek admission into conservatories than Begonias. Easily raised and easily grown pot plants. Are sub-tropical, but several species can be successfully grown at low elevations in India. Cannot survive the open sun and love semi-shady situations. Best when exposed to morning sun only. Require a rich friable well drained soil, which may consist of one part of sand, one part of loam, one part of leaf-mould and one part of well rotten horse manure, with a sprinkling of bone meal and charcoal pieces. Grown first in small sized 6 inch pots and then gradually shifted into 8 inch and 12 inch pots, as they grow in size. Being delicate, need protection from rain and winds.
Besides a few hybrids, there are five distinct classes of begonias namely:

(I) The tuberous-rooted begonias.
(II) The fibrous-rooted shrub begonias.
(III) The fibrous-rooted dwarf bedding begonias, known as semperflorens begonias.
(IV) Rhizomatous and semi-fibrous rooted begonias, which are mostly winter flowering.
(V) The ornamental-leaved or Rex begonias.

(I) **Tuberous-rooted begonias.** These are 'bulbous plants' and are dealt with here for convenience and not under Bulbous Plants. Extremely lovely plants with tuberous roots and neat attractive foliage bearing large brilliantly coloured flowers, which are finer and larger than Roses in several varieties. The modern 'Florist's begonias' bear many of them flowers from 4—6 inches across. Several lovely shades of colour varying from the purest whites through pink and purple to the deepest scarlet and crimson, as also clear yellow, primrose, and orange shades are evolved by careful hybridization, crossfertilization, and selection. There are both single and double flowered varieties, some with plain edges, others crimped and frilled, and others again with crests on the face of the petals. They are dwarf pot plants, 1—1½ feet high bearing a profusion of flowers well out of the foliage. But, the 'decumbens' type bears loose drooping branches and bears pendent flowers, these merits qualifying it to be grown effectively in hanging baskets. All thrive, as a rule, from medium to high elevations only.

Tuberous-rooted begonias are grown from bulbs usually imported from Holland, Australia, England and Germany. The tubers are started to growth by placing them in a layer of damp moss or soil. They soon show signs of growth and sprout. When the sprouts are about half an inch long, each tuber is planted in a 9 inch pot, using the compost recommended above. To prevent it from rotting away and to facilitate rooting, the tuber is best placed in a layer of sand all round it, and covered lightly with a portion of its stem by soil. Till growth starts vigorously, watering has to be sparingly done. Weak liquid manure—cowdung water—is given once in ten days, when it
is growing till commencement of flowering. The plants are sheltered from strong sun and wind; they bear flowers from August to October. Then, water supply is gradually reduced to them. They lose their foliage. Then the pots are removed to a cool dry place for resting the tubers till the next potting season in April or May, in Bangalore.

Tuberous-rooted begonias are also raised from seed. This, though troublesome is economical, as one can raise a number of plants from a packet of seeds, though a certain percentage of them bear only single and yet pretty flowers. Seeds are very minute and almost dust-like. They are sown with the usual care taken in sowing such fine seeds, in seed pans. (See pages 60-1), 2—3 months earlier than the time for potting tubers, that is in January in Bangalore. The seedlings are very tender and they damp off if overwatered. When they are fit to be handled with ease, when the seed leaves are well developed, they are pricked half an inch apart in porous light soil. They are carefully watered with a special very fine rose water-can, or better still, the pans can be watered from below, as described in page 60 till the plants can be safely watered from above. The pans are protected from strong sunshine. By the end of March, the plants are large enough to be potted separately in 3 inch pots. The plants require to be watered carefully as before. When the roots have filled the pots, they are shifted on to 6 inch pots, without disturbing the balls of earth attached to the roots. Thereafter, they are treated as plants growing from tubers. As the plants grow, they form tubers under the seasonal stems. By July—August, almost all the plants will be in bloom.

(II) Fibrous-rooted shrub begonias. Herbaceous shrubs of varied habit of growth; some are dwarf and shrubby, not growing more than 1—1½ feet high; others grow as tall 6 feet, producing canelike stems, carrying flowers. The foliage is usually dull or bright green. There are some hybrids however with very prettily variegated or coloured foliage. Most species flower throughout the year; some bloom but once a year in winter between January and March.

Most species produce sterile flowers and hence propaga-
tion is mainly from cuttings. Insert into a 6 inch pot by the edge, 4 to 6 terminal cuttings, about 5 inches in length using a mixture of four parts of pure sand and one part of leaf-mould as the medium for rooting. After the cuttings have rooted, which is indicated by top growths made, pot each cutting separately in a 6 inch pot, without injuring the roots. Shift the plants to bigger pots, as the pots are filled with roots. Several species of shrub begonias take one to two years to make full-sized specimens. Most species may be content with 10 inch pots, while some require larger pots for forming specimen plants. It must be emphasised, however, that Begonias should never be grown in pots too big for them. The roots should not be injured during any of the shifts. Anxious and desirous of making a large number of plants from one good shrubby specimen, some 'malis' tear up the plants into pieces and pot them separately. It so happens, that the whole lot of them is lost. Batches of cuttings put in at intervals of 4 to 6 months ensure new and handsome plants. As the shoots, lengthen and grow, they should be neatly tied to a stake or stakes. The plants should be fed with weak liquid manure of cow dung once a fortnight. The old canes which have finished flowering, should be cut away and used for purposes of propagation.

The following are some of the best shrub begonias:

*B. corallina (coral-flowered). One of the handsomest species, with ovate-oblong, pointed, dull green leaves, which are spotted grey when young. Bears numerous long pendent racemes of bright coral-red flowers from tall canelike shoots, which grow sometimes 6 to 7 feet. There is a handsome variety of the above, bearing pale white flowers, which are slightly smaller in size.

*B. gigantea rosea. Another splendid kind, probably a hybrid between the semperflorens type and B. coccinea; leaves are roundish, brightly polished, very large, thick and handsome. The plant has a sturdy habit of growth with side branches, all the shoots being surmounted by large erect clusters of bright rose coloured flowers. Sappy terminal cuttings, 2—3 inches long, make the best plants. H. 1½—2 feet.

*B. President Carnot. Showy species, bearing very large
clusters of deep red flowers, hanging down the ends of the shoots. A hardy species, which does well even in the plains. H. 2—3 feet.

*B. President Carnot variety rose coloured. Upright habit of growth, bearing very pretty deep rose coloured flowers in large clusters, which stand out of the foliage prominently. A very profuse flowering very attractive hardy plant. 2—2½ feet.

B. ornata is white flowering; like President Carnot. H. 2½ feet.

B. maculata is of similar habit as the above species. The foliage is variegated and blotched with silvery grey and pink dots and patches. The flowers are pink in colour and do not appear much, as they do not contrast well with the foliage.

*B. gloire de Seaux (?) is very pretty plant, with neat attractive foliage, which is variegated by dots of pink, green, and purple. Bears bunches of pink flowers. Both the flowers foliage are attractive. H. 2—2½ feet.

B. manicata. There are two hybrids with white or rose coloured flowers, borne in loose clusters, much above the green foliage. Very free flowering and desirable. H. 2—3 feet.

*B. Ingramii makes a good dwarf bush, bearing pink flowers. Suitable for hanging baskets and growing in urns.

*B. fuchsioides is a pretty shrub with comparatively small leaves, bearing fuchsia-like coral red flowers, in clusters from the ends of branches. 1½—2 feet.

B. echinosephala is a very pretty white flowering variety.

B. lobellata is a large coarse shrub with tall stems and large roundish leaves, bearing pale white flowers in erect large clusters. Flowers only once a year in winter.

B. weltoniensis; B. Haageana; B. ulmifolia; B. argentio guttata; B. luxurianus are some others, which are handsome. The silver and pink and purple variegated leaved hybrids are very attractive and they are grown more for their foliage than flowers.

* (III) Semperflorens begonias. Dwarf, compact, free flowering plants, not attaining more than about a foot in height. They make lovely pot plants; they are also valuable for
edging beds and borders. They are called "Bedding Begonias," as they can be successfully grown in beds making a good show for a good length of time. They are a hardy class, thriving well even at low elevations; the red flowered varieties do not seem to stand the hot climate of the plains of S. India as the white flowered kinds. The best season for cultivation in beds is between November and February. In the hot months, the plants should be taken out of the beds and potted firmly and removed to a semi-shady cool place. Propagation is from cuttings or by division of clumps or from seed. New plants should be raised every year to replace old ones. Put half a dozen cuttings, (do not choose very soft and tender ones), 4–6 inches long, in a 6 inch pot in sand to which a little leaf-mould is added. Water carefully and keep the pot in shade in a cool place. After the cuttings have struck roots, cut the top ends a little to hasten the formation of more fresh roots and to force the plants to throw out shoots from under the soil. When the pot is full of roots transfer with the ball of earth undisturbed to 9 inch pots. Do not allow the plants to flower till they have grown enough to cover the pot. Feed with liquid manure of cow-dung water, during period of active growth. The plants continue flowering, being loaded with a mass of flowers, for nearly three months. The duration of blooming period is lengthened, by removing seed pods systematically, which also keeps the plant clean. When blooms are past and the plants have lost much of their beauty on account of the continued growth of the shoots which become bare and ugly when they become old, shift the plants from 9 to 12 inch pots and cut away the ugly shoots. In three to four months more, the plants throw out new suckers and shoots and become new plants for all practical purposes.

(IV) Semi-fibrous-rooted rhizomatous begonias. This class includes some attractive varieties as B. seelumbifolia. They are characterised by having thick creeping underground stems and large leaves with long stalks. They mostly flower in winter. Flowers are produced freely in long loose sprays. Some of the kinds are very hardy and thrive in the plains even in exposed situations. They are suited for growing on rockeries. Propagation can be made by cutting the creeping stem into one inch
Terminal cuttings also strike roots and make good plants.

*B. neelumbifolia* has large roundish thick light green leaves, resembling those of the lotus (hence the name) and bears pale pink flowers in plenty, crowded in long erect sprays. Makes an excellent pot plant, the large leaves covering the sides of the pot and the flowers making quite a good show above the handsome foliage. Does very well in the plains.

*B. discolor* has brownish foliage and bears erect attractive sprays of pink flowers. Does well as a pot plant. Suited for growing on rockeries too.

**(V)** Ornamental-leaved or Rex begonias. Foliage plants, treated here for convenience. One of the most handsome foliage plants, suited for pot culture and for rockeries for places above 2,000 feet. They are dwarf, ¼—1 foot high, rhizomatous perennials with foliage beautifully striped and blotched with different colours. They retain their beauty throughout the year, but, they make comparatively little growth in the winter months. Rex begonias do not thrive in the plains but they do respond to good cultivation inside conservatories. Rex begonias do best under a glass roofing failing which, when kept away from direct sunlight, in moderate shade, in a comparatively moist atmosphere, as in conservatories. To the compost recommended generally for all *Begonias*, some brick and charcoal pieces are preferably added for better drainage. During the period of least growth, they should be watered carefully, never giving them more than what is necessary to prevent them from shrivelling up. Propagated by seeds, by leaf cuttings, (see illustration on page 69), and by division of the old plant. From seed, they are grown in much the same way as tuberous-rooted begonias. For a cutting, the centre of the leaf with an inch of the stalk attached to it, is best, as this forms the best plant. But, any place, where two large veins meet, will strike root, if cut there and kept pressed into moist sand. The pan containing the cuttings is to be kept in a shady place and watered carefully, just keeping the soil moist. Young plants are developed and emerge out of the soil. These are potted separately in 3 or 4 inch pots using a light
soil, and shifted to 9 inch pots later on. Flowers as they appear, are to be removed as they would weaken the plant if allowed to seed. There are several varieties of Rex begonias.

**Bellis perennis.** (N. O. Compositae). (Perennial Daisy). Handsome perennial of dwarf habit of growth, (H. 6–9 inches), yielding double and single flowers in white, pink and crimson shades of colours. Plants raised from seeds are preferable to those raised from suckers taken out of old plants, being more floriferous and vigorous in growth. The young plants are potted when two inches high in 6 inch pots or transplanted 6 to 9 inches apart. Finally shifted from the 6 inch to 9 inch pots. Soil used should be light and rich. Daisies like a situation shaded from severe afternoon sun. They are useful for small beds or for edging or for pot culture; may be grown on rockeries. They do not thrive at low elevations. B. 3½–4 months. (C).

**Brachycome.** (N. O. Compositae). (Swan River Daisy). Hardy annual of dwarf growth, 6–10 inches high, with finely divided foliage, bearing in profusion pretty star-like blue or white or rose coloured daisy-like flowers. Well suited for small beds, floral edgings, or for pot culture. Seedlings do not transplant very well and hence sowing should be done where it is wanted to grow the annual and the seedlings thinned out 6 inches apart. B. 2½ months. (C).

**Browallia.** (N. O. Scrophulariaceae). Browallias are one of the most easily grown, pretty, free blooming annuals. They are strong growing, attaining a height of about 24 inches, frequently coming up by self sown seeds. A profusion of delicate blue or white flowers are produced in less than three months after sowing. The cold season seems to be best suited for growing Browallias but they can be grown with little care at other times too. They are effective only in masses in large beds or borders. D. 8–10 inches. For bushy growth, the plants should be pinched back frequently. *Browallia elata* is the species commonly grown, bearing deep blue or white small flowers. But, *B. speciosa major* is a better species which is rather uncommon with large attractive blooms of a deep violet colour. This species makes a showy pot plant too. It is pro-
pagated by cuttings inserted in sand and potted off as soon as new roots are sufficiently formed and established. Plants can be easily raised from seeds to flower in four months. Browallia major thrives better if protected from the severe afternoon sun. (C).

Cacalia. The Tassel flower.—Also known as Flora’s Paint Brush. Grows like a weed without care. Useful in border, producing small tassel-like flowers of orange, scarlet, yellow and white colours. Height 1½ feet; D. 9 inches; B. 10 weeks. (R & C).

*Calceolaria. (N. O. Scrophulariceae). One of the most beautiful plants, remarkable for its gorgeously coloured peculiar flowers, which resemble circular pocket purses. Flowers are borne in wonderful profusion, making a gorgeous display of colour in all shades and blotches of different colours. Essentially a pot plant fit for culture in green houses. Cannot be grown with any degree of success in the plains. Thrives well on the Hill stations. At medium elevations, only Calceolaria pinnata does fairly well. Seeds are very small and hence should be sown with the usual care exercised with such seeds. When seedlings form four to six leaves, they are pricked off into small 4 inch pots in a light soil composed of a large quantity of sand and leaf-mould. They also suffer by sudden changes of temperature and from a dry atmosphere. The plants are later shifted on to 9-inch pots, using a slightly richer compost than before. But, the soil should be open and friable. For bushy growth, the plants should be stopped a number of times before flowering. Careful watering and shading from strong sunshine are absolutely essential. H, about 2 feet. B, 8—10 months. (C).

*Calendula. (N. O. Compositae). (Pot Marigold). Free flowering annual of easy culture, succeeding on any good soil and blooming continuously for nearly two months. There are many varieties, single and double flowered, varying from straw colour to deep orange, the double flowers often measuring 1½ to 2 inches across. Imported seeds do not germinate well except in the cold season and hence it is advisable to save seeds for future use by tying a piece of muslin over the flowers, after they are
well past their age, so that the seeds may not drop off on ripening. Seedlings do not transplant well and hence seeds should be sown where they are wanted to grow. D. 12 inches. For pot culture, pot the seedlings when they are about two inches high, without injuring the roots, in 9-inch pots. B. 2½—3 months. The blooming period is very much prolonged by regularly cutting away old blooms. Thrives well in places with heavy rainfall too. (C & R).

*Calliopsis. (N. O. Compositae). (Coreopsis). One of the most free flowering hardy annuals; very showy, producing flowers in great profusion, which are poised over their long stalks well above the foliage, which in many kinds is very handsome being beautifully divided or feathery. Flowers are single or double; they are available in yellow, bronze, orange, and crimson colours. Excellent for borders and they do better in the ground than in pots as they require a lot of room for their roots. Sow seeds in pans or seed-beds and when the sixth leaf appears on the seedlings, transplant them 12 to 18 inches apart, the distance depending upon the height to which the particular variety grows. H. 1—3 feet. B. 4 months. C. Drummondi is a dwarf variety, H. 8—15 inches, producing bright golden yellow flowers with velvety crimson centre, in endless profusion. C. grandiflora yields brilliant yellow flowers shaded with orange. A perennial H. 3—feet. C. tectoria bears dark crimson flowers, H. 2½—3 feet. C. coronaria is another good species. All are good for cutting. C. sultan is a dwarf kind, H. 9—12 inches, bearing hundreds of crimson and maroon flowers in a thick compact little plant. (RSC).

*Campanula. (N. O. Campanulaceae). Bell Flower. Large genus consisting of annuals, biennials and perennials of varying size and habit of growth, producing characteristic large cup or bell-shaped flowers of imposing beauty. The usual colours are blue, mauve, pink or white. Flowers are single or double. Campanulas thrive best only in the hill stations and some kinds can be tried with success at medium elevations. B. 8—9 months. Pot seedlings when fit to be handled in small 3 inch pots and transfer to larger pots with increasing growth (CR).
Candytuft.—See under Iberis.

Carnation.—See under Dianthus.

Celosia. (N. O. Amaranthaceae). Popular pretty garden annuals, which are grown for their agglomerated large flower heads; easy of culture, thriving in rich deeply dug soil, with a liberal supply of water; very effective in flower beds or borders, the blooms lasting for more than two months. (R.S.C).

There are several types, the following being noteworthy:

*Celosia cristata (Cockscomb). A charming annual, for culture in pots and in borders; H, 9—24 inches. A large compact velvety head of flower of yellow, crimson or purple shade, sometimes as large as a child's head measuring 12 by 9 inches, is borne well above the foliage. Grow dwarf kinds in 9 inch pots and intermediate and tall kinds in long borders. Can be grown throughout the year. Sow seeds in seed-pans and prick the seedlings off when they have half a dozen leaves. For pot culture, pot singly in 4 inch pots. Retain only plants which form good cobs and when they grow transfer to 9 inch pots. D. for dwarf kinds, 9—12 inches, for tall kinds, 12—15 inches. Apply liquid manure once in ten days. B. 3-months; tall giant varieties take 4 months.

*Celosia plumosa. (Feathery Cockscomb). H. 12—24 inches; of a branching habit of growth, unlike the preceding type, producing large plumes of more or less pyramidal form resembling ostrich-plumes, very effective in beds; can be successfully grown in 12-inch pots. The plumes often measure 12—18 inches by 8 inches at the thickest portion. D. 18—24 inches. B. 2½ months.

*Celosia Childsi (Chinese Wool Flower). A unique type of the preceding species. The plant is of the same habit of growth as C. plumosa but bears wooly globular heads of the size of tennis balls at the ends of the several shoots. H. 1½—2½ feet. The commonest colour is carmine but the pink, white and yellow are now available. B. 2½ months.

*Centaurea. (N. O. Compositae). The two species which are commonly grown are C. cyanus and C. moschata...The former is popularly known as the Corn flower or the Bluebottle and the latter as the Sweet Sultan. Corn flowers are
showy annuals, H. 18—24 inches. B. 4—4½ months, flowering in
great profusion. The colours are blue, pink, rose, lilac, white,
and purple. The flowers with their long stalks are very useful
for cutting. Do not flower as freely in the plains as at medi­
um elevations. Broadcast the seeds and thin out 9 inches
apart. Watering should be sparingly done.

The Sweet Sultan, H. 2—feet; bears very pretty thistle­
like, delicate-looking, delightfully scented flowers, which are
white, mauve, lilac, purple or yellow. The soil should be light
and rich and well drained; liable to rot if overwatered. Sow
in seed pans and very carefully transplant when the seedlings
are two inches high; the roots are very delicate and liable to
break by careless handling; or broadcast seeds and thin out
12 inches apart. More difficult to grow than Corn Flower.
B. 3—3½ months. *C. imperialis (Royal Sweet Sultans) bear
improved large sweet scented flowers. (C).

Cheiranthus. (N. O. Cruciferae). (Wall Flower; Gilli
Flower). Small shrubby biennials and perennials, growing
1—1½ feet high producing flowers like Stocks. They do not
bloom satisfactorily at low and medium elevations. Soil should
contain lime and be light. D. 12—18 inches; B. 5—8 months.
(C).

*C. Chrysanthemum. (N. O. Compositae). (Tamil, "Javanthi";
Canarese, "Savantige"). A beautiful family of plants of varied
character, comprising of both perennial and annual species.
Flowers are single or double, are available in very attractive
colours and are very useful for cutting. In Indian gardens,
one is accustomed to find only the perennial species, bearing
profusely, comparatively small, highly scented, yellow or white
flowers, which are used for Puja purposes and by Hindu ladies
for garlands and head-dress. These perennial small flowering
kinds are very extensively grown in large fields by market
gardeners to meet the demand for flowers during the Gouri­
Ganasa and the Dasara or Navaratri festivities. Fields of these
Chrysanthemums, when in full bloom, present one of the gran­
dest floral sights.

Annual species. Make good plants for the mixed border,
for bedding and for pot culture; they are hardy, thrive in open
Many annuals, biennials, herbaceous perennials are suitable for many situations, and can be grown with comparatively little care. Flowers are handsome and are useful for cutting. Except a few species, they thrive only from medium to high elevations. (C). The following deserve mention:

*C. carpinitum (or tricolor), known as the Summer Marguerite in England, is very handsome with its elegantly cut foliage and pretty daisy-like three coloured flowers, which measure 2 to 4 inches across; they have a dark centre with an inner ring of colour, different from the rest of the flower. The double flowers are available in yellow or white colours, raised from seeds. H. 2½—3½ feet. B. 3½—4 months. D. 2 feet.

*C. coronarium, called the Crown Daisy, is of a more branching habit of growth and has less finely cut foliage than the preceding species. Flowers are single or double and are white or yellow or orange coloured. A certain proportion of plants raised from seeds produce single flowers.

Perennial species.—Of the perennial species, those that are worth mentioning are:

*C. maximum and its varieties, (Ox-eye Daisies) are hardy herbaceous perennials, growing 18 to 30 inches high. They have glossy green, leathery, toothed leaves and bear showy white flowers with an yellow centre, measuring 2½—3 inches across.

*C. Leucanthemum grandiflorum (British Ox-eye Daisy) bears large refined flowers.

The Shasta Daisies are charming American hybrids from C. leucanthemum and C. maximum; they are dwarf compact bushes, covered with snowy white flowers nearly 4 inches across, produced in great abundance.

All the above mentioned perennial species thrive only on the hill stations and are propagated by division of the old plants and also from seed.

*C. frutescens (White Paris Daisy or the French Marguerite) is a small shrubby plant, 2 to 2½ feet high, with finely cut foliage of ashy green colour and bearing single, daisy-like white flowers. It is a charming plant for pot culture or for growing in beds or borders. It is easily raised from cuttings. It is
suited for medium to high elevations only; thrives well in Bangalore.

"Florist's Chrysanthemums" are varieties and types derived mainly from C. hortorum and C. indicum. Flowers are largely double—there are several attractive single flowering kinds also—often measuring 6 to 9 inches across. The colour, form, and the arrangement and the shape of the petals vary with the varieties or types. While some varieties are scented, others have but little fragrance. There are numbers of named varieties advertised by specialists in Chrysanthemums.

Generally, Florists chrysanthemums fall under one of the following types or classes: — (a) Incurved. (b) Reflexed. (c) Japanese. (d) Pompon. (e) Anemone. (f) Rayonnante. (g) Singles, and (h) Miscellaneous Fancy kinds, as the spidery, plumed and feathery kinds of a fanciful character. The shape and form of flowers and arrangement of petals form the basis for classification. In the incurved type of flower, the petals are turned upwards and away from the flower-stalk and curve inwards so that they form a globular head of regular outline. In the reflexed type, the petals are turned back and downwards towards the flower-stalk. The Japanese class includes a wide range of form, size and colour and it is very popular. In this type, the flower is highly irregular, being in utter contrast with the two preceding types; the petals are tossed about wildly in every direction in charming dis-array, though on the whole the flower is globular or nearly globular. The Anemones are distinguished from all the above types in having a high, neatly formed centre of close petals, almost like a Sun flower, but still more like an Anemone, surrounded by a fringe of edging of large loose petals. The Rayonnante and its forms offer a distinct pretty type with tubular petals, making light and graceful blooms; the Rayonnante has greater resemblance to the Cactus-flowered-Dahlia than any other Chrysanthemum. The single and semi-double kinds have one or two rows of petals with a large disc in the centre.

Chrysanthemums can be propagated in three ways: — (1) By suckers taken out of old plants, each piece or sucker having some roots of its own. (2) By cuttings. (3) From seed. Pro-
Propagation from seed is seldom resorted to unless new varieties are desired to be grown. Propagation by cuttings is the best method. Plants obtained by division produce during their growth, a larger number of troublesome suckers that come up from below and have frequently to be removed, than those raised from cuttings. Hence, the first step in the cultivation of Chrysanthemums is to secure good healthy cuttings. Plants of the preceding year which have finished flowering, afford good stock from which to propagate the following season. After flowering is over, the soil in the pot is top-dressed with a rich mixture of manure and loam and the stem which has finished flowering is cut back to the soil level. The plant is well taken care of with regular and liberal supplies of water and is kept in an open sunny situation. In a few days, sappy short sturdy suckers or "stools" as they are called, are produced. Growths that come up around the base of the stem make the best cuttings. When the suckers are 5 to 6 inches high, terminal cuttings, 2 to 3 inches in length are taken from them. The lower leaves of each cutting are removed and the upper leaves are shortened in length, if necessary. The cuttings, thus prepared, are potted in porous soil made up of equal parts of well rotten sifted leafmould and sand in seed pans or nursery beds. In Bangalore and Madras, Chrysanthemums are timed to flower early in the months of August and February respectively. For this purpose slips are started for rooting, about six months before the blooms are wanted. As soon as the slips are rooted well and are growing, they are potted off singly in 5-inch pots in fairly rich soil (compost no. 1, page 112). As growth progresses, the plants should be copiously watered. When the roots fill the pots, the plants are shifted to 9 inch pots. After the plants are well established, plenty of water and full sunshine should be given to them. The best plan to reduce the height of the plant to a minimum is to pot-hard them, that is, press the soil firmly around the plant, and see to it that the plants are not overcrowded while growing.

Chrysanthemums require a liberal supply of water and there is little danger of overwatering them. So long as the foliage is bright green, there is no fear at all. If it turns yel-
low and sickly, it is a sign that the drainage is not alright and that the plant is suffering from stagnation of water at the roots.

Chrysanthemums are gross feeders and hence for large blooms, weak liquid manure prepared by allowing pongamia oil cake in water is applied once a fortnight. No fixed rule is feasible regarding feeding. Very often, the look of the plant is a safe guide. The limit of feeding can be said to be reached when the leaves are dark green and have become brittle. In some varieties, overfeeding leads to refusal to bud, the plant going into leaf. Again, in some others, overfeeding results in distorted and mishappen buds and flowers and in the "burning" of the core of the flower head.

Suckers are to be removed as soon as they are noticed, as they grow at the expense of the parent plant and rob the soil of much of its nutritive contents. The plants are staked and trained from the stage they are about 9 inches high. All lateral growths from the stem are removed, only retaining shoots which are to flower. For large show-blooms, plants are restricted to a single stem and flower. But for garden decoration, the popular type of a pot-plant is a compact bushy plant, 1½ to 2 feet high, branched at the base and bearing 4 to 20 flowers, averaging 3 to 4 inches across. This kind of bushy specimen is obtained by pinching the top of the plant when it is about 6 inches high and allowing the lateral growths to come up. The buds on these shoots may be thinned out for larger blooms if desired. Single flowered kinds, if grown bushy look like Cineraria blooms. The 'Cascade' type is charming with daisy like flowers borne in hundreds.

In the cultivation of Chrysanthemums for exhibition, the whole energy of the plant is utilised to produce only one or two blooms by recourse to disbudding. In growing large flowered show-kinds, one has to note the difference between the crown and terminal buds. When a plant is grown to a single stem, it produces first, one single bud (the crown bud), which never comes with other buds. Below the crown bud, are a number of lateral growths, which if allowed to remain, will continue their growth and produce terminal buds later on. The crown bud is largest in size and with the removal of the lateral shoots
under this bud, disbudding is complete. But, it is to be noted, that very often and in the case of certain varieties invariably, the crown bud results in a coarse, though large flower. If that is the case, terminal buds give better blooms. Terminal buds come up later than the crown bud, in clusters and are not associated with lateral growths as the crown bud. If flowers are to be had from terminal buds, the crown bud is removed and one or two or three of the lateral growths just under it are retained, according to the vigour of the plant. At the apex of or in the centre of each cluster of terminal buds will be noticed a large bud, which is usually perfect and is saved, while the others are rubbed off with the thumb and the forefinger.

When the buds are half open, it is advisable to shelter them from the severe afternoon sun. At this stage care is be taken not to wet the petals of the flower. If the bud shows a disinclination to open, the calyx should be carefully split.

Pests and diseases to which Chrysanthemums are mainly liable to are (i) the Cockchafer grub. (ii) Aphis. (iii) Caterpillars, eating leaves. (iv) Rust, and (v) Black spot. For remedies, see under the respective headings in Chapter XI.

In summing up, it may be mentioned, that with careful selection of sturdy cuttings, generous culture throughout the growing season, close attention to watering, feeding, removal of suckers, staking and disbudding, and keeping the plants free from diseases and pests, one is assured of the lovely large blooms, which will repay the trouble taken over a period of six months. (R & C). 

*Cineraria.* (N. O. Compositae). Very beautiful perennial pot plants, for the conservatory. Very showy with their large luxuriant leaves which are surmounted by immense panicles of magnificent large flowers of most brilliant colours. Blooms last for quite a long time—as long as nearly a month. H. 1–1½ feet. There are two types, the Florist's or grandiflora type and the Stellata or the Star type. The latter class is very popular nowadays. The former are dwarf growing and bear solid masses of large flowers. The latter type grows taller, to about 2 feet, has smaller leaves, has smaller individual flowers but more numerous than in the grandiflora type; and the rays or the petals
are separated as in Michaelmas Daisies. Cinerarias cannot be successfully grown in the plains. They do well at medium elevations in the cold season.

Cinerarias are grown annually from seed, though they may be raised from cuttings taken from old plants. Seeds are very minute and sown with all the precautions to be taken in sowing such seeds. (See pages 38—60). Only good seed produces good flowers. Seedlings are 'pricked' when they show first rough leaf. When they are large enough to be handled with ease, they are potted in small 3-inch pots in a soil composed of 2 parts each of well sifted leaf-mould, fine silvery sand, and, 1 part each of red earth and well rotten powdered horse mure. The pots are removed to a shady situation and given only morning sun after they are established. As the plants grow and develop more roots, they are shifted to 6-inch and finally into 9-inch pots, using compost no. 1 (page 112). Shelter from wind, plenty of good air, a position where it gets morning sun, careful watering, occasional feeding with liquid manure, (weak cow-dung solution), are all that need to be attended to in the cultivation of Cinerarias. Frequent overhead sprinklings with clear water benefit them immensely. At medium elevations, the plants flower but once and die but on the hills, they can be cut down to an inch from the surface of the soil and top-dressed with fresh compost to flower a second time during the following season. Usually, for exhibition purposes, only one bunch of flower is grown on a plant. Mildew, aphides and thrips are the greatest enemies of Cinerarias; bad cultivation and overcrowding usually bring on mildew. As a preventive measure, the plants are sprayed with Bordeaux Mixture solution, when they are fully grown and are about to flower. Aphides and thrips are easily eradicated by spraying with weak tobacco water. B. 4½—5 months. (C).

*Clarkia. (N. O. Onagraceae). One of the most showy but delicate annuals, not succeeding well at low elevations, H. 1½—2 feet. Bears very handsome flowers of pink, white, magenta and red in several shades, in long spikes, which are useful for cutting. Clarkias are effective in beds and borders in masses but they are usually grown in 10-inch pots, putting
three to five plants in a pot. They do not stand much mois­
ture and they should necessarily be protected from exposure
to rains. They need pinching back twice or thrice for bushy
growth. B. 3½ months. Clarkia elegans and C. pulchella are
the favourite species. (C).

Cleome. (N. O. Capparidaceae). (Spider Flower). Hardy
stately annuals, forming neat attractive bushy plants, bearing
freely, erect clumps of very queer looking flowers well
above the foliage, consisting of large digitate leaves, which are
seven lobed and are carried on long stalks. H. 3—4 feet.
Flowers are very interesting, consisting of four showy petals
and long slender stamens and stigma so wonderfully arranged
that they have the appearance of spiders, hence the common
name, Spider Flower. There are two varieties, bearing pure
white or lilac flowers. The white kind is more striking than
the lilac coloured kind. Seeds are borne plentifully on long
slender pods borne on long slender stalks. They should be
soaked in water for at least three hours before sowing to insure
quick and uniform germination. B. 3 months. Flowering con­
tinues for nearly a month and a half. Cleomes thrive in a deep
rich soil and like being watered copiously during the period of
vigorous growth. Pot singly in 10 inch pots or grow in ground
18—24 inches apart. Very useful as a background for floral
borders and for circular beds cut out on lawns. (S.R.).

Cobaea scandens. (N. O. Polemoniaceae). (Cup and Saucer
Vine). One of the most beautiful annual climbers in cultiva­
tion. It is a tendril-climber and a very rapid grower and hence
it is very desirable for covering a large trellis with its large
fine glossy finger-formed foliage and large trumpet-shaped
flowers. Makes a good pot plant over a balloon. Flowers are
dull greenish white in colour on opening but they deepen in
a few days to deep purplish blue. When in full bloom, the
climber bears blooms of different colours according to their
different stages of development. Cobaea cannot be grown suc­
cessfully in the plains as it is affected by the severe summer.
Seeds are flat and they should be sown edgeways. The colour
of the flowers is appreciably intensified by the addition of lime
and brick rubbish to the soil.
Convolvulus. (N. O. Convolvulaceae). (Morning Glory).

Group of handsome climbing plants of great beauty. C. tricolor (C. minor) is a creeping dwarf annual, 1 to $\frac{1}{2}$ feet high; it is a useful bedding or border, free-flowering annual, with blue or purple flowers with white or yellow centre. Grown in baskets, it is very handsome. Broadcast seeds in the bed and stake the plants when they are having four leaves with green-painted sticks and allow the plants to grow thickly on them. Seeds can be sown all the year round except at the approach of the hot and the rainy seasons. (R.C.)

Convolvulus major (Ipomoea purpurea) is a popular creeper well suited for covering summer houses, trellis, ornamental wirework etc. It produces every morning a profusion of flowers, which are available in a large number of shades of colours. Flowers close at mid-day and are hence called Morning Glories.

*Cosmos. (N. O. Compositae). (Mexican Aster). Cosmos bipinnata is a delightful, hardy, popular, rainy-season annual, with graceful feathery foliage and large, daisy-like flowers of white, crimson, rose, and purple colours. H. 2—5 feet. Flowers are sometimes three to four inches across and bear long stalks, making them very useful for cutting and decoration of the dinner table. Some double or crested kinds have been introduced latterly. The plants easily grow into large bushes. branching from the base. B. 2—$\frac{1}{2}$ months. Seeds could be sown where the plants are wanted to grow and the seedlings thinned out 10 to 18 inches apart according to the habit of growth of the variety grown. The plants should be made bushy before they are allowed to flower, by pinching back the shoots. Seeds can also be sown in pots and seedlings transplanted, when they are two inches high. Cosmos can be grown throughout the year. C. hybrid Klondyke grows very tall and robust and produces orange coloured flowers. H. 5—6 feet. (R.S.).


Datura. (N. O. Solanaceae). Large, coarse growing annual and perennial shrubs with large, trumpet-shaped flowers, very easily grown. Though ornamental, they are very little appreciated. The fruits, leaves and flowers are poisonous. The following are handsome annuals grown from seed:

D. Cornucopia, called the Horn of Plenty, is a striking species with large double sweet-scented white flowers, marbled on the outside with royal purple. The flowers are often 8 by 5 inches.

D. Chlorantha flora plena bears sweet-scented, double, yellow flowers.

D. Wrightii is a showy species with dark bluish green leaves and dark purple stems and white, blue-shaded, sweet-scented flowers.

And many others may be grown from seed, either in pots or in the ground.


*Dianthus. (N. O. Caryophyllaceae). The genus, Dianthus, includes some of the most beautiful plants, which adorn our gardens. Carnations, Picotees, Pinks and Sweet Williams belong to this genus. They are all herbaceous plants, growing 6 to 18 inches high, bearing single or double flowers which are available in a good many bright and attractive colours and are valued for cutting. All are perennials by nature, though some of them are raised from seed each time they are wanted; all
are useful as pot or ground plants. All the above mentioned kinds dislike excess of water at the roots, being subject to root and stem rot.

*The Chinese or Indian Pinks which include *Dianthus chinensis, *Dianthus lacinatus, *Dianthus Hedewigii as also such types as the *diadem and *nobilis or (Royal) pinks are favourite bedding annuals, both in their single and double flowering forms. (C.).

Sow seeds at the end of the rainy season, in October in the plains and in March on the hills. Do not overwater the pans or the seed-beds or the seedlings will damp off. Transplant seedlings when they are about an inch high, and gradually harden them. When they are about two inches high plant them out in beds, 6 to 9 inches apart. For pot culture, one plant is put in a 6 inch pot or three in a 9 inch pot. Prick shoots twice or thrice before flowering for bushy growth. Raised from a mixed packet of seeds, a remarkable variation in the colours of the flowers is noticed, no two flowers being alike. The period of bloom is long and it is further prolonged by regularly removing fading flowers. A well drained light rich soil, sunny situation and careful watering are all that are necessary for success; it is always advisable to keep them on the dry side than overwatering them. B. 3½—4 months.

*C. *Dianthus barbatus. (Sweet William), has the same habit of growth as Pinks but the leaves are often broader than the latter and the flowers are borne in large trusses, each individual flower being very much like that of a pink. The true Sweet Williams do not bloom in the plains, or even at medium elevations. But, the annual kinds, *barbata chinensis, can be grown in the plains in the cold season, just like Pinks. They require lime in the soil.

*Dianthus caryophyllus. (Carnation and Picotees). Carnations are universal favourites. They are grown in pots or in the ground. Flowers are of exquisite form and beauty and are invaluable for cutting. Many of the kinds are sweet-scented, though some are without appreciable fragrance. The Marguerites have a distinct clove scent. There are distinct types of carnations and all of them can be grown successfully in the
cooler parts of the plains and at medium to high elevations, where they thrive best. In the plains only the Marguerites are successful. The following are important types:—

(a) Border carnations are the hardiest of carnations and they are grown in beds and borders in England. The modern varieties of border carnations are the high water-mark of quality in carnations. They are distinguished by broad smooth-edged petals, by their dwarf and compact habit of growth, branching usually at the base and not too much on the stem. There is a wide range in the colours of the flowers and according to the colour scheme displayed by them, they are classified as follows:—(1) Selfs have one decided colour in the petals, without any stripes or spots of different colour or shades of the same colour. (2) Bizarres and Flakes are white-ground carnations. The Bizarre has on every petal, stripes of two different colours. In the Flake, the stripes are of one and the same colour. In both the kinds, the stripes should be clear and well defined, and broad on the edge of the petals gradually diminishing until they sink into the heart of the flower. (3) Picotees have either yellow or white background; the petals are firm, flat and smooth, and their edges are well rounded and free from fimbriations and bordered with a band of colour at the margin. The line of colour on the edge of the petal may be light, medium or heavy but it should be of one continuous colour and confined to the edge, and (4) Fancies are varieties, which cannot be put under any other classes mentioned above: they should be large and have well-shaped brilliantly coloured petals.

(b) Tree or Perpetual or American carnations. Are tall growing and free flowering and have a tendency to produce lateral shoots on stems, forming a sub-shrubby appearance. Blooms have serrated or fringed petals and are borne throughout the year, and hence the name, Perpetual carnation. Classification into selfs, bizarres, picotees, etc. holds good in this type also.

(c) Malmaison carnations have a strong and sturdy habit of growth, taking up more room than any other type of carnation. Flowers are very large and sometimes as big as a rose.
They are self coloured and are not borne so very profusely as in other types.

* (d) Marguerite carnations are a race of hybrid carnations with fringed, fragrant, clove-scented flowers of all shades of colour. They are very easily raised from seeds and unlike other types, they flower in the same season in which the seeds are sown—in four months. Hence, they are treated as annuals and grown like Pinks from seed each time.

All kinds of carnations are grown in much the same way. B. 4—12 months. Imported seeds produce a fairly large percentage of double flowering plants. Very often, plants raised from seeds give rise to specimens, which run into leaf without producing blooms. This is particularly so at low elevations. Sow seeds thinly in well drained pans and keep them in a cool place. Water just enough to keep the soil moist, as seedlings are liable to damp off. When the fourth leaf has formed, prick the seedlings or pot them firmly in three inch pots singly, using a compost made up of equal parts of leaf-mould and garden soil and covering the plants to the level of the first seed-leaves. Harden the young plants gradually admitting more and more sunshine to them. Shift them to 10 inch pots, after they are well established in the smaller pots using compost No. 1 on page 112. Take care the drainage of the pots is perfect, and the roots are never sunk deep. Keep the soil on a level with the collar of the plant. Water sparingly till plants establish after potting. Give them a sunny situation. When the young plants are about six inches high, top them for promoting side growths. For this hold the plants firmly with one hand and pull off the tops of the shoots or bend the tops of the plants sideways and break them off. Retain only three or four suitable shoots of equal growth. When they grow about 6 inches, top them again and retain only two side shoots on each of them. Treated in this way, fairly bushy specimens are obtained, which if properly cultivated, will give at least 6 to 8 large flowers after disbudding; if no disbudding is done, 15 to 20 flowers can be expected. After the plants establish in the 10 inch pots, feed them with weak liquid manure prepared from horse-dung, once a fortnight till buds show colour. Top dress with a
mixture of three parts of powdered rotten horse manure and one part of sand and one part of red earth, once in three months, in which case, liquid manuring is unnecessary. Small bamboo thattles, painted green, are used in Bangalore for staking. These are very obtrusive but they seem to be indispensable for weak stemmed plants. For strong growing kinds, shoots of which stand almost upright, a strong bamboo stick, painted green, and inserted in the middle of the pot will serve as an agreeable support for tying the several shoots as they grow. Disbud, for large blooms. The method of disbudding varies with the varieties but in the majority of cases, the side buds are removed as soon as they can be handled with ease, leaving the top bud in the middle undisturbed. In the case of those kinds which burst the calyx, a small bud adjoining it is kept on till the top bud shows colour to prevent bursting of the calyx. But in some varieties, the calyx bursts inspite of all attempts to check it. Place rubber bands round the calyx one-third away from the base to prevent the calyx from bursting. A fortnight after the plants have ceased flowering, cut them back to four or six nodes from the base. After the new growths are about an inch in length, top dress or repot the plants. Retain only six to nine of the strongest shoots of equal strength and size. Treat the plants as before and they bloom again in another four months. After four to five seasons, the plants become too old to be profitably retained.

The commonest method by which carnations are raised is by cuttings. The shoots or growths situated about the middle of the plant make the best cuttings. The method of preparing and potting cuttings is described below:—Detach a little side-shoot, 2 to 4 inches in length, from the plant by pulling it downwards from the stem. Smoothen the heel or cut the cutting under a node if it is a terminal cutting, with a sharp knife. Cut away the leaves at the base to a height of about two inches. Reduce the top leaves to half their size if the weather is hot. Put six such cuttings into a six inch pot, placing one in the centre and the rest by the edge of the pot. Use pure sand for inserting cuttings. Make holes for their reception with a small dibber in the sand an inch deep and insert the slips.
into them taking care that they rest at the bottom of the holes. Firm the soil round each cutting as it is inserted in it. Water with a "rose" and place the pot in a propagating frame or under a bell-jar, or in shade, if neither is available. Shade cuttings from strong sun. Keep the soil just moist and do not allow it at any time to dry up. In about four weeks, the cuttings strike root, when they are potted singly in small four inch pots. Treat the young plants as described above for seedlings.

Carnations may also be increased by layers. Layering is done in pots or the shoots may be bent into the soil direct if possible. Usually, a joint half way between the commencement of a shoot and its tip is chosen for making the cut. The shoot is prepared by trimming off all the leaves, except those near the top, with a sharp knife. An incision is made half way through the shoot, with an upward cut, beginning below a joint and passing the blade through it for about half an inch or so. The layer is bent down into sandy soil and pegged down in such a manner as to keep the slit or tongue open and covered over with sand or light compost. The layers may be separated after two months by which time they may be ready. They are then potted in four inch pots.

*Didiscus. (Blue-Lace Flower). An upright much branched annual. H. 1½—2 feet. Flowers are interesting and attractively gathered in lace-like, delicate, flower heads about 2 inches across. D. 9—12 inches. B. 3—3½ months. The usual colour is beautiful sky-blue. There is a white flowered variety also. (C).

Eschscholtzia. (N. O. Papaveraceae). (Californian Poppy). Low growing annuals of easy culture. H. 1—1½ feet. The foliage is much divided. Large, expanded, saucer-shaped flowers, which measure 4 to 6 inches in diameter and are brilliantly coloured and open only in bright sunshine, are profusely borne for quite a long period. Only acclimatised seeds give good results in the plains. Light and sandy soil is necessary. Sow where they are wanted to grow, as the seedlings do not transplant well. Thin seedlings 10 to 12 inches apart. B. about 4 months. (C).

Forget-Me-Not.—See Myosotis.
**Fuchsia.** (N. O. Onagraceae). Small herbaceous shrubs with very pretty flowers hanging down the tips of branches as so many ear-drops. Hence the common name for them, Ear-Drops. There are several species grown in the garden. The plants are of varying habits of growth. Flowers are double or single. Fuchsias can be obtained from cooler regions and grown only for a season or two in the plains. They do best on Hill Stations and tolerably well at medium elevations. They are essentially grown in 10—12 inch pots. Some kinds are suited for growing in hanging baskets.

Propagation from seeds is interesting as new varieties are secured this way. Seeds are very tiny and should be sown with the greatest care possible. B. 12 months or so. The common method of propagation is by cuttings, which root with no great difficulty. Insert cuttings 2 to 3 inches long, taken out of the terminal portion of growing shoots in pure silver sand; water carefully and shade them from sun. They strike roots in three to four weeks. Pot the rooted cuttings singly in 4 inch pots in porous soil made up of equal parts of sand and leafmould. When the pots are filled with roots, shift the plants to 9 inch pots using compost No. 2 on page 112. Pinch off the tops of the shoots a number of times for bushy large specimens. Apply weak liquid manure, prepared from horse-dung, once every fortnight. Keep them in a cool place in the summer months and screen them at all stages of their growth from afternoon sun. The blooming period lasts for nearly a month and a half or more. A month after the plants have finished flowering, prune back the shoots to a third of their length. When the new shoots have made growths of an inch or so, remove a few inches of the old soil from the pots and replace them with fresh compost; or repot the plants firmly and take particular care in watering. If too many shoots come up thin them out retaining only the strong ones which give a shape to the plants. Treat them as mentioned above and they flower a second time in another four or five months. This can be repeated a number of times till the plants become old.

**Gaillardia.** (N. O. Compositae). (Blanket Flower). Hardy attractive bushy bedding plants, some perennials and others
annuals, all grown from seed only. Successfully grown throughout the year, valuable especially for summer bedding. Suited for borders and for cultivation in 10—12 inch pots. Flowers are very pretty, single or double, and are available in very pretty combinations of orange, crimson, purple, yellow and other colours, blended and streaked in various ways. Blooming which is very long is further lengthened by cutting away fading flowers without allowing them to run into seed. Flowers are very useful for making bouquets in which also they last long; they are invaluable for cutting for decoration in vases or bowls. H. 1—1½ feet. D. 12 inches. B. 4—4½ months. Gaillardia picta or Drummondii is a bedding favourite, bearing large single yellow and coppery red flowers. H. 18—20 inches. Lorenziana double is a new strain bearing double, yellow or red flowers. Gaillardia grandiflora is a perennial, very popular on account of its large flowers, which resemble small Sun-flowers, mostly in yellow, orange, and red colours. (RHC).


Geranium. —See under Pelargonium.

*Gerbera. (N. O. Compositae). (Transval or Barberton Daisy). Stemless perennial herbs with radical stalked leaves, which are 10 to 12 inches long and lobed. H. 12—15 inches. Flower heads are solitary, very pretty, large and star-like, often 4—5 inches across, and borne on long and slender stalks. Gerbera Jamesonii is the best species for cultivation in the garden. Propagation by division of old clumps or from seed. B, about six months. D. 1 foot. Excellent for borders and for pot culture. Double flowered varieties are recently introduced in a variety of colours.

*Godetia. (N. O. Onagraceae). Annuals, making sturdy little bushes covered with large handsome flowers of brilliant and delicate shades. H. 1½—3 feet. The colours are pure white, rose, deep red, crimson, and blotched shades. Of late, double flowered kinds are introduced. The plants can be
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grown in 9 inch pots singly or in beds; D. 9—12 inches. B. 3½ months. Godetias do not do well in the plains. They are suited only for medium to high elevations. They make rank growth in rich soil. Grow them in light soil which is not too rich. Give them just the same treatment as Clarkias. The following are noteworthy kinds:—Duchess of Albany bears large satiny white flowers in pyramidal clusters. The Bridesmaid bears flowers, very large and beautifully blotched rose on a bluish white background. The Marchioness of Salisbury is one of the most attractive kinds, bearing a profusion of large bright showy flowers, vivid glowing crimson with a broad white margin. The Crimson Gem is one of the most brilliantly coloured Godetias. (C).

*Gomphrena globosa. (N. O. Amaranthaceae). (Globe Amaranth or the Bachelor's Button). Pretty, hardy annual requiring very little attention in cultivation. H. 1—1½ feet. Bushy plants, bearing attractive, globular, everlasting flowers of the diameter of a coat button. The colours of the flowers are white, pink, rose, orange, and deep magenta. Plant out seedlings, when they are about two inches high; D. 12—15 inches. Plants grown in 6 inch pots are very useful for indoor decoration. Globe Amaranth can be grown throughout the year. (R.S.C.).

*Gypsophila. (N. O. Caryophyllaceae). (Baby's Breath Chalk Plant): Annuals and perennials. Plants are graceful, producing panicles of pure white or pink, tiny flowers. The mist-like sprays are very useful, for making bouquets, and as cut flowers, used along with other flowers of bright colours toning them down. Gypsophilas are cold season plants and they do not quite as well thrive in the plains as they do at medium to high elevations. H. 12—18 inches. Sow where they are wanted to grow, as seedlings do not transplant well. Light soil with lime in it is best suited. Thin out 8—10 inches apart. B. 2½—3 months. Rabbits are fond of this plant and they should be protected by twigs or brambles placed round the beds at night time to scare them away. Gypsophila elegans is a hardy graceful plant, about 18 inches high, bearing tall sprays of misty white small flowers. For pot culture, have a single
plant in a six inch pot or place three in a 9 inch pot. Blooms are produced 11 weeks after the seeds are sown and last for nearly 20 days. *G. paniculata* is a perennial but in this country, it is treated as an annual. (C).

*Helianthus.* (N. O. Compositae). (Sun Flower). The word, Helianthus is derived from Greek, helios, the sun, and anthos a flower, on account of the belief that the flowers follow the sun from east to west. But, this is true of only one species, *H. annus.* Helianthus is a variable genus, comprising of coarse growing hardy plants most of them being annuals. The *Russian Sun Flower*, a tall giant sort (*H. 6–8 feet*) producing enormous single flowers, is an economic plant, an oil being extracted from its seeds, which are also used as fodder for cattle. *H.* varies from 3 to 8 feet; D. 2–3 feet according to kind; B. 2 to 3½ months. Flowers single or double, in yellow and golden shades. The new “Red Sun Flowers,” having the appearance of giant Gaillardias, are handsome in large borders. All kinds are useful for planting in clumps or as a background for borders. They can be grown throughout the year. Seeds are sown in well prepared pits where the plants are to grow or sown and transplanted with care. As they are deep rooting, the ground is to be well cultivated and manured. The plants are to be staked as they grow tall and are to be plentifully watered.

The Japanese single kinds, known as the *cucumerifolias* are profusely branching, making large bushes bearing numberless small elegantly formed flowers for quite a long period. The *argyrophyllus* with its silvery foliage and medium-sized yellow single flowers with a dark centre is late flowering and quite attractive. Among the double flowered kinds, the *Chrysanthemum-flowered* variety is an improved kind with large yellow flowers, fully double and large, borne over the ends of every shoot of the plant. The other more familiar kinds are the *Globe of Gold*, which bears a number of globular compact flower heads from the side and main stems. *Globosus fistulosus* is a tall growing kind bearing very large perfectly double flowers. (RS).

*Helichrysum.* (N. O. Compositae). (Everlasting Straw
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Flower). Hardy annual bearing everlasting flowers about two inches or more in diameter and of perfect shape and symmetry, resembling half open roses. Available in several shades of colours as white, pink, salmon, scarlet, yellow, violet, etc. H. 18—36 inches. D. 12 inches. B. 3½—4 months. Flowers are useful for cutting, retaining their shape and brightness long after they are cut and dried. Not particularly suited for low elevations. Useful grown in ground or in pot. (C).

"Heliotrope. (N. O. Boragineae). (Cherry-Pie). Hardy herbaceous perennial, popularly grown for its sweet-scented flowers, which are small and collected in panicles, often measuring 6 inches across. The available colours are white and blue and purple and intermediate shades. Valuable as a pot plant and in borders.

H. 18—30 inches. D. 18 inches. B. 4—4½ months. Though a perennial and can be raised from cuttings or by layering, grown like an annual from seeds. When seedlings are 3 inches high, put them in 6 inch pots. When about 6 inches high, top them. Transfer to 9 or 10 inch pots finally, using compost No. 1 on page 112 and stop the laterals again at the third or the fourth leaf. During growth, feed with liquid manure prepared from oil-cake or horse-dung. After blooms are over, plant out the plants in borders. Sunny situation and freedom of soil from excess of moisture are two essentials for success. (C).

Iberis. (N. O. Cruciferae). (Candytuft). The common name is due to the fact that one of the species was introduced from Candia and the flowers appear in tufts. One of the most popular dwarf free blooming annuals, very useful for massing in beds and for edging larger flowers in beds and in borders. The flowers are good for cutting too. H. ¾—1 foot. D. 6—8 inches. B. 3—3½ months. Thrive with little care in cultivation: sow seeds where the plants are to remain, and thin out to required distances apart when the seedlings can be handled easily. Light rich soil suits them best. Candytuft Empress is a good variety producing large spikes of blossoms, often measuring six inches long by two and a half inches across. The 'Giant Hyacinth Flowered' kind produces strong sturdy plants with few branches and very large pure white blossoms. Candy-
tuft is available now in crimson, lilac, rose, and purple shades of colour also; but these are late flowered and do not seem to flower freely at low elevations. (C).

**Impatiens.** (N. O. Balsaminaceae). (Balsam). The word impatients is derived from Latin, with reference to the pods, which when ripe, on slight pressure, burst open, scattering the seeds. Impatiens is a family of highly interesting herbaceous succulent annual and perennial plants, much varied in aspect and valued in gardens for the beauty of their flowers.

*Impatiens Balsamina* (Balsam) is a very showy annual. H. 9—30 inches. Bears large pretty single or double rose-like flowers of many shades of pure colours and variegated kinds. Balsams are very easy of culture throughout the year. One's garden can be kept gay all the year round by sowing seeds every two inches. Balsams need a very rich, friable, open, well drained soil, heavily manured for a previous crop, an open sunny situation, and a very liberal supply of water during growth. Sow the seeds thinly in well drained seed beds and shade them till germination begins. When the plants have formed about six leaves, transplant them into beds, setting them 9 inches apart in regular rows which are a foot apart, or pot singly in 9 inch pots. But, if the plants are grown bushy by allowing the secondary shoots to come up, they should be grown nearly two feet apart. Good blooms are impossible if the plants are overcrowded. In planting, take care to cover the plants up to the first two real leaves. Retain three shoots on each plant but, if very large blooms are desired, pinch off all the side shoots as they come up, growing the plant to a single stem, which becomes covered up with a column of large flowers, produced at the axils of leaves. Remove the lower leaves, which may obscure the blooms. Keep the plants in a moist atmosphere and syringe them in dry weather. As they are gross feeders, supply them with liquid manure once a week. The plants are attacked with mildew at all periods of the year and especially in the cold season. Spraying with Bordeaux mixture will effectually check the onset of the disease. Blooms appear in 60 to 65 days after sowing and the blooming period lasts for about fifteen days. Good strains do not seed satisfac-
torily in this country and hence, seeds should be carefully collected as the pods ripen before they actually burst. (RCS).

*Impatiens Sultani and Impatiens Holstii are well known as Wild or Hill Balsams. They are erect, branching, perennial succulent herbs, 1 to 2 feet high, with pale green leaves and beautiful flowers with spreading petals, borne in plenty. Hill Balsams have a compact habit of growth and are perpetual bloomers. Flowers are produced so freely that a well grown specimen appears a mass of flower. On rockeries, they make a splendid show. They thrive excellently well in semi-shady situations. They form also very attractive and valuable pot plants. Originally, only the scarlet colour was available but now, several hybrids in pure white, rose, orange, brick-red, crimson, pink and other shades are introduced. The plants are very easily raised from seed or by cuttings. Plenty of moisture is required by them during period of vigorous growth. Plant them 18 to 24 inches apart in beds in shade-gardens or singly pot them in 10 inch pots. Pinch back the straggly shoots for bushy effect.

There are several other species of Impatiens, which are grown in our gardens and are worth noting:

I. Hawkeri is a herbaceous perennial; free blooming; bears large carmine flowers with a white eye. Succeeds well in the plains.

I. Oliverii is a herbaceous perennial; forms a large bush. Flowers are nearly two inches in diameter and pale rose in colour. The plant needs a moist conservatory and thrives in places, 2,000 to 4,000 feet above the sea. Raised from seed or by cuttings.

I. Hookeriana is a very succulent much branched herbaceous perennial, with long stalked leaves; height 2 to 3 feet; flowers are large, white and spotted with purple on the larger lower petals. Successfully grown 2,000 feet above sea level.

*I. aurea = I. repens, a herbaceous compact low growing plant with red stem and bright yellow flowers. Excellently suited for rockeries, hanging baskets, and low bedding. The plants are liable to damp off in summer and hence a number of plants should be made to safeguard against a loss of the species.
*Larkspur. (N. O. Ranunculaceae). Very showy annual, freely producing spikes of beautiful flowers, available in blue, lilac, purple, white, and pink shades. H. 9—30 inches. The seeds germinate best only in cool weather in moist place. Germination is however irregular and slow. Flowers are useful for cutting. Effective in beds and in borders. The Stock-flowered kind is the best for low elevations, where the Double Flowered kinds do not satisfactorily thrive. Acclimatised seeds give best results. Sow where they are wanted to grow and thin out 9—12 inches apart. For pot culture, put 3 plants into a 10 inch pot, using great care not to injure the roots while transplanting. B. 2½—3 months. (C).

*Kochia. (N. O. Chenopodiaceae). (Summer or Mock Cypress or Belvidere). Known also as Mexican Fire Plant or Bush. Hardy annual, with very narrow green ornamental leaves, forming globular bushes similar to clipped Cypress. The plant is useful for annual ornamental hedging, and it makes a delightful foliage plant for pot culture. It can be clipped to any desired form. As the plants get old, the leaves turn crimson in colour. The flowers which are crimson in colour and inconspicuous, together with the leaves, make the whole plant look a ball of fire. Easily grown from seed. H. 1½—2½ feet; reaches maximum size in 3—4 months after sowing. (R).

*Lathyrus odoratus. (N. O. Leguminosae). (Sweet Pea). A very popular beautiful annual, very much like the common edible pea in habit of growth, bearing sweetly fragrant, pretty blooms of wonderful variety in colour. On account of its range of colour, beauty of form, fragrance, and its value as cut flower, Sweet Pea stands very high in rank among the annuals, and hence it has long been known and grown universally in gardens. Within the last sixty years, there have been made very great improvements in the colour, size and form of the flowers, as a result of which there are now available several noteworthy and distinct strains. For want of space, it is not possible to enter into an enumeration of the several classifications into which Sweet Peas are divided. A good selection of seeds can be made from a catalogue of any recognised firm.
Sweet Peas are grown very much like their vegetable ally. They love an open sunny situation, which has plenty of light and air. In shade, the plants grow spindly and weak, bearing only a few flowers. The soil should be light and rich and worked to a depth of two feet as Sweet Peas are deep rooting. Plenty of well decomposed manure should be incorporated with the soil. For success, dig out trenches, two feet in depth, 16 inches wide, in rows 4 feet apart and sow the seeds 2 inches apart in the rows of soil so prepared and cover them up 1 inch deep. On the plains, near the coast, Sweet Peas are difficult to grow. In the interior of the country and at medium elevations, they do well. Acclimatised seeds do better than imported ones. Keep the soil well cultivated and make shallow furrows about five inches from the rows on either side, so that the plants may be watered liberally in seasons of drought. Thin out seedlings 4 inches apart. As soon as the tendrils appear support plants with twigs having a few side branches, placed against them. This also prevents the plants from being injured by wind. Liquid manure made up of 1 oz. of sulphate of potash, 2 ozs. of sulphate of ammonia and 2 ozs. of superphosphate in 8 gallons of water applied once a week gives excellent results and with the removal of withered flowers and pods, prolongs the blooming period considerably. For culture in pots, seven seeds can be sown in a 12 inch pot and the plants grown as suggested above. Of the insects and diseases that attack Sweet Peas, the following are common:—(1) Aphis. (2) Root-rot. (3) Mildew. Consult Chapter XI for remedies. (C).

*Linaria. (N. O. Scrophulariaceae). (Toad Flax). Charming hardy free flowering annuals, growing about a foot in height, and very beautiful when massed in beds and borders; miniature Antirrhinum-like flowers are produced in great profusion in erect bunches. They are very useful for cutting, for bouquets and vases. Linarias do not seem to flower freely in the plains but they do very well at medium elevations. Seeds are very small in size and hence should be bulked with fine soil before sowing to secure even and thin sowing. Sow them where the plants are wanted to grow, and carefully water with
a fine rose can till the plants are about two inches high. Thin out the seedlings, 6—8 inches apart, and pinch the tops of the shoots once or twice for bushy growth. Overwatering will kill the plants. B. 3—3½ months. The plants remain in bloom for nearly two months after that. (C).

Linum. (N. O. Linaceae). (Flax). The genus comprises of annual and perennial plants. Linum grandiflorum, the Scarlet Flax is one of the most effective and showy annual bedding plants of a long blooming period. It is erect growing, reaching a height of about 18 inches, with a delicate stem and fine foliage and bearing in great profusion showy five petaled flowers, which are an inch in diameter. As the plants do not stand transplanting, sow the seeds where the plants are wanted to grow. Linum perenne, or the perennial kind grows to a height of about two and a half feet and is suited for mixed borders. It can be propagated by division. It is very ornamental in the cold season at the margins of the shrubbery. Perennial kinds are only suited for medium elevations but the annual kinds can be tried in the plains. (C).

*Lobelia*. (N. O. Campanulaceae). A large family of annuals and perennials. Exceedingly pretty, profuse flowering plants of great value in the garden. H. 5—18 inches. Some kinds are particularly suited for growing in hanging baskets, in window boxes and in vases, and for pot culture. Dwarf kinds are useful for edging larger plants in beds or borders. Lobelia Erinus is a very variable species, in point of the colour of the foliage, the size and colour of the blooms. Lobelia Erinus compacta is dense growing and dwarf and is suited best for edging purposes. Lobelia Erinus variety gracilis is of slender growth and is hence suited best for vases and baskets. Of the tall kinds, Lobelia Erinus ramosa and its hybrids are best suited for pot culture. They attain a height of 9 to 15 inches and are available in white, light purple and blue and pink shades. Sow the seeds thinly in seedpans. When the seedlings are about an inch high, prick small clumps of them containing two or three plants two inches apart into a fairly light soil contained in 9 inch pots. Shade them from afternoon sun. As the plants grow, insert four to five bamboo round sticks about a foot
long and painted green by the edge of the pot at equal distances apart and pass round them thin raffia or plantain fibre to keep the plants from straggling about. In 3½ to 4 months, the plants bloom and retain their beauty for quite a long period. Except one or two varieties, Lobelias do not thrive in the plains. *Lobelia cardinalis* is a pretty pot or bedding perennial plant, 2 feet high, with bronze coloured foliage and bearing scarlet flowers in terminal racemose spikes. It takes a year to flower from seed. But, from young suckers, it comes up to bloom in about five months. *Lobelia fulgens* resembles *L. cardinalis* but is larger and downy. Both the above two species bloom better at medium to high elevations than in the plains. (C).

*Lupinus*. (N. O. Leguminosae). (Lupine). An extensive family of hardy annual and perennial plants easily grown on any good garden soil. H. 9 inches to 3 feet. Ornamental in bloom with tall spikes of pea-like flowers of white, yellow, blue and other colours. Useful for bedding, in borders, and for pot culture. They can be successfully grown from medium to high elevations only. Seeds should be sown where the plants are to flower permanently, as seedlings do not transplant well. Seeds are hard-coated and should be immersed in water for half a day before sowing. Acclimatised seeds give best results. The soil should contain lime and not be too moist. In order to save seeds, when the pods on the lower part of the flower-stalks have grown nearly to their full size, the tops of the stalks should be pinched off and the plants shaded from sun. If this is not done, seeds shrivel up without maturing. Thin out seedlings 12 to 18 inches apart. (C).

*Marigold.*—See under *Tagetes*.

*Mathiola*. (N. O. Cruciferae). (Stocks). Genus of several species, consisting of annuals, biennials and perennials, all differing very little except in size and the form of their blooms and the time taken to bloom from seeds. The biennial and perennial Mathiolas, which include the pretty *Brompton Stocks*, do not thrive in this country except on the Hills. *The Ten-Week Stocks*, which are annuals thrive from medium to high elevations only. They grow 1 to 2 feet high, with lance-shaped leaves and produce erect branching spikes of deliciously frag-
rant flowers; these annual stocks are useful summer bedding plants and for pot culture. Seeds obtained from recognised firms yield about 70% of double flowering plants. Acclimatised seeds yield better results at medium elevations than imported seeds. The seedlings are liable to damp off unless great care is exercised in watering. Sparingly water the seedlings; transplant them when they are about two inches high, in well prepared beds, containing very rich soil, 9 to 12 inches apart, or pot singly in 9 inch pots. Never allow it to be saturated for any length of time. Do not allow the plants to suffer for want of water either. B. 4-4½ months for annuals and 7-8 months for biennials. (C).

Mesembryanthemum. (N. O. Ficoidaceae). (Fig Marigolds). They are dwarf annuals, growing 6 to 8 inches high, of a succulent nature, bearing small daisy-like, pink, crimson, white, rose or yellow pretty flowers, opening only in sun-shine. They require a well-drained open soil, mainly consisting of sandy loam and small broken bricks. They are raised easily by seeds in October in the plains and March on the hills, in wide, shallow pans, containing richer soil below a layer of sand. Care should be taken to see that no water lodges by the collar of the plants. *M. crystallinum* (Ice-plant) is suitable for baskets, rockeries, and vase work. The foliage looks as though covered with particles of ice. H. 6 inches. *M. tricolor*, attractive little plants with flowers of different colours. H. 5-6 inches. (C).

*Michaelmas Daisy. (N. O. Compositae).* *Aster Amellus*, called the Michaelmas Daisies, are known also as Perennial Asters. They are herbaceous perennials, quite distinct from the China Asters, which are annuals. Michaelmas Daisies are low growing plants, throwing a number of suckers from the base, making clumps. Flowers are single and are composed of a central disc and numerous rays. They are produced in plenty on sturdy flower-stalks in erect conical bunches. There are several varieties of perennial asters, producing stalks of flowers growing from 9 inches to 4½ feet high available in white, rose, magenta, blue, lilac and purple colours. Michaelmas Daisies thrive best from medium to high elevations only, where they grow tall and freely flower. But, for low elevations, only a particular white
flowered variety seems to be best suited. All the varieties are hardy and attractive and serve as handsome border, or bedding or pot-plants.

Easily propagated by division of the clumps and rarely from seed. Each little plant with its crop of roots is separated from the parent plant or clump with a sharp knife or by pulling the several pieces apart, and started independently. As soon as the new plants are sufficiently established, they are planted in 8–12 inch pots or in beds 9–12 inches apart. The soil should not be very sandy; the perennial asters thrive in a fairly heavy but well drained soil. Flowers are produced in 3 to 4 months after planting. Suckers, which continually come up from below, should be removed frequently. Liquid manure given once in 15 days during growth is attended with good results. Unless at planting time, similar sized suckers are planted, plants do not bloom simultaneously in beds. After blooms are past, flower stalks are cut away; the soil is raked up; good manure is forked in; and only one or two suckers are retained on each plant, removing all the others. Plants, thus treated, produce a fresh crop of flowers and this process can be repeated a number of times. But, it is advisable to dig up beds after they have flowered twice and replant them with new plants. Michaelmas daisies are at their best during the cold and the rainy seasons. (CR).

Mignonette.—See under Reseda.

Mimulus. (N. O. Scrophulariaceae). (Monkey Flower). Genus of handsome profuse flowering perennial plants, which are treated as annuals and grown from seed each time. Flowers are brilliantly coloured and are distinguished by their rich striking markings. They are Gloxinia-like, interesting and gape mouthed; probably the common name Monkey Flower is got on account of this fact. M. tigrinus grows 9 inches high and has fine spotted and blotched flowers with yellow as the ground colour. M. cardinalis has showy scarlet flowers. M. moschatus has a delicious musky smelling foliage and bears yellow flowers.

Seeds are tiny and hence bulk them with sand for even sowing. Sow in seed pans and water from below. Prick out
seedlings, as soon as they can be handled with ease, singly in small three inch pots. After these pots are full of roots, shift plants to 9-inch pots, using as compost a rich soil which contains plenty of sand. As they are semi-aquatic plants, they require a plentiful supply of water when they are making vigorous growth. They are not quite as well suited for the plains as for medium to high elevations. B. 3½ months. (C).

*Mina lobata.* (N. O. Convolvulaceae). An attractive popular, elegant, slender, annual climber, having a foliage of deeply divided leaves, and bearing long graceful spikes of red and creamy orange flowers, peculiarly arranged on one side of the main stalk. A rapid and easy grower, reaching about 15 feet. Three plants grown in a 15 inch pot furnished with a balloon of split bamboo are strikingly beautiful. B. 4—months. (C.R).

**Myosotis.** (N. O. Boraginaceae). (Forget-Me-Not). Charming dwarf popular perennial herb, 4 to 6 inches high, bearing beautiful little flowers, which though small are full of life and appealing in their looks. The flowers are light blue with a golden eye or rose or white or purple, there being numerous kinds and varieties. Forget-Me-Not's are beautiful in shady nooks and beds, where many other plants would not flower well, and are exquisite for cutting and for wearing in button holes like Pansies. Being semi-aquatic they thrive in damp and semi-shady situations and like being watered liberally. Do not thrive at low elevations, where they cannot survive the heat of the summer. Though perennials by nature and can be propagated by cuttings, they are mainly grown as annuals from seed, from which they take only 5—6 months to flower. They are usually grown in shallow broad pots (seed pans), 4 to 5 plants, being put in each pot. The blooming period continues for about two months. (C.R).

*Nasturtium.*—See under Tropaeolum.

Nicotiana. (N. O. Solanaceae). (Flowering Tobacco).
Nicotiana is the genus of plants under which are placed all the species of tobacco plants. The Common Tobacco (N. Tabacum) is an easily cultivated plant, which grows 2–3 feet high, bearing rosy flowers. It is of economic importance and is superceded in the garden by more attractive species. Nicotianas are furnished with handsome foliage of large broad leaves and they produce large tubular flowers on long stalks, about two feet tall. They can be grown in the ground in beds or in pots. They grow in ordinary garden soil and thrive with ordinary care in an open sunny situation. Sow seeds thinly on the surface of a mixture of fine leaf mould and sand made in the proportion of three of the former to one of the latter, in shallow boxes or seed pans in shade. Prick seedlings, carefully when they have four leaves on them. When large enough, plant out or pot them singly in 6 inch pots; later on shift them to 10 inch pots. During the period of vigorous growth, water freely, but with care at other times. D. 12 inches; B. 3½—4 months. Stake flower stalks. The following species are noteworthy:

N. Affinis. (Syn. N. alba grandiflora) is the Sweet Scented Tobacco; it grows about 3 feet high and bears hundreds of sweet scented white flowers on tall terminal stalks. Its hybrids bear flowers of different colours.

N. Sanderae are the hybrids of N. Affinis with N. forgeti, a red flowered species. The hybrids show a fine range of colour from crimson to white and their flowers are very large; sometimes the tubes measure as long as five inches; they are without fragrance. (C.S).


Onenothera. (N. O. Onagraceae). (Evening Primrose). Group of generally trailing, naturally perennial plants, growing wildly on the hill stations and suited for places 2,500 feet above the sea. They are well known as Evening Primroses and are useful for borders, edgings, beds or rockeries. Flowers are
showy, large and saucer-shaped, white or yellow or rose or pink coloured. They open in the evening. Seeds should be sown where the plants are desired to bloom, as they do not transplant well. O. Drummondii; O. rosea; and O. speciosa; and O. odorata are fine species. (C).

Orthosiphon staminetls. (N. O. Labiatae). A little herbaceous perennial plant, 1½ to 2 feet high, bearing very interesting pale lavender-coloured flowers with long white projecting stamens. It requires a situation, which is shaded from afternoon sun and it is suited for beds in shade gardens. Raised and grown easily from seed or by cuttings.

*Pansy. (N. O. Violaceae). (Heart Ease). Small perennial herbs, not growing more than 4–6 inches high, but treated as annuals being raised from seeds every time they are grown. Believed to be derived from Viola tricolor; there are few plants more popular than the Pansy. Its folk name, “Heart Ease” is very suggestive of its appealing power to one and all. Flowers are borne freely, are very pretty, brilliantly coloured and butterfly-like in appearance. Pansies are available in all shades of colours and in almost all combinations of colours by way of blotches, stripes, and dots. There are several strains of Pansies varying in size, substance, colour and shape of the flowers. The Trimordeux, Bugnot’s, Masterpiece and Orchid flowered strains are noteworthy. The Masterpiece type is noted for large flowers with curled or ruffled petals. The Orchid-flowered type is noted for the delicate orchid-shades of colours. Some of the modern introductions of pansies measure nearly 3 inches across. The Tufted Pansies are dwarf in habit and not of a spreading habit as the florist’s types. Tufted Pansies bear smaller blooms but in greater numbers in clusters and are sweet scented. They are more suitable for bedding than the real pansies. Pansies are charming pot plants. Flowers are invaluable for cutting, for button-holes and bouquets.

Pansies degenerate quickly and hence obtain seeds of the best strains from reliable firms. Sow seeds in seed-pans thinly in light porous soil. Germination is very capricious and irregular. Wait till all seeds have germinated and the seedlings are fit to be handled with ease. Then, pot them singly in 4 inch
Geranium. (Page 423)

Begonia semperflorens. (Page 385)
Pots in a compost of equal parts of loam, sand, leaf-mould, and horse manure. Do not disturb the soil while taking out the seedlings from the nursery bed or the seedpan, as germination of some seeds takes place long after others have germinated. When the plants have well established themselves and filled the small pots with roots, shift them to 9 inch pots. Stop the plants twice or thrice for compact specimens. Stir the soil frequently, once in fifteen days, to a depth of an inch, or the plants do not flower freely, becoming too full of roots and pot-bound. Water freely in the evening. Do not expose the plants to noon-day sun. Remove flower buds till plants have grown sufficiently large to cover the pots. Feed with liquid manure prepared from horse-dung once a fortnight. For large blooms, retain only one flower per shoot. Cut the flowers as they fade, without allowing them to run to seed. Treated in this way, the blooming period may be kept up for nearly two months. B. 4 months.

Particularly attractive and noteworthy varieties, which cannot be propagated from seeds with certainty, can be increased by cuttings. (C).

Papaver.—See under Poppy.

*Pelargonium. (Geraniaceae). (Geranium). The genus Pelargonium includes the garden varieties of Geranium. Pelargoniums are Cape plants and the modern varieties are crosses between certain species. Geraniums, in general, are well known herbaceous perennial popular pot plants grown for the beauty of their flowers which are borne in large trusses. Some kinds are grown for their foliage. H. 9—24 inches. Propagated easily from cuttings or from seed. Geraniums do not thrive well in the hot plains of India, especially at places where the rain fall is heavy. They need protection from hot winds, severe sun, and rain in the rainy season. In all seasons, they should be watered very carefully, a certain amount of root dryness being absolutely necessary for their successful culture. They do not relish overhead waterings. In deep pots, and in light rich soil, they start vigorous growth yielding only a few flowers. In undersized pots, with the soil well firmed in them, with occasional supplies of liquid manure, one can expect a
profusion of bloom on well shaped sturdy plants. New plants produce larger and healthier blossoms than old ones. Early growth and underpotting are two essentials which need to be emphasized in the cultivation of Geraniums.

There are several distinct kinds of Geraniums and most of the cultivated forms may be grouped into five horticultural classes. They are:—(1) The hybrids derived from *P. inquinans*. These are available now in different shades of colour from white to intense scarlet. The leaves are almost circular, soft to the touch and are margined by large blunt teeth. These form the hardiest class of Geraniums, and are better suited for culture in the plains than others. (2) Zonal Geraniums derived from *P. Zonale* are distinguished by horse-shoe markings on the leaf, which may be all brown or golden or bronze and golden or silvery white. *Bicolor* has leaves green edged with white or white edged with green. *Tricolor* has leaves green edged with white, yellow, and crimson. *Bronze* has yellow leaves with bronze zone. The flowers may be single or double. The plants are less hardy than the preceding class and do not seem to thrive in places below an elevation of about 3000 feet. (3) Ivy-leaved Geraniums are derived from *Pelargonium peltatum* and they have trailing slender stems and polished, thick, dark green leaves. They are effective in window boxes, in hanging baskets and in vases. Flowers are single or double. Recently some compact growing hybrids between Geraniums and Ivy-leaved Geraniums are introduced, which partake of the characters of both the types in foliage and flower. (4) The Show, Decorative, and Fancy Geraniums, derived from *P. grandiflorum* and *P. cuculatum* bear large flowers. They are much more difficult to grow than the Zonals and cannot be grown even at medium elevations. (5) Various scented leaved geraniums, known as “Rose-Geraniums.” These are derived from *P. quercifolium*. These seldom flower but they are grown for the delicious fragrance of their leaves, which go into Indian flower garlands. The Geranium Rose scent is manufactured from them.

Geraniums are cultivated in the following manner:—Allow the parent plant from which the cuttings are to be taken
to suffer for want of water for a day or two. To secure best results, propagate only from perfectly healthy stock. Select shoots, which are neither too firm or woody nor too tender or flabby in texture. Cut them sharply under the nodes, keeping the length of the cuttings from 4—7 inches. Strip the leaves from them, without injuring the skin, leaving two or three at the top. See illustration 32. Insert six such prepared cuttings in soil consisting of equal parts of sand and well sifted leaf mould contained in a well drained 6 inch pot by its edge. If too many are inserted in a pot, the roots of the cuttings get mixed up and break while separating them and potting them independently; and the rooted cuttings with broken roots take a long time to establish themselves. Keep the pot in semi-shade or even in the open, if the sun is not severe. Keep the cuttings on the dry side till callus is formed. Never overwater them or expose them to rains. In 4 to 5 weeks, the cuttings strike roots and show growth at the top. Pot them singly in 5 inch pots in soil, composed of equal parts of loam, sand, and horse manure. Shift them finally to 9 inch pots using compost No. 1, page 112. Firm the soil well to have stocky plants bearing more blooms and less leaf. If growth is too vigorous and the shoots are too long for the plant to be tidy, nip off the tops for side shoots to be produced. Examine the soil at least once a fortnight for cockchafer larvae, which devour the roots and kill the plant in a short time. Thin the foliage, when it gets crowded too much, to turn the energy of the plant towards flower production. Till the plants have made sufficient healthy growth, keep removing flower buds. Disk out till 35—40 days before flowers are wanted. While in bloom, limit the supply of water. After the flush of blooms is over, allow the plants to rest for about a month and then prune back the shoots. As new growths are an inch or so in length, repot or top dress the plants. Treated this way, the plant becomes bigger in size and produces larger number of blooms in about 3½ months after repotting. Reject old plants after two or three seasons.

Geraniums are easily raised from seed. Sow them in well drained seed-pans, placing the seeds about an inch apart and cover them up with about ¼ inch thickness of fine soil. Water
carefully, never keeping the pan wet. If overwatered, seedlings easily damp off. When leaves of the seedlings touch each other, pot them singly in 4 inch pots, in light porous soil made up of equal parts of loam, sand, and horse manure. Pot firmly. Water sparingly to start with and increase the supply as growth progresses, never keeping the soil wet for a long time. Shift plants to 9 inch pots using compost No. 1 on page 112. Treat the plants now on as suggested above in connection with those raised from cuttings. Seedling plants have a thick tap root and few fibrous roots and hence are more liable to rot from overwatering than plants raised from cuttings.

The chief enemy of Geraniums is the larva of the cockchafer. The soil has to be periodically examined and the grubs handpicked. Manure should be free from them. Certain catarpillars eat the flowers. They are handpicked also.

*Pentstemon. (N. O. Scrophulariaceae). Herbaceous perennial of great garden value and ornament. It is a very satisfactory bedding plant and has a telling effect with its large erect spikes of tubular, open-mouthed, Gloxinia-like flowers, which are available in several shades of colours. The recently introduced hybrids, with the throats of the flowers very prettily pencilled and variegated with different colours are very attractive. In Bangalore, Pentstemon is usually grown in pots. Pentstemons can be raised by division of old plants or by cuttings or by seeds. From seed, flowers are produced in 8 to 9 months. From cuttings or by division, plants can be got to bloom in 4–6 months. Sow seeds in friable soil in seed-pans and cover thinly and water the soil from below as the seeds are very minute. When seedlings are fit for handling, pot them off singly in 3 inch pots and later shift them to 10 inch pots. Use compost no. 1 on page 112. For bushy growth, pinch back the young plants twice or thrice before flowering. During growth, supply them with water regularly. They would die if they receive any severe check in growth. Remove flower spikes after they are past their best to benefit the secondary shoots that come up soon after and bear blooms in their turn. Cut back the flowered shoots, after the plant has finished flowering, to 4 or 6 nodes from the soil level; out of the new growths which are
produced, retain 6 to 8 and remove the rest and treat the plants as before till another crop of flowers is obtained. Apply a top dressing with rich mixture of 2 parts of horse-manure and 1 part of loam once in three months to sustain the plants in vigorous condition. Repot once in every six months.

*Petunia. (N. O. Solanaceae). Petunias are one of the loveliest ornaments of the garden; small soft sun-loving plants of a rather straggling or decumbent habit of growth, bearing large showy flowers. The flowers are single or double, are often 4 inches across, are available in all shades of colour except the pure yellow. The recent introductions of hybrid Petunias are noted for their large sized blooms, beautifully blotched or striped or variegated in different colours. Many of them are beautifully fringed and curled in various ways. The single kinds are usually grown in the ground in beds, and the improved large flowering kinds and doubles in pots. For hanging baskets the hybrid pendulous varieties are well suited. Petunias grow to a height of 9—15 inches and produce a mass of bloom. The double flowering kinds are often treated as perennials and are raised from seeds as well as by cuttings. Seeds are very tiny and hence should be sown with care. See pages 59-60.

Late winter and early summer is the best time to have Petunias in bloom, as they are liable to rot and die in the rains. Prick the seedlings when they can be handed with ease, in light porous soil in well drained seed pans, two inches apart. Do not reject very small seedlings, as they are likely to be those which produce the finest shades of colour. When the pricked plants are strong enough, plant them singly in 9 inch pots, using compost No. 1 on page 112. Overwatering of the plants at any stage of their growth is sure to kill them. As soon as they begin to branch freely, pinch the tops twice or thrice to produce large number of shoots and hence flowers. Treated this way, they may not require any stakes to support them, as they make short and sturdy growth. If any staking is necessary, insert three to four slender sticks painted green by the edge of the pot at equal distances apart and pass round them thin raffia for the plants to rest on. While watering, do not splash the water on the leaves. The double flowers do not seed
freely in this country and so the seeds have to be imported from foreign firms. The single flowering kinds also degenerate after two sowings and so to maintain the standard, seeds have to be got from reliable firms. For ground culture, D. 12–18 inches. B. 4–4½ months. (C.S).

*Phlox. (N. O. Polemoniaceae). *Phlox Drummondii* is a favourite of one and all, being a very pretty free blooming annual, which is very easy to grow. It is effective in beds or in pots. There are three strains of this beautiful annual, viz, the grandiflora, attaining a foot in height and bearing large flowers; the intermediate type, growing about 8 inches high; and the compact or 'nana' type, growing only 4 to 6 inches high. Flowers are profusely borne in large trusses, often measuring 4 to 5 inches across, covering from ground to summit of the plant. They are available in all imaginable single colours or in handsome combinations of these in striped, blotched or eyed kinds. The petals are usually round but they are twisted and angular in the ‘stellata’ type. Phloxes requires a rich open soil, sunny situation, and just enough watering to keep the soil moist. They are best suited for summer bedding. Sow in seed pans or nursery-beds; prick when the seedlings are ready; and transplant 6 to 8 inches apart in beds. For pot culture, put 5–7 plants into a 10 inch pot. Pinch back shoots twice or thrice before flowering for large bushy plants. B. 3½ months. Period of bloom lasts for over a month. (C.S.).

*Phlox decussata*. (N. O. Polemoniaceae). (Perennial Phlox). Herbaceous perennial, 1–2 feet high, mainly propagated by suckers and rarely from seed for new varieties. Flowers are similar to the annual Phloxes but are less varied in colours and the trusses are larger and conical in shape. Perennial phlox is usually grown in pots, each plant being confined to one to three shoots only. It is grown very much like Michaelmas Daisy. A sucker taken out of a healthy plant and grown in a 9 inch pot will bloom in 3½ to 4 months. Mealy and green bugs and scales are the greatest enemies of this lovely plant. Infected leaves and stem should be washed with fish oil soap.

Pinks.—See under Dianthus.
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*Poppy. (N. O. Papaveraceae). (Papaver). Poppies form an interesting class of popular garden plants. Flowers are single or double and are of varied and bright colours and appear well above the elegantly cut foliage on their long and wiry stalks. It is a great pity that the blooms are short lived but the profusion and the freedom in flowering make up for this demerit. The single flowering kinds are very graceful and prettier than the doubles. The well known Shirley Poppies are mostly single and are the best of garden poppies. The flowers are often three to four inches across and are available in a surprisingly varied range of colours, from white to almost black. All the poppies are very easy to grow. But they do not thrive well on the plains of India. They can be grown with little care under sub-tropical conditions. (C).

There are four species of Poppies, which are commonly cultivated and they are all distinct. They are (1) P. Rhoeads, the Corn Poppy of Europe with a neat dwarf habit of growth and finely cut hairy foliage and small flowers. *The Shirley Poppies are the best strains of this class. (2) P. somniferum, the opium poppy. It is an annual of tall and stately habit of growth and its flowers are very large though they are useless as the petals drop off as soon as the flowers are cut. Opium is made from the juice of this plant, which it produces on being lightly cut when young. The Carnation and Paeony flowered kinds belong to this class (3) P. nudicaule, the Iceland Poppy. These are excellent for cutting. They are short lived perennials, grown from seeds as annuals. They are mostly yellow flowered, though recently other colours are introduced. (4) P. orientale, the Orientale Poppy, is also a perennial but for garden purposes, it is treated as an annual. It grows to three feet and a half and is stiff and hairy and is suited for growing in a shrubbery.

Cultivation of poppies is simple. Seeds germinate readily. Sow them soon after the rains in light rich soil where the plants are wanted to grow as the seedlings do not transplant well. Thin out the young plants when they are sufficiently large to be handled with ease 9–12 inches apart. Water only enough to keep the soil just moist. Grow them fully.
exposed to sun. Keep removing seed pods to prolong the period of bloom.

*Portulaca. (N. O. Portulacaceae). Portulaca grandiflora is a very pretty low growing annual with a trailing stem with short thick leaves of the thickness of a broomstick, bearing in great profusion brilliantly coloured flowers, one inch or more across. The flowers resemble roses in form and are single or double. They open out at about 9 a.m. and close at about 3 p.m. and wither away in a short period. Mix the seeds which are very small with four times the quantity of fine sand to ensure uniform and even sowing. Sow where the plants are wanted to grow or in seed pans and transplant carefully when ready. Water with a fine roseed can. Portulaca thrives well in sandy soil in open sunny situation. Do not allow the soil to get dry at any time but do not keep it wet either. Sunny situation and careful watering with a fine roseed can and fine mellow soil are all the essentials for successful culture of this lovely annual. It is usually grown in shallow seed-pans with four to five plants in each. It is very serviceable for edging large plants in tubs and vases. H. 6 inches. B. 3-4 months. (SC).

*Primula. (N. O. Primulaceae). Primrose. This genus is a very large one including as many as 150 species but the florist's flowers, viz., the Primula auricula, stellata, obconica, japonica, and sinensis are the only garden favourites. They are handsome, delicate, pretty in leaf and in flower and continuously bloom for nearly two months at a time. They are small herbaceous perennials, bearing their showy flowers which are either single or double, in clusters or trusses on stalks, 6 to 12 inches high. But, they are treated as annuals and raised from seeds each time. In India, they thrive only in the cooler parts of the plains and on the hills. In the plains the seeds may be sown during September and October, and on the hills, from March to May. They are plants eminently suited for pot-culture. The seeds are very small in size. To sow them, fill the seed pan to half an inch from the top with fine sifted soil containing a large quantity of leaf mould or thoroughly well rotten old spent manure; leave the surface
rather rough and sprinkle the seeds, previously mixed with fine sand, thinly upon it, not covering with soil. Water the pan from below, by standing it in a basin of water. Cover the surface of the soil with paper tied round the pot and then place the pot over a hot bed, failing which in a warm shady situation. Keep the soil moist by watering the paper only and if necessary, by watering it from below also, as described above. In two to three weeks, germination takes place irregularly; and when the seedlings are big enough to be transplanted with ease, pot them singly in 3 inch pots and shift them to pots, 2 inches bigger in size, as the pots they are in get filled up with roots, till they are finally put into 9 inch pots. A rich loamy soil suits them best. Give them only so much water as is absolutely required by them. A shady situation is very necessary for successful culture of these plants. They take about a year to flower from seed but they amply repay the trouble taken in growing them. If the old plants are healthy, repot them in fresh soil and they will flower again in six months’ more.

Reseda odorata. (N. O. Resedaceae). (Mignonette). A great favourite with many on account of the sweet fragrance of the flowers, which are not particularly attractive. The plants grow into bushy specimens, if pinched once or twice, before flowering. H. 9—15 inches. Flowers, which are in white, yellow or red shades are produced 3 to 3½ months after sowing, in tall erect racemose spikes. Mignonettes are very delicate plants and do not stand transplanting. Hence, seeds should be sown, where the plants are wanted to grow and seedlings thinned out 9 to 12 inches apart. Well prepared sandy loam with some old mortar added to it, is the soil best suited for growing this annual. Mark rows 8 to 12 inches apart and drop at the intersection of the rows, about three seeds and cover them lightly. For pot culture, sow thinly in 10 inch pots filled with the soil required and thin out seedlings, retaining three of the strongest ones. Or, grow one plant in a 7 inch pot. Water with especial care particularly at the initial stages of their growth. Shade them from afternoon sun. Provide wire supports to them as they develop. The side growths at the top may be removed
when the flower heads show themselves up. Two or three side growths at the bottom may be retained for a second crop of flowers. B. 3—4 months. (C).

*Rudbeckia. (N. O. Compositae). (Cone Flower). Herbaceous perennial plant like the Michaelmas Daisy, bearing large, showy, bright yellow, ox-eye, daisy-like, long stalked flowers. There are hybrids available in other colours too. Plants are useful in borders and flowers are useful for cutting. Grows easily in any good garden soil without care. Renew old with fresh plants raised from seeds, which are sown in October in the plains and in March on the hills. Also raised by division of clumps. H. 1—1½ feet; D. 12 inches; B. 4—5 months.

*Saintpaulia. (N. O. Gesneraceae). (African or Usambara Violet). Called after the discoverer of the plant, Baron Walter von Saint Paul. S. ionantha, the species grown in our gardens, is popularly known as the African or Usambara Violet. It is a small herbaceous perennial plant of great beauty, fit for decoration of the conservatory and growing on rockeries in shade. The plant is almost stemless with a rosette of long stalked ovate hairy leaves, resembling those of Gloxinia, to whose Natural Order this plant also belongs. The flowers are coloured deep purple and resemble violets in shape though in size they are much larger. Throughout the year, the plant flowers freely. Saintpaulia is best grown in well drained small 5 inch pots and then shifted to 8 inch pots or in shallow pans in a light rich soil composed of two parts of fine sand, two parts of sifted leaf mould, one part of friable soil, and one part of horse manure, which is well decomposed and sifted. The soil should be covered with a layer of broken bricks so that the fleshy leaves may not come in contact with the soil and rot. Afternoon shade should be provided for the plants. In summer, care has to be exercised in watering, as excess of moisture causes the leaves to damp off. Propagation is by seeds, which are very small and are sown like Begonia seeds, and by cuttings of leaves. The latter is the simpler and the easier method. Mature leaves, which are not overripe are cut off with an inch of the stalk and inserted in sand in such a way that the stalk with the base of the blade is under the
soil. See illustration on page 69. The cuttings are sparingly and carefully watered neither keeping the sand very wet during the process of rooting nor allowing it to get too dry at any time. The rooted cuttings are then transferred to 5 inch pots as stated above.

**Salpiglossis.** (N. O. Solanaceae). (Velvet Flower). Beautiful annual, 2—2½ feet tall, with clammy leaves and stems and bearing gorgeously beautiful petunia-like but smaller velvety single flowers, which show a variety of colours unsurpassed by any other flower. The flowers are usually beautifully marked and pencilled with several colours and they never fail to please the eye. In the plains, Salpiglossis does not come up so well as at medium to high elevations, where it can be grown in beds. Grow 3 plants in a 10 inch pot. (C).

*Salvia.** (N. O. Labiatae). (The Sage Family). The genus comprises of mostly herbaceous perennial plants and subshrubs, which are mostly natives of Mexico, Brazil, and Central America. Some species, as the Common Sage (S. officinalis), the Clary (S. Sclarea) and (S. Horminum) are of immense economic importance, as their leaves are of medicinal value and are useful for seasoning. There are several ornamental species which make excellent bedding, border and pot plants. Variation in Salvias within the generic limits is something very astonishing; the habit of growth varies from 6 inches to 6 feet; the colour ranges from deep scarlet to purple, violet to azure blue, white to light yellow and pink and rose; the form of flowers also varies, some flowers open wide open while others are nearly long and tubular; in some species, the colour of the calyx and corolla is the same while in others, they are of different colours. Almost all the species are hardy. The species which are best suited for the plains are S. splendens and its hybrids and S. farinacea. Others thrive from medium to high elevations only. Salvias can be easily propagated from cuttings and by division of clumps in some kinds but they are best treated as annuals, being raised from seed, each time. Seedling plants are more vigorous and floriferous. Sow seeds thinly in seed pans or in nursery beds. When the seedlings are sufficiently big, prick them in light rich soil 2 inches apart.
When the leaves of the adjacent seedlings touch each other, pot them singly in 5 inch pots or plant them out in beds 12–24 inches apart according to the variety. Prune the tops of the plants for bushy growth. Transfer the plants from 5 inch to 8 inch pots, as the former get filled with roots and finally shift to 12 inch pots, using compost No. 1 page 112. Water the plants liberally during vigorous growth and feed them with weak liquid manure of any kind once a week. They remain in bloom for 1½ to 2 months or more and they would flower again if the shoots, which have finished flowering, are cut back and the soil is top dressed with rich manure. The following are a few of the noteworthy species:

*S. splendens* or the Scarlet Sage is the most widely grown Salvia. It is very attractive, with numerous large erect racemes of bright scarlet flowers, appearing well above the dark green foliage. It is very useful for massing in large beds and along borders and it enjoys bright sunshine. Varieties of *S. splendens* are many and attractive. They are of different colours and in some kinds the colour of the calyx is different from that of the corolla. It is the hybrids of *S. splendens* that make up the attractive displays of Salvias in the Flower Shows at Bangalore. *S. splendens plumosa* is a new introduction. Flower spikes are massive and compact, looking like those of Celosia plumosa. Very handsome variety. H. 18–24 inches; D. 15 inches; B. 4 months.

*S. fulgens* (*Syn. S. cardinalis*) is similar in habit of growth to the preceding species.

*S. farinacea* is also a much grown species; a free flowering perennial, 1½ to 2 feet high, with branches from top to bottom, bearing large long spikes of small lavender blue flowers. The white flowered variety is also handsome.

*S. azurea*, 1 to 1½ feet high; azure blue spikes of flowers; leaves small; plants produce numbers of suckers from which propagation is easy.

*S. leucantha* is a pretty straggling shrub, about 2 feet high with silvery herbaceous stem and linear acuminate leaves, which are dull green above and silvery beneath. The flower
racemes are elongated and are about 10 inches long. The individual flowers are small and are light purple and white in colour, the calyx and the corolla being coloured differently. Excellent for growing in small tubs and in long borders.

*S. Grahamii* is a shrub, 2 to 2½ feet high, with elongated racemes, more than a foot long; colour of flowers, deep crimson. A pure white variety of this species is charming.

*S. involucrata variety Bethelli.* 2—2½ feet high; has large cordate oval leaves and bears brilliant large rosy crimson flowers in large terminal whorled spikes. Very pretty. Makes a very good pot plant.

*S. coccinea* (*Syn. S. rosea*). 1 to 2 feet high; Long erect spikes of small crimson scarlet flowers; varieties with white and rose coloured flowers are available.

*S. patens.* 1 to 1½ feet high; the flowers are loosely arranged in the racemes. They are very attractive, being deep blue in colour and very large in size; the calyx is campanulate and the corolla is broadly tubular and two inches or more long. Forms tuberous roots. There is a white flowered variety.

*S. uliginosa* is a pretty shrub, producing suckers from below in plenty, growing to 2½—3 feet high, bearing spikes of blue flowers. Very good for border. Requires a large pot for cultivation.

*S. rubicosa* grows 2—2½ feet high bearing red flowers. Leaves are Pine-apple scented.

*S. pratensis* bears violet flowers. H. 2—2½ feet when in bloom. White and rose flowered varieties are latterly introduced. (C.R.S).

*Saponaria.* (N. O. Caryophyllaceae). (Soap wort). *Saponaria calabrica,* called popularly the Soap wort, is an annual of low growth (about 9 inches tall), producing small star-shaped flowers of pink or rose colour, in great abundance. Effective for edging larger plants and also in beds. (C).

*Scabiosa.* (N. O. Dipsaceae). (Pincushion Flower). Also known as Mourning Bride. Hardy biennial raised from seed every year. H. 1½—2 feet. Large handsome globose heads of flowers are produced on long stalks, about 18 inches tall. Flo-
wers are useful for cutting. Best grown in the ground 15—18
inches apart. (C).

**Schizanthus. (N. O. Solanaceae). (Poor Man’s Orchid.
Butterfly Flower). One of the best cold season annuals,
suited for medium to high elevations, growing 1—2 feet high,
with very pretty cut foliage of a light green colour and bearing
sprays of orchidlike flowers of varied colours, from which, it
has obtained the name Butterfly Flower or Fringe Flower.
Schizanthus is available in varied shades of colours such as
yellow, apricot, pink, salmon, carmine, crimson, mauve and
purple, in various markings and combinations. S. Wisetonensis
is a strain with very large and showy flowers. Only grown in
pots for cut flowers. Acclimatised seeds give best results at
medium elevations. Sow seeds thinly in light soil or they
damp off. On the appearance of the second leaf, transplant
carefully. Shift to 3 inch pots and finally to 8 inch pots. Stop
once or twice for bushing out. Stake, as the stems are very
fragile. Protect from wind. Best grown on Hill stations with
a prolonged cold season. (C).

**Solidago. (N. O. Compositae). (Golden-Rod). A genus
comprising of many species of the well known Golden-Rods.
They are coarse growing but ornamental herbaceous peren­
nials, growing 1½ to 4 feet tall, producing erect feathery rod­
like trusses crowded with pretty golden yellow flowers. Though
natives of temperate climates, they do well under tropical con­
ditions. They are hardy and thrive in any good garden soil and
a sunny situation though they may be grown with satisfaction
in semi-shade. They are raised by suckers as Michaelmas Dai­
sies and grown like them. Golden-Rods are suitable for mass
planting in beds and borders in and adjoining lawns. There
are several attractive species.

Spider Plant.—See under Cleome.

**Statice. (N. O. Plumbaginaceae). (Sea Lavender; Sea
Pink). Several species with everlasting flowers, used for cut­
ting. S. Suworowi, an annual growing to about 2 feet bear­
ing bright rosy red large clusters of blooms on tall stalks. Flo­
ers are ‘ everlasting ‘. B. 3½—4 months. Grow in pots or in
ANNUALS, BIENNIALS AND HERBACEOUS PERENNIALS

ground. D. 9—12 inches. S. Bonduelli and S. sinuata are others.

Stock.—See under Matthiola.

Streptocarpus. (N. O. Gesneraceae). (Cape Primrose). They are difficult to grow in the plains but do well from medium to high elevations. They are attractive perennial stem­less herbs with one or more prostrate radical leaves, bearing erect scapes of large showy blooms of blue, lilac, mauve, white, or pink. Hybrids are very large flowering and show diversity in colours. Streptocarpus are suited for pot culture and for planting on rockeries in shady situations. Raised from seeds, they take 8 to 15 months to flower. Seeds are very minute in size and should be sown with the usual care necessary with such seeds. Select kinds can be propagated by division or by leaf-cuttings. Discard old plants after flowering.

Sun-Flower.—See Helianthus.

Sweet Pea.—See Lathyrus odoratus.

Sweet Sultan.—See Centaurea moschata.

Sweet William.—See Dianthus barbatus.

Tagetes. (N. O. Compositae). (Marigold). Well known, easily grown annuals which are very useful for massing in beds and for planting in mixed borders and for pot culture. Flower heads vary in size from the size of a button to 3—3½ inches across and they are in shades of yellow or orange. Some single kinds are marked with red. Rich soil and plentiful supply of water are twof essentials. Almost all the kinds have gracefully cut pretty foliage, which in some kinds is scented. For garden purposes, Tagetes is divided into two groups, based upon habit of growth. Tagetes erecta and T. lucida constitute the African Marigolds and they have a tall and upright open habit of growth and are not quite as well suited for bedding purposes as the French Marigolds. They are however better suited for border planting. Flowers are immensely double, often measuring 10 inches in circumference. Colours are shades of yellow and orange. Sow seeds in nursery beds and plant out 18 inches apart. Tagetes patula and T. signata constitute the French Marigolds and they have a
spreading habit of growth, making bushy plants, the branches often lying close to the ground. They are compact bushes with a mass of foliage and innumerable flowers, single or double, in yellow or orange or red tinted variegated colours. Flowers are comparatively much smaller than in the African type but this is compensated by the larger number of blooms produced. French Marigolds are very satisfactory bedding plants with a long period of bloom. They are also very rapid flowering excellent pot plants. The dwarf or 'nana' kinds are very useful as edging plants. Start them in small pots and set them a foot apart. (R.C.).

*Tithonia. (N. O. Compositae). (Mexican Sun-Flower). Popularly known as the Mexican Sun-Flower, Tithonia speciosa is a showy annual, growing 3 to 6 feet tall, and bearing in profusion orange-scarlet flowers provided with long stalks and useful for cutting. It is easily grown, thriving well in light, richly manured soil. Sow seeds in nursery-beds and transplant seedlings 2 feet apart. Flowers in three months after sowing and is valuable for planting in long borders and in shrubberies. (C.S.R.).

*Torenia. (N. O. Scrophulariaceae). Profuse flowering annuals and perennials, very useful for massing in small beds, for edging larger flowering plants in flower beds, for hanging baskets, and as window plants. They are excellently suited for pot culture too. Torenia Fournieri is one of the handsomest of annuals. The common kind is bright purplish blue in colour with a golden yellow throat. There are other varieties with light purple, light blue, yellowish white, and almost pure white colours with a different colour in the throat. Torenia can be grown throughout the year. Seeds are sown where they are wanted to grow and the seedlings thinned out 9 inches apart or seeds may be sown in seed pans and the seedlings transplanted when ready. To make bushy and satisfactory plants, it is essential that the plants should be stopped twice or thrice. The duration of blooms is nearly two months. T. flava (syn. Bail- loni) is a handsome species bearing golden yellow flowers with dark maroon eye. It has a slight trailing habit and is not quite as suited for the plains, as the preceding species, where it can
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be successfully grown only in cold season. *T. asiatica* is a
dwarf trailing herb, a perennial, a native of the Nilgiris. It
makes a very fine plant for hanging baskets and for carpet beds,
the foliage covering the soil and the brightly coloured flowers
displaying themselves above the foliage. Though the species
is a perennial, still it is desirable to treat it as an annual as it
only takes about five months to flower from seed. It can, how­
ever, be easily raised from cuttings. (R.C.).

*Tropaeolum*. (N. O. Geraniaceae). (Nasturtium). The
genus comprises of some of the best annuals we have in
existence. *Tropaeolum minus* is the dwarf Nasturtium. It is
a very hardy, popular, effective bedding annual, growing 9—12
inches high, with long stalked roundish, attractive leaves, and
bearing very brightly coloured queer looking large flowers in
great profusion throughout the season. Nasturtium grows
without care in any garden soil, by sowing the large seeds
wherever they are wanted to grow. Too much manure in the
soil makes the plants run into leaf at the expense of flowers.
Sow seeds six inches apart in beds and thin out a foot apart, if
there should be overcrowding. The extra plants may be used
for filling other beds. Thin out such foliage as hide the flowers.
If plants show a tendency to weaken and slant, steady them by
earthing up soil round the stems.

*Tropaeolum majus* is the tall or climbing Nasturtium. It
can be used as a bedder by pegging down the shoots and as a
low climber for windows or screens. It is easy to grow, and
resembles the dwarf Nasturtium in every way except that it has
a climbing habit of growth. This kind does not thrive at low
elevations.

*T. aduncum*, the Canary Creeper is a pretty climber about
eight feet high, bearing beautiful canary yellow flowers in pro­
fusion. It does not thrive in the plains.

Perennial species of Tropaeolum can only be grown on the
Hill stations. (R.C.).

*Verbena*. (N. O. Verbenaceae). The garden Verbenas are
very popular trailing plants ½ to 1 foot in height, of a perennial
habit but grown as annuals each time from seed though they
can be very easily propagated from cuttings and layers. Spe-
cial and attractive kinds are best propagated by vegetative means as plants raised from seed may not come true to the parent. Verbenas strike root as the shoots trail along the surface of the soil wherever they come in contact with moist soil. Hence, to propagate them, peg down the shoots as they creep along at different places and separate the rooted portions of the shoots from the parent and grow them independently. Verbenas are very serviceable as ground cover under tall plants and in the shrubberies, for hanging baskets, for culture in the ground in beds and for pot culture. The following species are grown:—(i) *Verbena hybrida. (ii) *Verbena Erinoides. (iii) *Verbena venosa. (C.S.R.).

There are very few flowers which can beat the *Verbena hybrida in the exquisite range of colours, varying from white through blue and rose to purple and dark purplish blue, with shades of pink and pale yellow. Flowers are produced in very great profusion well above the foliage in large velvety clusters which are often four inches across. The flower clusters are of the finest form and have in many kinds a delicate sweet scent. The hybrids can be conveniently classified under three heads, according to the colour of the flowers:—(a) Selfs are one coloured varieties. (b) Oc;ulatas are eyed varieties, the centre of the flower having a different colour from the rest of the flower and (c) Italian or striped varieties with their petals marked by bands of two different colours. Sow the seeds, which look like small bits of cut straw, in seed pans. Transplant the young plants twice, before they are finally potted or planted out. Space them a foot apart each way in the beds, though the plants will very well cover over three feet of ground in course of time. Do not overwater them as they are very impatient of wet. On account of this reason, they are sometimes grown in raised beds. As the plants grow, lead the shoots to bare spaces in the ground and peg them down with small unobtrusive bamboo hooks so that the plants may cover the beds well and produce a mass of bloom. Pinch the tops of the shoots for bushy and compact growth, till six weeks before the flowers are desired. Remove all flower buds till the plants cover the pot or the beds well. Verbenas are gross feeders and hence top dress the soil with rich manure mixed
with some soil. The manure should be well forked into the soil. Apply liquid manure once in 15 days.

Verbena erinoides is known as the Moss Verbena, as the plants cover the ground closely as moss. The leaves are small and graceful and the flower clusters, though small, are produced so freely and so very plentifully, that the bed looks a carpet of light purple, which is the colour of the commonest variety. Lately the pink, pure white and white variegated with purple are introduced, but the latter kinds are not quite as hardy as the purplish kinds. Moss Verbenas are excellent plants growing under standards along walks in narrow long beds or in small round or oval beds. These are easily raised by separating rooted portions from beds. After the flush of bloom is over, cut the plants to the level of the ground, thin them out 9 inches apart and fork in plenty of manure mixed with a little garden soil. Water regularly and in 2½-3 months more, the plants are in a mass of bloom. Dig the beds once a year and replant them.

Verbena venosa is less showy than the hybrid kinds and bears purple flowers. It is a distinct kind with stiff leaves and panicked inflorescence and tuberous roots. It is serviceable for grouping in mixed borders and for edgings.

Vinca. (N. O. Apocynaceae). (Madagascar Periwinkle). Vinca rosea, and its varieties with pure white flowers, with or without reddish eye in the middle, are hardy perennial plants growing to a height of about two feet. They are furnished with neat attractive foliage of polished smooth green leaves and bear the flowers freely throughout the year. The Vinca is called in Tamil, "Sudukadu mallikai" (the Burning ground or Grave-yard Jasmine). They are very hardy and can be grown throughout the year. They should be cut down every four months. They are useful as pot plants, in beds and in borders and on open rockeries; easily raised from seed, also by cuttings. (C.S.R.).

Violet. (N. O. Violaceae). The Violet is one of the choicest garden flowers. The plants are small herbaceous perennials, which are reproduced by runners which are developed in abundance. The flowers are provided with long stalks and are emit-
nently suited for cutting and for button holes, being very sweet scented. The available colours are white, pink, and violet. The flowers are single or double. The cultivated species are derived from Violia odorata, which is widely distributed over Europe and Asia. Violets are natives of the temperate climate and hence can only be grown in the plains as seasonal plants. In the plains, the plants do not flower freely and the size of the blooms too are comparatively small. Any good garden soil suits them but sandy loam is most agreeable. Violets are usually grown in seed pans three plants being put in each pan. They can also be grown in well prepared beds. They abhor a dry spot and love a cool and moist one, under the shade of large trees or in a border exposed to morning sun only. The soil should be deeply dug and the addition of wood ashes contributes to good results. Watering should be regular and the beds should be hoed frequently. Of the diseases and pests to which Violets are subject are the leaf spots, stem and root rots, red spider, green bugs and aphides. See chapter XI for remedies. Good cultivation, ventilation, proper watering and careful picking off of affected leaves, etc., are some of the things that will have to be attended to for success. Propagation is by one of two methods:—(a) After the plants have finished flowering, lift them out of the soil, shake off the soil, and pull them into several bits, each bit having some root system of its own. Pot them in small 4-inch pots singly or start them in seed pans. By this method, some plants do not come out well as the woody and hard stems do not root freely and do not make satisfactory plants; (b) Select young and vigorous off-shoots, separate and root them in sand as cuttings. This is the better of the two methods of raising Violets. Chose suckers from plants that flower well. After the suckers have established themselves, pot them singly in 5-inch pots or three in a seed pan in a compost composed of one part of sand, one part of loam, and two parts of well rotten horse manure. Remove the runners as they come up. Keep the soil open by frequent stirring. Water regularly keeping the soil moist always. Do not expose the pots to continuous rains. A dressing of half decomposed horse manure acts as a stimulant applied before flowering.
*Zinnia. (N. O. Compositae). The Zinnia is a very fine popular hardy Mexican annual, 1 to 3 feet high with ovate stem-clasping leaves and very attractive single or double flowers of various colours in several shades. There are very few flowers which are so easily grown from seed in the open ground or bloom so abundantly and continuously for quite so long a time as Zinnias. They combine richness and diversity in colour with profusion and duration of bloom. They have been very much improved in recent years and quite a number of different desirable strains are available. The taller kinds are excellent for borders where they are effective. The dwarf double kinds represented by Sutton's Miniature Pompones grow only nine inches tall, forming very valuable bedding plants. The

Dr. Julia Flowered kind bears very large flowers resembling flowers of Decorative Dahlias, measuring six inches across. The Double Quilled kind bears large flowers with petals which are tubular to some extent at the base and which open out at the tip, giving the appearance of Cactus Dahlias. The Picotee Zinnias consist of blooms of several colours, each petal being distinctly tipped with a contrasting colour. The Haageana kind bears single yellow or orange coloured flowers and grows 12—18 inches only. For growing Zinnias, a richly manured soil and sunny situation are necessary. To get the best satisfaction, imported seeds should be got every now and then, as Zinnias degenerate raised from acclimatised seeds. Zinnias can be grown without any difficulty at all, throughout the year. Transplant the young seedlings 9 to 18 inches apart according to the habit of growth of the kind. The first flower bud should be cut away in the large double flowered kinds, as it generally produces an inferior flower. As the several kinds have a tendency to rush into flower, pinch the tops of the shoots for bushy plants. Cut away all the small and inferior flowers leaving only the large ones for making good seeds. (S.R.). *Z. linearis produces small single bright yellow flowers enveloping the plants in a mass and colour. Grows 6—9 inches tall and is very pretty.
BULBOUS PLANTS

For more detailed information on this subject, the book on the Cultivation of Bulbous Plants in India by the author may be referred to.

The term 'bulbous plants' as used in horticulture, embraces such botanically distinct plants as those bearing bulbs, tubers, corms, rhizomes, pips and fascicled roots. They are all seasonal plants with underground modified stems containing a store of food and energy for the development of the seasonal aerial shoots or stems, leaves and flowers. The true bulb is of two kinds; it consists of modified fleshy leaves folded round each other as in the Amaryllis and the Hyacinth or it is made of scalelike narrow thick leaves overlapping each other like the tiles of a roof as in Lilium. A tuber is a thickened modified underground stem bearing buds in the axils of scalelike leaves developing into new growths, as in Achimenes and the Potato. A corm is a solid tuber developing offsets, as in Gladiolus, from which it is grown. A rhizome is an underground creeping stem bearing roots below and aerial shoots above carrying flowers and foliage. Canna is the best example of a rhizomatous plant. The Dahlia, though it bears fleshy roots, is not a tuber, as it cannot be grown into a plant from the fleshy root itself without a portion of the stem with a bud attached to it.

True bulbous plants are characterised by three stages in their growth, viz., the blooming, the growing and the resting periods. When the plants are growing actively, the leaves and stems send down to the underground part nourishment which is utilised to thicken the latter and is stored in it. After a period of vigorous growth, the foliage becomes yellow and dies down along with the shoots. From this time onwards till the bulb again starts growth by swelling its buds and pushing out its aerial shoots during the growing season, the bulb enjoys rest and is dormant, being dead to all outward purposes.
The other kinds of bulbous plants, which are not true bulbs, also experience a period of rest after a period of activity, though not so markedly. There is a certain amount of lack-lustre appearance and cessation of active growth during a certain period. Resting period for bulbous plants may be said to be from November to March generally, varying with climatic conditions in different places.

Bulbous plants are grown for their flowers or foliage or both. There are a number of them, varying in habit of growth, form, colour, etc., so that some are available for massing in beds as the Canna, some for border planting as Dahlia, Crinum and Amaryllis, some for hanging baskets as Freesia and Achi-
menes, some for growing on lawns brightening them as Coop-
peranzhes and Zephyranthes, some furnishing excellent flow-
ers for as Gladiolus, Iris, etc. For pot culture, Glo-
xier, Achi-
menes, Dahlia, Begonia, Caladium, etc., are of unsurpassed beauty.

The time for planting different kinds of bulbs differs in different places in India. The time of planting the same kind of bulb at low, medium and high elevations differs. Dahlia for instance is planted in Bangalore early in June to bloom in August; in Madras, it is planted in November or December. The time for planting is best determined by the time when the particular bulb naturally blooms in the particular place.

While all bulbous plants generally thrive on hill stations, there are some kinds which do not thrive and bloom at medium elevations and many which will not do at low elevations. Anemone, Begonia, Belladonna Lily, Crocus, Daffodil, Hyac-
inth, Clivia, particular species of Gesnera, several species of Iris, Isollom (Tydacea), Ixia, Kniphofia, Lilium, Montbretia, Narcissus, Ranunculus, Saxifrage, Watsonia, Tulip, Tigridia, and Sprekla—these can be grown only on hill stations, 4,000 feet above the sea. At medium elevations, some im-
ported bulbs of some of the above kinds may thrive, such as Anemone and Ranunculus but they perish after blooming for one or two years. Only the following kinds can be grown at low elevations, that is, up to 1500 feet:— hardy purple types of Achi-
menes, Amaryllis ( the ordinary kinds with red and
white colours), Canna, Crinum, Alpinia, Costus, Caladium, Alca saia, Colocasia, Dahlia, Eucharis, Euryales, Gladiolus, Gloriosa Haemanthus, Hemerocallis, Hedychium, Kaempferia, Mirabilis, Oxalis, Pancratium, Polyanthes tuberosa, Zephyranthes, Heliconia, and Maranta. To the above list may be added, the follow ing, for growing at medium elevations, that is from 2,500 to 4,000 feet:—All varieties of Achimenes, Agapanthus, Amaryllis hybrids, Arisaema, Begonia, Belamcanda, Calla, Clivia, Costus, Cyclamen, Freesia, hardy kinds of Gesnera, Gladiolus, Gloxinia hybrids, some hardy species of Iris, some kinds of Liliums for one or two years, Montbretia, etc.

Bulbs for growing at medium elevations and on hill stations are got out from England, Holland and Germany and sometimes from U. S. A. Bulbs for low elevations are best got out from Australia, as the flowering season there corresponds with that in Madras and such places. Otherwise, the bulbs from the Continent should be kept by and potted only next year.

The general method of cultivation of bulbous plants is almost the same. After the resting period, take out the bulbs and place them in moist sand. The dormant buds swell and push out the shoots. When sufficient growth is made—this may be from ½ to 1 inch according to the kind—pot the bulbs or plant them out as the case may be. The soil should be sandy loam rich in leaf-mould. Do not place any fresh manure immediately in contact with the bulb. Compost no. 3 on page 112 is suited for most kinds for pot culture. Drain the soil effectively and in the case of pot plants, provide them with more than the usual quantity of drainage material at the bottom of the pots. The depth to which bulbs should be planted varies with the kinds. Plant Amaryllis, Haemanthus, etc., in such a way that their growing tip or crown is just above the soil; cover Gladiolus bulbs with a two inch depth of soil; some Lilies as L. tigrinum and L. speciosum emit roots from the stem above the bulb in addition to those which are produced below; plant such bulbs sufficiently deep—as much as 5–6 inches of soil may be necessary above the bulbs—to encourage the formation of the upper set of roots also. Non-stem-rooting Lilies may be planted 2–3 inches deep according to the size of the bulb.
On hill stations, bulbs like Hyacinth and Tulip are planted 3-4 inches deep, generally to their own depth of soil. Pot or plant the bulbs early in the season so that they may have as much time as possible to grow. To facilitate early and easy rooting and to prevent rotting, put a handful of sand all round the bulbs while planting. See to it that the hole for putting the bulb in the soil is made with a trowel and not with a dibber; in the latter case, the bulb would not rest on soil but would get stuck up in the hollow of the soil and would rot soon. Soon after planting, water copiously and sparingly thereafter till the bulbs are rooting and have begun active growth. Increase the supply of water as more and more growth is made. Stake the plants as they grow. Apply liquid manure prepared from cow or horse dung once a week or ten days from the time the buds are forming to the time the buds open. Avoid artificial manures as they are likely to do more harm than good with the least indiscretion in their use. When the growing season finishes, the leaves begin to turn yellow and the leaves and the shoots begin to die down. Then, decrease the supply of water. Stop watering altogether when the shoots have died down completely. Do not cut away the shoots and leaves; let them die down naturally. Then toss the bulb out of the pot or dig it out of the ground carefully and allow it to lie in a cool and shady place for a few days till the excess of moisture associated with the soil evaporates away. Then remove all earth from the bulbs and put them in dry sand in a cool place in such a way that the bulbs do not touch each other. Examine them occasionally to see if any rot has set in to prevent infection.

Bulbous plants are propagated by offsets, in the case of such kinds as Tuberose and Amaryllis which produce offsets, from cuttings of portions of tubers with growing buds on them as Caladiums and Potato, by spawns or little entire corms attached to large corms as in Gladiolus, or from seeds, from which it takes more than three years generally to bloom. The methods by which the several kinds can be propagated are mentioned under their respective heads. Also see pages 77-79.

Bulbous plants are a hardy lot and they suffer from very
few pests and diseases. The black caterpillar is the only formidable insect pest. It should be handpicked when it appears. Sometimes roots rot on account of fungus developing from cut surfaces of tubers or injured spots. These should be dusted with sulphur powder before planting. Below are two lists of plants:—(A) Select Bulbous Flowering Plants, and (B) Select Bulbous Plants grown for their ornamental foliage.

(A) SELECT BULBOUS FLOWERING PLANTS

*Achimenes.* (N. O. Gesneraceae). Tropical American small plants, 6—12 inches high, producing in the rainy season a constant succession of effective flowers of great variety in form and colour. Flowers are long and tubular or have a more or less flattened limb; the former are known as the longiflora type and the latter grandiflora type. Tubers are scaly and brittle; they are pear shaped borne at the ends of the roots or caterpillar-like and clustered under the stem. Achimenes are valuable pot plants, useful for decoration of vases and the verandah. Some varieties are excellently suited for growing in hanging baskets. Hardier kinds may be planted on rockeries. Only the purple flowered forms thrive best in the plains; all others do well from medium to high elevations only.

Grow Achimenes in 10 inch pots, putting about a dozen tubers in a pot. Fill up the pot to about an inch from the top and have a thin layer of fine sand in it. Space the tubers about 2 inches apart in the sand and cover up with fine soil, about half an inch deep. Water every other day; keep the pots in shade. Growths emerge out of the soil. Then on, water by the edge of the pots only and not directly on the foliage. With increasing growth of the plants, water them every day. Give the plants morning sun and protect them from severe sun and wind and rain. When the shoots are about 4 inches high, pinch back their tips for bushing out the plants. Give weak liquid manure (cow-dung water) once a fortnight when they are vigorously growing. Treated this way, blooms are produced in about 3½ months. When the blooms are over reduce the water supply and finally stop it after the plants die down. Store the pots with the tubers in them in a cool dry
place or take out the tubers carefully and store them in sand. The time for potting in Bangalore is from the end of April to the middle of May.

Achimenes are propagated mainly by tubers, which are preserved year after year and increase in quantity every year. Terminal soft cuttings about an inch long come up well; these grow and die down after forming small tubers, the pots containing them being kept by till the growing season. Propagation from seeds is done for securing new varieties. Seeds are very very small and need to be sown very carefully.

*Agapanthus. (N. O. Liliaceae). (The Blue African Lily). A native of the Cape of Good Hope region. One of the most beautiful bulbous plants, not only handsome in foliage consisting of evergreen gracefully arching narrow, thick numerous leaves which are two feet long, but also very ornamental when a clump of them is surmounted by abundance of strong clusters of bloom produced on scapes, 2-3 feet tall. The flowers are blue, funnel shaped, 1½-2 inches long, 10-30 of them being found on an inflorescence (umbel). The white flowered variety is less common. Agapanthus is effectively grown in tubs placed at corners of lawns or entrances to porches. It is a stout rooting plant and hence requires light rich soil and plenty of pot room. Best suited for places 3,500 to 7,000 feet above the sea. Grows in semi-shade. Foliage is evergreen unlike other bulbs. Water liberally during growing season. Apply liquid manures while growing, once a fortnight. Flowers are usually produced during March-April. Repot once in three years but top dress every year. Propagate by separating offsets.

*Amaryllis. (N. O. Amaryllidaceae). (Hippeastrum). A family comprising of some of the grandest flowering plants. Natives of the Cape Region and South America. The garden "Amaryllis" are hybrids of Hippeastrum, being evolved from the South African species, H. vittatum, H. Regineae, H. pardinum and H. Leopoldii, by crossing and intercrossing. Two to four large trumpet-shaped flowers, are borne on stout erect scapes, 1-2 feet tall, well in advance of the foliage. Flowers
are pure white to bright crimson, blended in a great variety of streaks and bands. They are invaluable for cutting. Cut the flower-stems near the base just after the buds open and keep in water indoors. Remove a slice of the stalk at the bottom and change the water every day. Looked after in this manner, flowers remain fresh for about ten days.

Amaryllis are effective in borders when in bloom and are often used for edging walks and paths. They are hardy and easily grown pot plants. Once planted in the border or in prepared beds, they need no further attention, thriving and increasing in size by producing offsets in the rainy season, going down about November and coming up again with their beautiful flowers with approaching rains in March or April. For pot culture, take out bulbs from the ground or their pots and keep them in a cool dry place for about a fortnight, in December or January, in Bangalore. Then, pot them one each in a 6 inch pot or three in a 12 inch pot in such a way their crowns are exposed. If the old pots the bulbs are in are not full of roots, it may be needless to repot, in which case top dress the soil with fresh compost. Soon after potting, water liberally and keep the pots in a shady situation. Sprinkle or sparingly water till flower spikes appear. Then on, regularly water every day and apply weak liquid manure of cow-dung or horse-dung once a week. Flowers appear in February to April. Cut back the flower stalks after blooms fade. After period of growth, leaves begin to turn yellow; then decrease the supply of water gradually. When all the leaves are gone, withhold water from the plants. Then store the bulbs. Propagate from offsets, or from seeds, from which blooms are obtained after 3 years.

*Amaryllis Belladonna* is the Belladonna Lily. It has strap-shaped leaves and bears normally Lily-like rose-red fragrant flowers on scapes, 2 to 4 feet long. Flowers freely on the hills.

*Amaryllis vittata* bears flowers, orange with white throat, on scapes about a foot high. Flowers in February-March in great profusion. Very pretty in borders as floral edging.

*A. reticulata* and *A. Mrs. Garfield* have a broad white band on the midrib and bear pink flowers. They are both fernhouse-plants.
Anemone. (N. O. Ranunculaceae). (Wind-Flower). Perennials of small growth, bearing pretty single or double flowers resembling Poppies or Chrysanthemums, there being two types of flowers. Hybrids of *A. coronaria* are usually grown. They are propagated by imported tubers or from seeds. They thrive only on hill stations but at medium elevations they can be grown for one or two years with some amount of success. Tubers should be potted 2 to 3 inches deep in light soil, with a layer of sand all round them. Weak liquid manure may be given when plants are growing. Treated properly, they flower in February-April, planted in October, at medium elevations. On the hills, tubers are started in March to bloom in July-August.

Arisaema. (N. O. Aroidae). (Snake Lily). Hardy tuberous-rooted curious looking plants, most of the varieties having strangely mottled thick flower-stems. Plants should be freely watered during growth and kept dry afterwards. *A. speciosa* (Snake Lily) is about 2 feet high and very ornamental, the greenish purple spathe broadening out and folding over the spadix like the hood of a cobra. *A. fimbriatum* has beautifully fringed spadix.

Begonia. (N. O. Begoniaceae). Tuberosous rooted Begonia has been dealt with in pages 382-3.

Belamcanda. (N. O. Iridaceae). (Leopard Flower or Black-berry Lily). A half-hardy tubulous plant, thriving in light rich soil in well drained sunny borders, bearing flowers of orange colour, spotted red. The bulbs are placed 3 inches deep and 3 inches apart and watered moderately. Propagated by offsets or from seeds, which are shining black and rounded.

Calla. (N. O. Aroidae). (Arum Lily). Callas come under Richardias. They are popularly known as Arum Lilies.

Richardia Aethiopica (Syn *R. africana*) (the Arum Lily) is a moisture loving tuberous plant with handsome foliage of dark green, large arrow-headed radical leaves, bearing showy blooms composed of a large pure white spathe enclosing the spadix bearing minute flowers. The flowers are used in Easter decorations. Rich light soil good drainage, plenty of moisture while growing and shady situation are necessary for success in
its culture. The plant dies down in the cold season and come up again in March. Confine the roots in small 6 inch pots or put three bulbs in a 10 inch pot or there will be rank foliage at the expense of flowers. On hill stations, near running water, Callas do excellently well, blooming freely, but in the plains, they seldom flower. Propagated by offsets.

_R. elliottiana_ is the yellow Calla, which is less common than the white variety. Leaves are spotted white and decorative. Flowers are yellow.

_R. maculata_ has pleasing, green foliage, marked with crystal white spots. Flowers are pure white.

**Canna.** (N. O. Scitamineae). Popular ornamental rhizomatous-rooted plants, 2 to 6 feet high, with handsome strong musa-like foliage of green, or bronzy green or bronze colour, bearing erect large bunches of bright colours. The garden Cannas are derived from Canna indica (called the Indian Shot on account of the seeds which are hard, round and black, resembling shots), which is a native of the Indian wilds, bearing small but comparatively insignificant yellow or scarlet flowers. The modern Cannas are really plants of imposing beauty, being stately in appearance and gorgeous in bloom. For massing in large beds and for cultivation in pots alike, they are invaluable. There are several types of hybrid Cannas, as the Gladiolus-flowered or Crozy type, the Dreadnaught, and the Alipur hybrids. In the Orchid flowered type, which is no longer popular, the individual flowers, though large, do not open, except in twos or threes at a time. In the Gladiolus type, flowers are firmer and the flower-heads larger than in the preceding type. The Dreadnaught is an advance on the Gladiolus-flowered Canna. Alipore hybrids are improvements of the Crozy-type and in them are some of the most attractive colours and colour combinations. The Dwarf Cannas are a newly introduced type, bearing massive heads of flower and not growing more than 2 feet high.

Cannas thrive in open sunny situations in heavily manured soil cultivated about two feet deep. Except during the hottest months, they can be planted at any time of the year. Just before the rains would be the best time for planting. Take up
the old clumps and clean the roots. Cut away unhealthy parts. Cut up fresh portions into clean bits, 3 to 6 inches long, each bit having at least one bud. Plant them 1½ to 2 feet apart and 3 to 4 inches deep. Flood the bed with water. Cover up the bed with bamboo matting or any other material for shade to keep off sun if it is very severe. Water once in three days till shoots come up the soil. Increase the supply of water as growth progresses. When the plants are growing well, never water the surface of the soil only. Soak the soil through. In 3—3½ months, blooms are produced on vigorous shoots. Cut back the stalks which have flowered to the ground level. Feed the plants with liquid manure prepared from oil-cake once every fortnight. Dig up the beds once a year and replant them.

Pot cultivation of Cannas is very simple. Put 7 or 8 bits of roots into a large 18 inch pot using compost No. 1 mentioned on page 112. Grow as indicated above for ground plants.

Propagation is ordinarily done by division of rhizomes, which grow and multiply under the ground. See figure 47. New varieties can be grown from seeds, selected from large flowering kinds after cross pollination. As the seeds are very hard, they have to be filed in one place and soaked in water at least for two days before sowing.

Clivia. (N. O. Amaryllideae). (Imantophyllum). South African Amaryllids, better known as Imantophyllums, with handsome evergreen foliage of deep green strap-shaped leaves and showy tubular red and yellow flowers in large umbels. The bulbs are imperfect and are formed mostly of old leaf-bases. As in Agapanthus, the root system is thick and fleshy. Pot three bulbs, of the size of the Amaryllis, in a 10 inch pot, in December and February at medium elevations and high elevations, respectively. Established plants may be grown in the same pots year after year with top dressing every year. Apply weak cow-dung water during growing season. Sparingly water during winter. Repotting, if any, is best done after flowering. Propagate by division of clumps. From seeds, it takes 3—4 years for blooming.

Clivia miniata bears funnel-shaped flowers of a bright scarlet colour with a yellow throat, 12 to 20 of them being cluster-
ed together in an umbel. \textit{Imantophyllum chryantheflorum} bears salmon-red flowers. \textit{I. nobilis} is another pretty species.

\textbf{Crinum.} (N. O. Amaryllideae). Extensive genus of plants, allied to Amaryllis and bearing flowers, which are white or red tinted, mostly in summer. Many species are natives of this country. The stem rises from a bulb with a more or less elongated neck; the foliage is handsome consisting of long, strap-shaped leaves; the flowers too are very handsome, large, mostly sweet-scented, and borne on top of tall, fleshy stout scapes. Crinums may be generally divided into two types:—(a) Those, which have more or less evergreen leaves and Leek-like elongated bulbs and bear symmetrical, star-like, straight-tubed, more or less erect flowers; and (b) those which are deciduous and bear mostly roundish bulbs and produce nodding irregular bell-shaped flowers. All of them are propagated by offsets. Rarely they are raised from seed. Most species are hardy and need no particular attention after planting. They do well in the ground forming large clumps with offsets. Large pots or tubs are necessary for growing them. Sunny situation, rich friable soil, and plenty of water during the growing season are important essentials. At times, leaves and flower-buds are attacked by black caterpillars. The following are a few noteworthy species:—

*C. asiaticum* has columnar stem-like bulbs, which are 10 to 15 inches long and should not be planted deeper than 3 inches. Leaves are strap-shaped, 2 to 3 feet long. Flowers are produced almost all the year round; the scapes bear as many as 50 large deliciously fragrant pure white flowers. *C. asiaticum variegatum* has variegated foliage, bands of white on green, best developing colour when pot bound or when starved.

*C. longiflorum* is a common scented variety with scapes carrying 8 to 12 large white bell-shaped flowers.

*C. Moorei* has large bulbs, 5 to 8 inches in diameter, with slender stem-like neck, about 10 inches long. Leaves are thin, wavy, long and very beautiful. Flowers are fragrant, bell-shaped, rosy or pink-red, and borne 4 to 10 in an umbel on the scape. A truly noble species. There is also a white variety of the above.
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*C. Powelli is another handsome species, with long graceful spreading leaves and large showy heads of rose coloured flowers. *C. Powelli variety alba bears white flowers. *C. Powelli variety intermedium bears light rose coloured flowers.

Other handsome species are *C. americanum; *C. giganteum; *C. Sanderianum; *C. amabilis; *C. Kirkii and *C. zeylanicum.

Cooperanthes. (N. O. Amaryllideae). Plants very much like and derived from Zephyranthes (see below) bearing flowers in a wide range of colours in white, pink, rose, orange and yellow shades. Unlike the Wind Flowers which flower only when the monsoon starts, Cooperanthes produce sheaves of bloom springing up suddenly within two days of a shower of rain.

Costus. (N. O. Zingiberaceae). Rhizomatous-rooted plants of dwarf or semi-dwarf habit, with attractive foliage and leafy stems, bearing flowers in spikes with overhanging bracts. They are natives of India and thrive in a compost of sandy loam to which a little peat is added. They are effective as pot plants and on rockeries in semi-shady situations. They grow like Hedychiums. Propagated by division of rhizomes. *C. igneus bears bright orange-scarlet flowers and is furnished with handsome foliage; height of plant, 1–3 feet. *C. speciosus is an elegant species, growing about 4 feet high, with oval leaves spirally arranged on the leafy stem and bearing at its apex a spike of pure white flowers, about 4 inches long. This species does well 2,000 feet above the sea, in partial shade. *C. elegans; *C. pictus and *C. argyrophyllus are other attractive species.

*Cyclamen. (N. O. Primulaceae). Tuberous charming plants, with neat and dwarf habit of growth, with beautiful foliage of radical long-stalked, leaves, bearing stalked flowers of purple rose or white colours. Bulbs are circular and compressed root-stocks, from which leaves and flowers spring. There are several species, of which *C. perspicum (Persian cyclamen) is the most popular. *C. africanum; *C. ibericum and *C. neapolitanum are also handsome species. Several improved varieties are being raised by cross pollination and careful selection.

Although Cyclamen is a perennial and is capable of flowering year after year from the same bulb, it is best raised from
seeds every year. Thrives only from medium to high elevations. Sow seeds in well drained seed- pans in soil composed of equal parts of loam, sand and sifted leaf-mould. Fill up the soil to within half an inch from the top of the seed-pan; press the soil lightly down and level it; space out the seeds an inch apart and cover with ½ inch of fine soil. Water with a fine-rosed water can and cover the pan with a plate of glass to keep the soil moist. Keep the soil just moist, without allowing it to get dry, by occasional supplies of water, when necessary. Keep the pan in a shady situation. Germination is slow and irregular. Small bulbs appear from which tiny leaves emerge in a month or so after sowing. As germination becomes complete and as more and more leaves are formed in succession, allow morning sun to seedlings and remove the glass plate from the top of the pan. Water them with care as too much will rot the young bulbs and too little will injure them beyond recovery. When leaves of adjacent bulbs are touching each other, lift each little plant carefully and pot it in a 3 inch pot, using similar compost. Let the crown of the bulb be on a level with the top of the soil; rot sets in if the crown is buried under the soil. Give the plants only morning sun. Shift them to 6 inch pots, using compost No. 3 on page 112. As plants grow, feed with weak liquid manure prepared from cow-dung, once a fortnight, especially just before flowering. Sprinkle the foliage with clear water both morning and evening. If plants fill the 6 inch pots and can grow more, shift them to 8 inch pots. Blooms can be expected 8—10 months after sowing. Grown well, the bulbs attain a size of 1—1½ inches in diameter and bear 12 flowers or more easily; as many as 30 to 36 flowers are reported to be borne on a single plant at a time on hill stations. Exercise great care in watering at every stage of growth and especially during the blooming period; over watering surely brings on rot to the bulbs. When the blooms are over and the foliage begins to show discoloration decrease the supply of water. After the foliage dies down completely, withhold water from the bulbs; take them out of the soil; put them in a cool dry place in sand till potting time in Octo-
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ber or November at medium elevations. On the hills, they are started in March to flower in July—August.

*Dahlia. (N. O. Compositae). One of the most gorgeously coloured, free blooming, easily cultivated popular plants. They are not tuberous-rooted, in the sense that potatoes are. They are provided with fleshy roots, in which nourishment for the production of annual stems and flowers are stored and these roots are connected to a crown bearing a number of eyes or buds. Flowers are useful for cutting, are single or double and brilliantly coloured, being available in a wide range of colours; the only colour not available is the blue. For mass effect in borders, for cultivation in large beds, and for pot culture, there are few plants to excel the Dahlia. Flowers are of several forms and sizes. The following are well recognised types of Dahlia:

1. Show or Double dahlias.
2. Fancy dahlias.
3. Pompon dahlias.
4. Double Decorative dahlias.
5. Double Cactus dahlias.
6. Collarette dahlias.
7. Paeony flowered or Art dahlias.
9. Pigmy or Tom Thumb dahlias. The latter grow only 12—18 inches high and are useful for bedding out.

Propagation is by one of the three following methods:
(a) By cuttings, which is more or less the commercial method. Propagation by cuttings is a cheap way of making a collection. Slips with the heel attached are more successful than terminal cuttings. Terminal cuttings should be tender and should possess no hollow at the core at the place cut. The cuttings are inserted in pure sand and are taken care of like cuttings of other kinds of plants. They strike root and develop small bulbs, which go to rest after the growing period. They grow bigger and bear larger flowers during the next growing season.
(b) By division of the ‘tubers.’ Time for planting is generally indicated by swelling of the buds on the crown to which the
tubers are attached. The roots are kept on moist sand and sprinkled with water. When buds have grown about \( \frac{1}{2} \) inch, the clumps are divided in such a way that each part has a growing bud on it. (c) By seed. Seeds are sown 2 inches apart in seed-panns or nursery beds and the seedlings potted off or planted out when they are about 2 inches high. Seeds collected from large double flowers give a large percentage of double flowering plants. The blooms improve as the fleshy roots develop after the first year.

Dahlias can be grown throughout India, except at the hottest places. A moderate rainfall during its growing and flowering period and a mild climate with comparatively humid atmosphere are conducive to best results. At Bangalore, planting is done about the end of May or early in June for blooms early in August. At Madras, it is done in October or November for blooms in January and February. On the Nilgiris (Ooty), bulbs are planted in March and April. At Hyderabad (Deccan), planting is done in June or July. Seeds can be sown about the same time as planting of bulbs or a little earlier. Good blooms are not produced if seeds are sown late in the season. At high elevations, plants are liable to be killed by frost.

Dahlias are cultivated in pots in the following manner:—

Start the dry tubers by placing them in a cool place in moist sand for four or five days. Cut them up into pieces as indicated above. Place each tuber in a pot. Choose a large pot, either 12 or 15 inch pot. Fill it to a little more than half with compost No. 3 on page 112. Place the tuber with a handful or two of sand under it and cover it about an inch deep with the compost. Water plentifully soon after planting and then sparingly till shoots emerge out of the soil. Keep the pots in an open sunny situation, well sheltered from wind. Remove all but the strongest shoot. As it grows, fill up the pot to about half an inch from the top with the soil covering the new shoot at the base. When it is about 8 inches high, cut its growing tip to induce branching. Retain only three of the shoots that come up. Stake the plants as they reach 9 to 12 inches. Water liberally as growth progresses and do not allow the plants to flag for
want of water. It may be necessary to water them twice a day on warm sunny days. Feed with liquid manure, prepared out of oil-cake once in ten days, from the time the buds are forming. One tablespoonful of a mixture of superphosphate and ammonium sulphate in the proportion of two of the former to one of the latter, dissolved in water, may be supplied at intervals of applications of oil-cake water. Blooms may be expected, in 40 to 45 days after the shoots are topped. For exhibition blooms, all except crown buds should be removed. Generally, buds come up in threes. Rub off side buds retaining middle ones. For garden decoration, it is desirable to have a large number of flowers on the plants; in which case, do not disbud. The blooming period lasts for 1½—2 months. After flowers are over, diminish the supply of water gradually till all the leaves and shoots die down. Then cut back the dried stems to the ground level; free the roots from the soil and store them as suggested in page 447.

Dahlias are grown in the ground in much the same way as in pots. The ground should be well worked—at least two feet deep. Dahlias will grow in any kind of soil, provided the drainage is perfect. But, sandy loam enriched with manure gives best results; open sunny situation, shelter from high winds, freedom from the roots of large trees and shrubs, and plenty of water are essentials for good results.

Dahlias are comparatively free from insect and fungus pests. Green flies or aphis are very common; before they weaken the shoots, spray with weak tobacco solution or with soft soap solution. Slugs sometimes attack dahlias and they can be caught at nights with a lamp or kept away by sprinkling soot or lime on the surface of the soil. Beetles, sometimes attack them and they can be handpicked and destroyed. In certain localities, on account of bad culture and unfavourable environment, mildew sets in. Treat, then, with the standard fungicide, Bordeaux Mixture. If the attack is severe, plants should be cut down and new growth started with suitable precautions.

*Eucharis. (N. O. Amaryllideae). An exceedingly handsome bulbous plant with large radical dark shining leaves, a foot and a half in length, bearing late in winter and at other times
with suitable treatment, pure white sweetly scented lovely flowers, 5 to 7 of them being carried well above the foliage on long stout scapes. The bulbs are 1–2 inches in diameter. They thrive well in soil, inclined to be heavy. Eucharis does not like frequent repotting. Protection from full sun-shine, good drainage, and a north-east aspect conduce to best results. Liberal supply of water, frequent syringing of the foliage keeping it clean, and applications of liquid manure (dung-water) when the flower-scapes show are also necessary. The only pest is the black caterpillar, which feeds on Lilies; it can be handpicked and destroyed. There are several species; E. grandiflora is the one most commonly grown.

**Euryycles**. (N. O. Amaryllideae). Free flowering tunicated bulbous plants with large round leaves, bearing creamy white flowers resembling those of Eucharis on erect peduncles, 12–18 inches long. Flowers are pretty and nearly 2 inches across. Grown like Eucharis. *E. sylvestris* = *E. amboinensis*, which is known as the *Brisbane Lily* is the largely cultivated species.

**Freesia**. (N. O. Iridaceae). Genus of dwarf bulbous plants producing bell-shaped deliciously fragrant flowers, six to eight of them, in clusters, being borne on slender stalks above the foliage. Flowers are useful for cutting and are now available in rose, blue, yellow, bronze and bi-colours. *F. aurea* bears yellow flowers. *Freesia refracta alba* is very pretty with its white flowers. Bulbs are small and cormous in nature. Put 5 to 7 of the largest sized bulbs into an 8-inch pot using compost no. 3 on page 112. Cover up with soil and press the soil down firmly. Water sparingly at first and increase the supply as growth progresses. Give weak liquid manure, prepared from cow-dung, once in fifteen days, as plants develop. Only bulbs which have been fed and well cared for during their period of growth produce flowers satisfactorily. Decrease the supply of water as the foliage turns yellowish and stop watering after it has died down completely. Keep the pots dry for a month or so with the bulbs in them and then remove bulbs for storing. Undeveloped bulbs and small sized ones should be grown separately to produce flowers during the next season.
Freesias flower from seed the third year after sowing. They thrive only from medium to high elevations.

**Gesnera.** (N. O. Gesneraceae). Pretty genus of underground stemmed plants, propagated by seed or by tubers. Species with succulent leaves are also increased by leaf-cuttings. Flowers are very showy, tubular and droop from the branching erect stems. Only some species thrive on the plains, if kept shaded from sun and grown in cool plant-houses. Gesneras are tuberous-rooted plants allied to Achimenes, Gloxinia, Isoloma and Streptocarpus and are treated like Achimenes. Open well drained light soil, careful watering, shelter from sun and rain are necessary. The new hybrids are very handsome. *G. splendens* grows 1 to 1½ feet, is hardy, and bears bright red, very showy flowers. *G. refulgens* is another attractive species.

**Gladiolus.** (N. O. Iridaceae). Very popular and decorative cormous plants with grassy one sided stems and long spikes of flowers which are available in rich brilliant varied colours of almost every shade. Gladioli are grown mainly for cut flowers for decoration of the vase, the spikes coming to full development when kept and placed in water till the last bud opens. The modern hybrids bear very large flowers in very long gorgeous spikes.

Grow them in deep rich sandy loam in sunny situation sheltered from wind. Compost no. 3 on page 112 is used for pot culture. Plant the corms 2—3 inches deep. Water sparingly at first, increasing the supply as growth progresses. Shoots with sword-like leaves arranged in one plane come up soon, one on each corm. If the plants are not staked from the time they are six inches high, the flower spikes and the stems get distorted. Apply liquid manure once a week. Top dress the soil when the plant has made about 6 inches of growth. After flowers are over, leaves begin to turn yellow; reduce the supply of water gradually till the leaves dry up, then withhold water from the plants. Cut down the stalks to six inches from the ground, two or three weeks before the corms are lifted for storing. Put the corms, after they are lifted from the soil, side by side in a cool dry place. Gladioli are usually planted in the month of June to flower in August at Bangalore.
At low elevations, the imported corms should be started in September-October. But Gladiolii give best results only in medium to high elevations. It is necessary to start the corms by keeping them in moist sand and plant them out after shoots are formed.

Propagation is from seed or by offsets called spawns. From seeds, new varieties are obtained. Sow seeds in well drained seed-pans in light porous soil. Thin out seedlings if too crowded, harden them, and allow them to remain in the same pans for two seasons for the corms to develop. Water less and less when the leaves begin to turn yellow till they dry up when watering should be stopped. At the end of the second year, bulbs are large enough to be potted. Put 4 or 5 of them in 5-inch pots. But flowers are produced only after three years of sowing. The more rapid and easy method of propagation is by separating the bulbils or spawns from the old corms and potting them, four to five being put in 5 inch pots. They mature in one to two years and bear flowers.

Gloriosa. (N. O. Liliaceae). (Canarese, karadi kannina gedde). *Gloriosa superba*, the best known species, is a tall, weak-stemmed, slender deciduous tuberous-rooted indigenous creeping plant, supporting itself by means of tendril-like prolongations of the leaves. Flowers during the rainy season in great profusion; they are peculiar, with long twisted or wavy crisped petals, reflexed after the manner of Cyclamens, which are light yellow in one half and crimson in the other half, the entire flowers turning crimson as they become old. The foliage dies down with the approach of the cold season and the plants remain dormant till the next rainy season. Gloriosa can be grown in pots or in the ground and it is propagated by division of the Turmeric-like rhizomes. They are planted just before the rains, one rhizome being put into a 8-inch pot. Good drainage and light rich soil are necessary. The pot should be furnished with a balloon over which the plant creeps and blooms.

*Gloxinia.* (N. O. Gesneraceae). Florist's Gloxinias or Gloxinia hybrids are derived from *Sinningia speciosa* and are strictly Sinningias. They are dwarf plants, with very short stems and
large hairy leaves producing very showy bell-like flowers on a long stalk. Flowers are available in exquisite shades of colour and are often variously blotched and speckled with different colours. Gloxinia hybrids are grown in pots for decoration of the conservatory. They are warm-temperate plants, suited for elevations of 4,000 to 7,000 feet. In hot places at low elevations, they are short lived, the tubers not surviving after flowering once. But, they can be preserved to flower year after year at medium to high elevations. In Bangalore, tubers are started in May to flower in August. In the plains, they are started in November or December. Import one year old bulbs and pot them singly in 4-inch pots using a soil composed of equal parts of leaf-mould and sand. Cover the bulbs with soil leaving the eyes upwards. Shift them into 8-inch pots after the small pots are filled with roots. Do not overwater them. Do not wet the foliage. Ensure perfect drainage of the pots. Maintain a warm moist atmosphere and avoid draughts and sudden chills. Shade from direct sunshine. Use compost no. 3 on page 112 for final potting.

Gloxinias may be propagated from seed, by cuttings of leaves and stem. Seeds are best sown in September-November in the plains and March to May on the hills. Sow in shallow well drained pans in soil composed of equal parts of sifted leaf-mould and sand. Water and cover with a plate of glass. Germination is complete in about a week and in about a month, the young seedlings are fit to be potted singly in 3-inch pots in soil composed of 2 parts of leaf-mould, 2 parts of sand and \( \frac{1}{3} \) part of loam. Seedlings damp off if overwatered. Treat the plants as described above. Do not water the small bulbs when they go to rest. Start them after the period of rest in the same pots and they will flower during the second year.

\textit{Gloxinia maculata} is a hardy vigorous growing plant, about a foot high, having pretty bright glossy succulent bronzy green leaves, producing in October and November large blue bell-formed flowers. This species grows with comparatively less care than the hybrids mentioned above. In partial shade, in light rich soil, \textit{G. maculata} does well, if supplied freely with water during period of vigorous growth. The resting season is
usually from December to May, when the scaly tubers, resembling a mass of caterpillars, should be stored in sand in a dry cool place. Plant the tubers like Achimenes, putting one or two in a 9-inch pot.

* * * 

**Haemanthus.** (N. O. Amaryllideae). (Blood Flower; Blood Lily). Also known as the Red Cape Tulip. Several species are natives of South Africa. All are bulbous plants carrying spherical umbels on a scape. Flowers precede leaves and are of shortlived beauty, looking like scarlet powder puffs and are produced in March—April. The bulbs can be grown in pots or in the ground. Pot firmly three bulbs in a 9-inch pot or one in a 5-inch pot, placing them half their depth in the compost no. 3 on page 112. Water carefully till plants get into active growth and then freely till the bulbs go to rest. Supply weak liquid manure to strengthen the bulbs. The larger the bulbs, the larger are the heads of flowers. It is not necessary to pot the bulbs every year; they may be continued in the same pots for two or three years. Propagated at potting time in February in Bangalore by offsets which are removed from old bulbs and are potted in small pots.

* H. *multiflorus* bears scarlet-crimson heads of flowers, about 6 inches in diameter, on short erect scapes, about a foot high, before the leaves appear.

* H. *Lindeni* is a superior species with larger heads of rosy-scarlet flowers.

**Hedychium.** (N. O. Scitamineae). Called differently as Orchid Lily, Butterfly Lily, Ginger Lily and the Garland Flower. Ornamental rhizomatous herbaceous perennial plants growing from 3 to 7 feet and bearing in the rainy season large showy spikes, which are 6 to 18 inches long and 4 to 10 inches in diameter. Flowers of some species are fragrant. Colours of flowers are white, scarlet or yellow. The plant has stems with sheathing leaves and grows like the Canna. Stems die down in the cold weather as the plants are dormant in winter. They are increased like Cannas by dividing the roots and potting them. The rhizomes look like centipedes, and lie just under the surface of the soil being anchored by the roots. Do not plant the rhizomes deep. A moist semi-shady situation suits
A well grown Dahlia. (Page 417)
(By Courtesy of the Superintendent Govt. Gardens, Bangalore.)
them best. They are too large growing to be satisfactorily grown in pots. But like Cannas, they can be grown in very large pots or tubs.

_H. coronarium_ (Indian Garland Flower) is commonly grown and it is one of the loveliest hardy species. Stems rise 3 to 5 feet high, in succession, in the rainy season, bearing large terminal spikes of fragrant pure white flowers. This species is best suited for low elevations and it succeeds best as a semi-aquatic in rich deep soil with abundant supplies of water. _H. coccinum_; _H. elatum_ and _H. flavum_ are some other handsome species. _H. Gardnerianum_ is a favourite species.

_Hemerocallis_. (N. O. Liliaceae). Called the Day Lily. Bulbous plants with roots which are bundles of fleshy tubers and leaves which are two ranked, linear, acute and grassy, bearing flowers which are orange yellow on erect tall scapes, early in hot weather. Hemerocallis does not bloom as freely at low elevations as at medium elevations. Propagated by division of fleshy roots.

_H. aurantiaca_ (Golden Lily) bears large orange coloured fragrant flowers.

_H. fulva_ (Lemon Lily) bears yellow flowers; it does not grow as tall the preceding species.

_Hyacinth_. (N. O. Liliaceae). Hyacinths are bulbous plants bearing pretty spikes of flowers. They are grown from imported bulbs. Below an altitude of 4,500 feet they do not thrive and bloom freely. Put the bulbs in pots proportionate to their size, one for a 6-inch pot or three in a 8-inch pot and cover up with soil composed of sand, leaf-mould and charcoal only. Water very sparingly till growth starts. Keep in shade in a dark place. Bring them out when flower spikes are two inches high.

_Hymenocallis_. (N. O. Amaryllidaceae). Very much allied to Pancratiums but are more delicate to grow in the plains than the latter. For culture, see Pancratiums.

_Imantophyllum_.—See under Clivia.

_Iris_. (N. O. Iridaceae). There are innumerable species and varieties in existence but only a few are hardy, free blooming
and worth cultivating. Iris form a very interesting class of plants remarkable with two-ranked narrow long leaves and curiously constructed flowers of attractive and gorgeous colours. There are two groups of Iris, the rhizomatous-rooted and the tuberous-rooted. Plants evince marked diversity in habit of growth, from 3 inches to 3 feet. Propagation is from seeds or offsets in the bulbous group and by division of rhizomes in the rhizomatous group.

Iris thrive only at high elevations, being best suited for sub-tropical and temperate conditions. The species chinensis is hardy and grows at medium elevations bearing blue flowers. Rich sandy soil containing a large quantity of leaf-mould and well rotten cattle manure suits them best. The rhizomes or tubers should not be kept out of the ground for any length of time. Planting should not be too deep; it may be in the ground or in pots. The following are suited for medium to high elevations:

1. *I. japonica*. Evergreen, rhizomatous, large blue flowers the falls being spotted with yellow and white and fimbriated at the margin.


1. *I. Florentina*. Large white flowers. Thrives at Poona with moist treatment; blooms in the rainy season.

1. *I. hispanica* belongs to the bulbous class and bears flowers of distinct shades as blue, yellow, white, bronze, dark purple, etc.

1. *I. sibirica* bears very large flowers of fine colours.

Isoloma. (N. O. Gesneraceae). Now known as Tydeaea. Perennial herbs of American origin, allied to but coarser than Achimenes and Gesnera and needing the same treatment. Suited for pot culture, being compact growing. Flowers are produced in the cold weather between October and November. *Tydeaea amabilis* grows 1 to 2 feet high, has velvety leaves and bears showy dark rose coloured solitary flowers with long peduncles from the axils of the upper leaves. Tydeaeas require shaded situation and thrive only from medium to high elevations.
**IXIA.** (N. O. Iridaceae). Called the African Lily. Pretty bulbous plants from South Africa with grass-like foliage and spikes of flowers, useful for cutting for vase-decoration. They are all hill types and do not thrive at low elevations. Grown in much the same way as Gladiolus; between 3,000 and 7,500 feet altitude, they do well. 5 bulbs are put into a 9-inch pot and covered over with 2 inches of soil.

**Kaempferia.** (N. O. Zingiberaceae). Ornamental dwarf plants, grown for their ornamental foliage and flowers, with ginger-like rhizomatous roots. They are compact in habit with egg or lance-shaped leaves which are green, bordered or flaked with white above and purple beneath. Plants are deciduous, producing flowers usually before the leaves appear, in a crowded manner opening day after day in the morning and fading in the evening. Flowers are delicately scented and are borne close to the ground; hence unless grown in pots, flowers are hidden from view. Propagation is from the roots which are cut up into bits with buds on them after the leaves die down. Put 4 to 6 pieces into a 9-inch pot. January or February is the flowering season. Feed well with liquid manure during period of growth. Repotting is necessary only once in two years. Several species are favourites in Indian gardens. *K. Galanga* (chandra-mulika), *K. rotunda* (Boi-champa), *K. Gilbertii*, *K. Kirkii*, *K. speciosa* and *K. Parishii* are desirable species.

**Kniphofia.** (N. O. Liliaceae). Synonymous with Tritoma. Known popularly as Red-Hot-Poker plant or Flame Flower. Handsome plants with abundant radical leaves bearing immense spikes, closely covered with flowers, which are orange, rose, salmon, scarlet, white or pink in the several species. Kniphofias are only suited for sub-tropical conditions and do not thrive at low elevations in India. Propagated by division and from seed, blooming the second year from seed.

*T. aloides* is a striking object while in bloom. Leaves are ensiform-acuminate, 2—3 feet long and about an inch broad. Flowers are coral-red in colour fading to orange-red and are borne densely on spikes, which are about 6 inches long and 3 inches thick, on peduncles, as long as the leaves. Thrives on hill stations.
Lilium. (N. O. Liliaceae). Genus comprising of many floral beauties. Liliums, as a class, do well only on the hill stations and tolerably well at medium elevations of 4,000 feet and above. Some species may be induced to flower in the plains but bulbs perish after one season. Liliums require a comparatively cool atmosphere with moisture all the year round. Liliums are divided into three classes for purposes of cultivation:—

1. Stem rooting kinds, which produce a second and distinct root system on the stem above the bulbs. These roots support the plants throughout the growing period, leaving the original roots to concentrate their energies on the bulb. These kinds should be potted or planted about 6— inches deep in a fairly rich top soil. 

2. Non-stem-rooting kinds may be planted to a depth of 2½ times the size of the bulbs. 

3. Swamp lilies require a soil that is always moist but not waterlogged. Sandy peat to a depth of a foot and a half would suit them best. Liliums dislike lime in the soil, with very few exceptions. Use of animal manure also is not conducive to good results. What they require is sandy soil containing a large quantity of well decomposed leaf-mould. Drainage should be perfect. Liliums can be grown in the ground in raised beds or in pots. A situation where the plants get only morning sun should be chosen. Till growth commences, watering should be done very carefully. Water is withheld after flowering when the stem shows signs of withering. Frequent disturbance or repotting does irreparable injury. Liliums multiply quickly and they are propagated by division. Bulbs are imported usually from Holland, England or Japan and die after two or three years even at medium elevations. The following are a few noteworthy species:

*L. longiflorum* have small bulbs with slender stems about 1½ feet long, bearing in February—March pretty fragrant pure white flowers about 6 inches long. Leaves die down in June and the resting period lasts till September, when they are potted. As bulbs do not survive being kept long out of the ground, great difficulty is experienced in obtaining them in good condition. Stake plants when they are 6— inches high. This lily is popularly known as Madonna Lily.
*L. tigrinum* (the Tiger Lily) grows 2 to 4 feet high, bearing flowers which are deep orange-red, spotted dark purple. Moisture all the year round and coolness are necessary for satisfactory growth.

*L. giganteum* grows to about 8 feet, has heart or egg-shaped leaves, 1 to 1½ feet long; bears 5 to 6 flowers on each stem, which are 5 to 6 inches long and about 4 inches in expansion. Blooms in August.

*L. auratum* (Golden-rayed lily) grows 3 to 4 feet, bearing white or yellow flowers with orange spots.

*L. candidum* grows 2 to 3 feet bearing white flowers. It is the true Madonna lily.

*L. Neilgherriense* grows 3 feet high, bearing large trumpet-shaped flowers, 8 inches long and 5 inches in expansion at the mouth.

*L. Harrisi* (Bermuda Lily) bears large white flowers.

**Mirabilis.** (N. O. Nyctagineae). *Mirabilis Jalapa* is a pretty tuberous rooted small herbaceous shrub, 2–2½ feet high, bearing in great profusion in the rainy season, very brightly coloured flowers, made up of coloured calyx, having the appearance of corolla. Flowers are variously coloured and are funnel-formed with a long tube and expanded mouth. They close about 4 o'clock in the evening and open out in the morning and hence the common name, *Four O'Clock Flower*. The other popular name, *Marvel of Peru*, is derived from the name, which means wonderful. Plants come up rapidly from seeds which are produced in plenty. They are also grown from the tubers of previous year. Regular supply of water and rich soil give best results. The plant can be grown in pots, shrubberies or perennial borders. It dies down completely to all outward appearance in November–December, and comes up again during the rains.

*M. longiflora* bears longer sweet scented flowers.

**Montbretia.** (N. O. Iridaceae). Allied to Tritonias and grown very much like them. Showy and hardy summer-flowering bulbs with flowers of rich and brilliant colours borne on spikes, which are useful for cutting. They thrive in open sun-
ny borders in rich soil, at medium to high elevations. Propaga-
gated by division or from seed.

Narcissus. (N. O. Amaryllidaceae). Genus of well known
bulbous plants thriving only on hill stations, where they grow
wild and freely bloom. Very few members of the family do
well at low elevations in South India. Narcissii require light
open soil composed of sand, leaf-mould, well decomposed ma-
ture and loam in equal proportions. Plant 5 bulbs in a 9—inch
pot, covering the bulbs with three inches of compost. In beds,
bulbs may be covered 4 inches deep. Till growth starts, very
little moisture is needed. On the hills, bulbs are started in
February.

Oxalis. (N. O. Geraniaceae). Some like this tuberous-root-
ed plant, which is of dwarf habit, growing three to six inches
high. Leaves have an acid taste and the flowers are not much
in most of the species; but new hybrids are pretty, bearing
large tri-oliate leaves and large flowers. Oxalis is easy to
grow; it may be grown in pots or on rockeries. Blooms are
produced during the cold season and the plants die down by
May, when the bulbs are rested and stored, like Achimenes.
O. Bowei is a large rose-flowered variety, which thrives in the
plains. Oxalis thrives best from .. medium to high elevations.

Pancreatium. (N. O. Amaryllidaceae) called the Spider-
Lily. Bulbous plants, requiring little care to be bestowed upon
them after planting them in open beds or borders. They are
grown in pots also. Leaves are long and broad. Flowers are
characterised by beautiful structures, known as staminal cups,
having the texture of petals and being fringed and toothed in a
variety of ways. The filaments growing out of the cup are long
or short. The pure white deliciously fragrant flowers, having a
spider-like appearance, usually appear in the hot weather after
a shower in large panicles measuring over a foot across. Pan-
creatiums are moisture loving plants and they should be never
kept dry at the roots during period of growth. They bloom
best if left undisturbed in their old soil or when pot-bound.
Propagated by offsets, which are separated and potted off in
small pots.

*Poylanthes tuberosa. (N. O. Amaryllidaceae). (Canarese
and Tamil, "Sugandaraja"). Well known as Tuberose. One of the commonest and handsomest of Indian garden plants, easily propagated by offsets and growing without any particular care. The plant is dwarf, about 5 inches high, with radical light green long narrow arching crowded leaves. Flowers are single or double, waxy-white, sweet scented, tubular, 1½ to 2½ inches long, and are borne in lax spikes on flower stems, 2-2½ feet high. The spikes of flowers are useful for cutting for vase-decoration and flowers are useful for making bouquets and button-holes. Cut away the old roots at the base of the bulbs and remove small sized ones attached to the larger bulb found in the centre of each clump of bulbs. It is only these larger bulbs that flower; the small ones take one or two seasons, according to their size to bloom. Plant the large bulbs in the ground, 6 inches apart, cover them with an inch and half of fine soil. Stake the flower stalks to prevent injury from winds. For exhibition purposes, 5 to 6 large bulbs of about the same size are put into 10-inch pots, using compost no. 3 on page 112. As tuberoses are strong feeders, supply plants with weak liquid manure once a week, during the period of vigorous growth when the flower stalks are being pushed up. Trim unhealthy leaves. Bulbs can be rested and planted during any part of the year. By successive planting, blooms may be had all the year round.

Ranunculus. (N. O. Ranunculaceae). The Butter-cup or the Crow-Foot is a lovely tuberous-rooted perennial of about 6 inches in growth and of good form bearing brilliant handsome flowers of white, crimson, yellow, Carmine and other colours. Individual flowers are often 2 inches across, beautifully imbricated and as full and double as a rose. Ranunculus thrive only on hill stations and they require a moist sandy rich soil and a cool shady situation. They are grown like Anemone and Gladiolus, three bulbs being placed in a 9-inch pot and covered over with a 2-inch layer of compost.

Richardia.—See under Calla.

Saxifraga. (N. O. Saxifragaceae). Popularly known as Rock-foil; Break-stone; and Saxifrage. Genus of hardy dwarf perennial tuberous-rooted plants, 4 to 6 inches high, producing panicles of delicate flowers, of white or yellow colour and rarely
purple or rose. Leaves are handsome and are usually clustered at the base. Saxifrage is suitable for rockeries, carpet-bedding and for pot culture. It delights in peaty soil and prefers to be surrounded with stones and hence the common names. It should be provided with efficient drainage. Propagated by division and offsets. Saxifragas do not thrive in this country, except at high elevations.

Tritoma.—See under Kniphofia.

Tritonia.—See under Montbretia.

Watsonia. (N. O. Iridaceae). South African plants, 1 to 1½ feet high, allied to Gladiolus and grown similarly. Flower spikes appear in the rainy season. Watsonias are better bedding plants than Gladiolii, being harder and having a longer duration of blooms. They require rich sandy soil and should be protected from excessive rains. There are several effective species, all of them being suited only for high elevations.

*Zephyranthes. (N. O. Amaryllidaceae). Popularly known as Thunder-Flower or Zephyr-Flower or Flower-of-the-west-wind. Hardy deciduous dwarf bulbous plants, 4 to 6 inches high, with fine shining grass-like leaves and beautiful lily-like flowers, produced one on a scape. Wind flowers do exceedingly well in well drained sunny beds, borders or rockeries and patches of them on lawns have a cheerful effect. They are useful for edging walks and paths and flower beds. They burst suddenly into bloom nearly three or four times a year, soon after rains succeeding a spell of drought. If left undisturbed where they are, they bloom freely and in masses. When planting, put the bulbs 4 inches apart and 3 inches deep in the soil. In course of time, offsets crowd round the old bulbs and fill up the entire length. There are several species, with white, pink, rose or yellow flowers. Hybrids of Zephyranthes with Cooperia (the white evening "Crocus") introduced by Mr. Percy Lancaster and called Cooperanthes are more floriferous and exhibit greater variety of shades of colour than Zephyranthes. The following species of Zephyranthes are particularly worth noting:

Z. Atamasco.—Flowers nearly three inches long and pure white. Scape 6 to 12 inches high. An uncommon very large flowered species.
Z. Andersonii.—Yellow flowered, flushed on the outside with red tint.
Z. sulphurea.—Bright yellow flowered.
Z. candida.—Pure white.
Z. rosea and Z. robusta are rose and pink coloured.
Z. carinata is a large rose flowered kind.

(B) BULBOUS FOLIAGE PLANTS

*Caladium. (N. O. Aroidae). Large genus of cormous aroids of South American origin, grown for the richness of colour and beauty of foliage. Caladiums are very popular plants grown for decorating verandahs, dwelling rooms, corridors and conservatories or plant-houses. They are usually grown in pots but they would grow, quite as well, in the ground. It is impossible to describe the varied hues of the leaves which are strikingly ornamental. They are broadly arrow-shaped, peltate, are of a membranous texture and vary in size from a few inches to a couple of feet. Colours vary from pure white to deep crimson, purple, bronze and pink and the leaves are conspicuously blotched and splashed with distinct colours, in many kinds. Most of the species of Caladiums are deciduous, beginning growth in April or May and dying down for rest in October or November at medium elevations. October to February or March is their period of growth at Madras. Soil for Caladiums should be light, open and rich. It may be made up of equal parts of loam, sand, leaf-mould and well decomposed manure. Drainage should be perfect. Some charcoal pieces added to the compost will keep it sweet. A little addition of lime will augment the colour of the foliage. Start the dormant bulb (corm) by keeping it in sand kept moist for about a week. It begins to sprout naturally in March. Put one large bulb into a 5-inch pot and then shift to 9-inch pot; or two or three small ones into a 9-inch pot. Plants remain compact and in better color in limited than in considerable bulk of soil. Do not cover the crowns of the corms with soil. Water very sparingly till the leaf-sheath is about three inches high. Then, gradually increase the supply of water with corresponding growth of the plant. Remove the flower, which
appears usually before the leaves, as it will take away the strength of the coming leaves. Stake plants when they are sufficiently large. Give them a sheltered situation, where they are not exposed to severe direct rays of the sun, but do get a lot of light. In too shady situations, colours are not properly developed. Supply weak liquid manure (cow-dung water) once a week. The foliage loses its brightness about the middle of September; then onwards, lessen the supply of water gradually and stop it, when the leaves completely die back. Turn down the pots and when the soil is completely dry, take out the bulbs for storing or store with the pot in a dry cool place.

The following two species are valuable as edging plants:

C. argyrites. (Syn. C. Humboldtii) is a dwarf type, about half a foot high; leaves are small, green and white. Suited for edgings and ribbon borders.

C. bicolor grows about a foot high. Leaves are bright pink with green borders and are showy. Suitable for edging.

Calathea.—See under Maranta.

Colocasia. (N. O. Aroidae). Plants allied to Alocasias and Caladiums and grown similarly. C. gigantea and C. antiquorum are two large growing species, which are usually cultivated. C. antiquorum variety esculenta produces large leaves and tubers which are edible and are used as vegetable.

Heliconia. (N. O. Musaceae). Foliage plants allied to Muss or Plantain with large striking leaves, coloured and beautifully marked in several species. They are grown in large pots like Canna and are useful for decoration of ferneries and for growing in beds in shade gardens. They should be shaded from direct sunshine, watered liberally while in vigorous growth, and somewhat sparingly between November and April, when they take a sort of rest, without losing their foliage. Most of the species do not flower. Flower stalks of the species that flower should be removed. Propagate by division of rhizomes as in Canna. Start the pieces of roots in small pots and then transfer the plants to bigger pots. Use 16 inch pots for final potting, in which the plants make quite a good show. Following are a few of the more ornamental species.

*H. aureo striata (Golden striped). 3 to 5 feet; large hand-
some broad leaves, striated with yellowish parallel transverse lines; stem is striated with yellow and green; a noble plant.

*H. illustris* 3 to 5 feet; leaves, large, coppery, striated with bright pink lines.

*H. insignis* grows 3 to 5 feet. Leaves, bright bronzy green, long, narrow and wavy.

*H. rubra* is a very desirable species growing 3 to 5 feet, with large leaves, brown and bronze.

Heliconias are at their best in the rainy season.

*Maranta.* (N. O. Marantaceae). Marantas and Calatheas are closely allied tropical plants, mostly natives of Brazil, cultivated for their highly ornamental foliage, the leaves being variously marked with shades of green, red, brown, yellow and white. They are rhizomatous plants with creeping underground stems. Some species are deciduous during the period of rest and some are evergreen. In horticulture, Calatheas and Maranthas are confused with each other and they are treated alike, and all of them are known only as Marantas. All are easily grown in conservatories in shade. Protection from strong sunshine is very essential, as it will destroy the foliage making it unsightly. Maranthas are moisture loving plants but stagnation of water at the roots should be particularly avoided by providing efficient drainage of the soil. Syringing with clear water keeps off insect pests and it is further useful to preserve around the plants a humid atmosphere, which the plants need. Artificial manures should not be used. Soil best suited for growing Maranthas is one which contains equal parts of sand, loam, leaf-mould, well rotten manure and some peat. Maranthas are propagated by division of rhizomes. In February—March, the plants are taken out of the pots, the roots are washed free of soil, best healthy portions are selected, and a number of pieces containing roots and buds of their own are cut clean and potted in the soil recommended above. They may be started in small pots and shifted to larger pots according to the size of clumps formed. The following are noteworthy species:—

* C. Leitzii, 1½ feet high; *C. Lindenii*, 2—3 feet high; *C. Sanderiana*, 1 foot high; *C. medio-picta*, 1½ feet high; *C. tigrina*, similar to *C. zebrina* but distinct from it; *C. zebrina*, 2 feet
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*Massangeana, about 1 foot high; C. Veitchii, 2 to 3 feet high; C. Makoyana, 1 foot high; and C. cannaeefolia, 1½ feet high.

Rex Begonia.—See under Begonia. Page 387.

*Xanthosoma Lindenii. (N. O. Aroideae). Also known as Phyllotaenium Lindenii. A very fine looking tender foliage plant, resembling an Alocasia, with large arrow-shaped peltate leaves, brilliantly marked white along the mid-rib, with parallel creamy yellow veins running therefrom. Grown like Alocasia and Anthurium. Propagation like Alocasia. Native of Columbia.

Zingiber Darceyi. (N. O. Zingiberaceae). Variegated ginger. Tuberous rhizomatous plant, 2 feet long, with leaves and stem variegated green and white, like Alpinia vittata. Propagated by division of rhizomes. Growing season is between April and November and the resting season from December to March.
CHAPTER XXVIII

ORCHIDS

There are few flowers which show such diversity in form, size and colouring as orchids. The blooms are of wonderful beauty; they are often gorgeously coloured, and peculiarly and fantastically shaped, mimicking forms of birds, spiders, scorpions, moths, butterflies and several other insects. The flowers are either solitary or are borne in clusters of spikes, racemes or panicles. In orchids, flowers last very long, as long as three months in some kinds.

Orchids are a very large family of plants, comprising of hundreds of genera and thousands of species and varieties. They are very widely distributed in several parts of the tropical zone, especially in the forests of India, Java, Sumatra, Borneo, Straits Settlements, South America, Mexico, West Indies, and South Africa. Several beautiful species are found there, growing in the crevices of rocks upon moss grown spots or upon the branches and trunks of trees, in places where humidity and shade abound, and bursting into bloom, just about the time of the monsoon, in the months of June and July and also in September and October.

About a century and a half ago, only very few species of orchids were known to European horticulturists. It was the proud privilege of the rich only to possess them. The lovely flowers naturally awakened the interest of all plant lovers who spared not trouble and expense in collecting several beautiful specimens from their native homes. Societies were formed to send out collectors to distant lands. Though collections were made in this way, successful cultural knowledge of orchids was only very gradually acquired, with the increasing knowledge of the several species and conditions of their growth in their native environments. In the latter half of the 19th century, several hybrids were raised successfully by a careful study of the peculiarities of the flowers and the arrangement of their
different parts. On account of the patient and strenuous efforts of specialists at hybridization, several lovely species and varieties now find a place in our gardens, at comparatively little cost.

A typical flower of an orchid has a perianth arranged in two whorls. The three sepals of the outer whorl are more or less alike and coloured like petals. The inner whorl consists of three petals. Two of these—the lateral ones—are alike, narrow and the other one called the lip or the labellum, is large and broad and more fancifully and better coloured than the lateral petals. The lip is either lobed or spurred or it assumes wonderfully quaint and beautiful shapes such as a pouch or a slipper or a butterfly poised over a plant and the like. The beauty of the flower and its peculiarity much depend on the lip which acts as a convenient landing place for the insects which are attracted to it by its colour, in search of honey. The stamens and pistils of orchids are united into a column opposite the lip. The parts of the flower are so placed that self pollination and consequent weakening of the offspring is avoided. Though the study of fertilization of orchids is very interesting, amateurs do not attempt raising new kinds as it takes some years before flowers can be obtained from seed.

The structure of an orchid plant has an intimate bearing on the natural conditions which obtain in their native homes. As most orchids grow on branches of trees or on rocks, where after the rainy season, they are exposed to long periods of drought during which they get no food or water, they develop, what are known as pseudo-bulbs, and thick leathery leaves in both of which they store, like bulbous plants in bulbs, starch, food and water as reserve supplies to sustain them during the period of drought. Further, they send out long aerial shoots which not only enable them to cling to trees and but also help them to absorb moisture from the air and food from the dust that collects around the roots or is washed down to them during rains.

Orchids can be generally classified to fall under any one of the following heads:—(1) Terrestrial or Ground orchids, which grow more or less in soil and have their roots imbedded in it, from which they absorb the nourishment necessary for their
The great majority of orchids from the temperate zone are terrestrial. (2) Epiphytic orchids, which grow upon the branches of trees, having their roots exposed to air, from which they imbibe all the nourishment requisite for their growth. These, though they cling to trees and grow on them, are not parasitic, as they do not get their nourishment from them. A great number of epiphytic orchids are from tropical zones. (3) An intermediate class of semi-terrestrial orchids like the tenantheras which, besides sending roots to the ground and deriving partial nourishment therefrom, also develop aerial and adventitious roots, with which they cling to trees for support and get their chief nourishment by absorbing moisture and food from the air, and (4) Saprophytic orchids which live on dead matter. These are very rare.

In order to succeed in the cultivation of orchids, one should try to place them in conditions similar to those obtaining in their native homes. As they come from countries varying considerably in soil, rain-fall, temperature, climatic conditions and altitudes ranging from the sea level to 8,000 feet above it, it is the first business of the orchid grower to find out the native country of each plant and to study the climatic conditions prevailing there and also the habits of the plants. These are ascertained from geographical text-books and standard works on orchid culture. The grower should then try to reproduce these conditions as closely as possible. Those belonging to dry regions fail often, when removed to wet places and vice versa. But, like many other plants, orchids adjust themselves to altered conditions. Most orchids are lovers of shade and abhor direct sun. Some are hardy, however, and grow when exposed to the sun.

In England and such other temperate countries, orchid growers have to build three separate glass houses fitted with hot-water pipes for producing different temperatures and humidity, and for regulation of shade, but in India, except in the hottest and driest parts and on very cold high hill stations, one need not construct special orchid-houses. In most places in India, a fernery or the grass-conservatory covered with creepers and kept cool inside by syringing water on the plants and the round, answers the purpose of an orchid house. But, a glass
house shaded from severe sun would no doubt be more agreeable if one could afford it.

Orchids are grown either on logs or blocks of wood, or attached to trees, or in wooden or wire baskets or in pots, or in ground according to the habit of the kinds in question. Orchid pots are special pots containing a number of holes on the sides for free aeration of the roots which they need.

Terrestrial orchids are, as a rule, cultivated in pots, pans, and hanging baskets, filled with soil composed of knobs of charcoal, bricks broken into small sizes from the size of a pea to a walnut, coarse decayed leaf-mould and fibrous loam and peat. The pot is filled to one third its depth with pieces of brick and well cleaned crocks for drainage. A layer of moss or coconut fibre is placed over the drainage material to preventuperincumbent layer of soil from getting down and blocking the drainage holes. For compost for orchids, see page 113. The plant is put on the compost in the pot and steadied up by building loosely around it, pieces of charcoal and brick and finishing off with dressing of peat and moss. If the plant has pseudo bulbs, care should be taken that they are not immersed in the compost and are placed above it or they rot away and die. In no case, should the crown of the plant be covered over by soil. Hardier kinds may be potted in compost containing sand, red earth, leaf-mould and well rotten cow-manure in equal proportions.

A different treatment has to be adopted with reference to epiphytic kinds. They hardly require any kind of soil. They are best grown on logs of wood such as those of the Mango, with rough bark and free from disease. Sometimes, epiphytic kinds are grown attached to square blocks of teak wood. For attaching the plants to logs or blocks as the case may be the following plan is adopted:—Some moss is placed on the log; the plant is placed over it and roots spread on it; more moss is put on the roots; the plant is kept in position by passing round the log and over the moss strands of thin copper wire or strong thread. The moss is kept moist. The plant sends out aerial roots which cling to the supports in course of time. Epiphytic orchids are also often grown in undersized pots having holes on their sides using the compost mentioned in page 113.
As a general rule, the period soon after the flowering season is the best for potting or repotting orchids. Repotting is undertaken only when necessary. Any plant, which has gone bad and is ailing on account of unsuitable material ought to be repotted at once irrespective of the season. Small pots should be used in proportion to the size of the plants.

True epiphytic orchids require no manure. Chemical manures are most injurious to orchids. Liquid manure prepared from cow-dung or from soot is useful in connection with terrestrial orchids.

Orchids generally pass through three periods every year. They are:—(a) The growing period, which is during the rainy season. They absorb nourishment and keep growing, storing water and food in the pseudo-bulbs. (b) The resting period, which in the majority of orchids, is from November to March. They lie dormant and ripen during this period. (c) The blooming period is when the plants wake up from their slumber burst into bloom, and produce seed for perpetuation of the species.

The resting period of each plant ought to be watched and noted for different treatment. The plants give the best indication when the resting period has come. Those kinds which shed their leaves, show how much rest is necessary. The starting of fresh growth indicates when the growing conditions should be restored. In respect of the very small growing evergreen species, it is much better to ignore the resting season, rather than to lower their vitality by severe drying off.

Care has to be exercised in watering orchids. Meagre watering, without doubt, injures and destroys them; over-watering without regard to the period of rest, etc., is certainly harmful. During the resting period, orchids require little or no water or only so much as is sufficient to keep them alive. As soon as they are repotted or top-dressed with fresh soil they should be sparingly watered for the first few days and the quantity of water is to be increased as more and more growth is made. Plenty of water is given during the period of vigorous growth. The entire material in the pot should be moistened through at each watering, watering being done however, only when the soil is drying up. Light syringing during the day is beneficial.
Cleanliness is very essential in orchid culture. Every material used should be clean. Clean crocks, disease-free logs or blocks of wood, fresh pots and good clear water are necessary. Damaged leaves and those that have turned yellow with age should be cut away clean where they join the stem. Old bulbs should be removed at potting time and if they are likely to be of any use, they may be independently potted. Unhealthy parts should be removed and burnt.

Orchids are gathered and forwarded during their period of rest. Freshly collected plants at mid-resting time are the best for transmitting. As soon as they are received, they are trimmed and the damaged parts are removed. They are then sponged and suspended in a cool place for a few days and then potted in small pots. Orchids having pseudo-bulbs are not watered but are sponged occasionally until growth commences, when they are potted in the usual way. Those, without pseudo-bulbs, may be treated similarly but better results may be obtained by immersing them in water for about five minutes every day.

As a general rule, propagation of orchids, is effected by division of clumps of pseudo-bulbs or stems after flowering. Some are easily increased by dividing them into pieces, not injuring the roots in the process of division and taking care to see that each bit has roots attached to it. The pieces are potted in small pots and do not receive much water till growth commences. Such plants as Renanthera, Aerides and Saccolabium grow easily by cuttings, the only precaution to be observed is that each cutting should have a few aerial roots for its sustenance until it has become established; till then its lower end is kept moist with a binding of moss. The best time for propagation is just before the plants begin to grow, that is, in the month of February or so. Propagation from seed is quite possible but it is seldom resorted to by amateurs as it is difficult and takes long—some years, before one can get plants to bear flowers.

Orchids are attacked by thrips, red spider, slugs, snails, wood-lice, cockroaches, mealy bugs, scale insects, etc. Fumigation and sponging with insecticides are resorted to eradicate pests. Diseased plants should be segregated from healthy plants and they are better destroyed if suffering badly.
For cultivation in the plains and elevations up to 1,500 feet, among the epiphytic orchids may be selected, Vanda, Aerides, hardy species of Dendrobium, hardy kinds of Renanthera, and Saccochabium. Among the terrestrial orchids, the following may be selected: Spathoglottis, Phais, Thunia and Cypripedium.

SELECT ORCHIDS

Aerides.—The name Aerides is derived from a Greek word meaning, air plant. True epiphytes with pleasing evergreen foliage and leafy stems without pseudo-bulbs. Natives of India, Malaya Archipelago, and other nearer parts. Flowers are borne in dense arching spikes of rose-purple, blush-pink, buff, or white and purple. In some species, they are fragrant. As the stem is evergreen and as there are no pseudo-bulbs storing nutrition, the plants should be watered with care whenever needed, without allowing them to get dry. The roots are mostly aerial and hence, the plants require very little potting material—only just enough to anchor the plants in the pots. Most kinds are suitable for growing in baskets. Roots should not be injured in any way at any time. The following species are noteworthy:

* A. odoratum with leaves 6 to 8 inches long by about 2 inches broad and racemes of flowers longer than leaves. Flowers are very fragrant, being lemon scented, are white, tipped with pink or magenta. Native of Assam.

A. affine bears long spikes of rose coloured flowers.

A. crispum is a native of South India. Flowers, white, suffused with purplish rose, nearly 2 inches in diameter. Racemes are many flowered and last long.

A. multiflorum bears rose coloured flowers on branches sometimes 2 feet in length.

Bletia.—Terrestrial orchids with leafy stems arising from the apex of pseudo-bulbs and bearing blooms on lateral leafless stems. Blooms are purplish or white and are borne freely in erect terminal erect spikes in well established plants. They should be kept fairly dry during winter, when plants are at rest. Repotting is done in fresh material when growth begins in February—March.

B. verecunda and others.

Calanthe.—Calanthe, from Greek word, meaning most beautiful flower, are mostly terrestrial and some are sub-epiphytal orchids, indigenous to Burma, which are easy growing and can be cultivated in pots. They are special favourites of amateurs as they produce abundance of showy flowers, lasting a long time in perfection and as they are very easily managed. Most of the species are deciduous and have broad plaited leaves and bear erect many flowered scapes, shedding the leaves about the flowering season in late summer. Water sparingly during rest and till flowers are cut. Pot each year in fresh compost, taking care to secure efficient drainage. With Calanthe, it is necessary to depart from the usual style of potting orchids; instead of elevating them above the rim of the pots upon a cone of peat and moss, they are kept below the rim, as in potting any other ordinary kinds of plants. Liquid manure may be applied occasionally when the plant is vigorously growing. Propagation is by separation of bulbs.

C. veratrifolia; a native of Malaya and moist districts in Northern India; is an evergreen, with broad many-ribbed wavy leaves about 2 feet long, produced from creeping rhizomatous roots. Flowers are white and are freely borne in dense corymbose racemes, 2—3 feet long, in June—July. Being an evergreen, should be kept fairly moist all the year round.

C. vestita with its varieties is a very popular orchid, with long leaves, 2 feet long, bearing numerous whitish flowers, nearly 3 inches across, in racemes. The species is deciduous, needing a fairly dry resting season. Native of Burma and Malaya.

C. Masuc is a native of North India. Flowers are deep violet, fading to lilac, and are borne in late summer.

Cattleya.—Very beautiful flowering evergreen epiphytic genus. Most species are natives of Central and South America, especially Brazil. Flowers are borne singly or in clusters, usually at the apex of the pseudo-bulbs and rarely on leafy stem.
arising from the base of the pseudo-bulb. Flowers are very showy and often measure 5 to 6 inches across from tip to tip of the petals. They also keep long, as many as 10 to 12 weeks. Propagation is very slow and it is accomplished only by cutting the rhizome between the bulbs, leaving the parts where they are until new growths and roots are made.

*C. labiata* is a native of Brazil. Its flowers measure 7 to 8 inches broad and 9 to 10 inches deep; the sepals and petals are pale rose, and the lip is large and broad, of a rich deep purple or violet in front, and having a large, yellow eye-like blotch on each side of the throat.

*C. Gaskelliana*; *C. gigas*; *C. Skinnerii*; *C. Mendellii*; *C. citrina*; *C. Bourgingiana*; *C. Eldorado*; *C. Warscewiczii* and others.

Coelogyne.—Genus of pseudo-bulbous epiphytic orchids, free flowering and easy of culture. Flowers are borne in loose racemes springing from the bases of pseudo-bulbs. Their habitat is Nepal, Burma, India, Malaya and China, often at high elevations. They are best grown in pots; increased by division directly after flowering period; repotted also at the same time. Coelogynes have a distinct dry resting season and they require an abundant supply of water during growth.

*C. cristata* is a native of Nepal, bearing long 5 to 9 flowered drooping racemes. Flowers are 4 inches across, have white sepals and petals, with beautiful yellow and orange stains on the lips.

*C. flaccida* is a native of Nepal; an erect free flowering variety of great beauty. Racemes are many-flowered, long and pendulous. Flowers are scented, sepals and petals are pure white, with lips stained with pale yellow and crimson.

*C. Dayana* has small leaves and tall habit and bears lemon-yellow flowers.

*C. odoratissima* is a native of the Nilgiri Hills and Ceylon, bearing slender racemes of white flowers, with lips stained with yellow in the centre. Very sweet-scented flowers.

*C. asperata* is from Borneo, having long pseudo-bulbs, and bearing long drooping racemes of fragrant creamy-white flowers with brown streaks.
C. *mysoresis* is another handsome species.

**Cymbidium.**—Cymbidiums are intermediate in character between true epiphytes and terrestrial orchids, growing in nature in clefts in trees and in such places where there is an accumulation of dead leaves. They should be grown in soil, containing rough loam, broken bark, dead leaves and broken pots in equal parts. Most of them are plants of large size with narrow elongated more or less arching leaves and bearing flowers in erect or arching, occasionally pendulous racemes. There are a number of species bearing decorative blooms in long spikes, often 2 feet in length. Native of Burma, Ceylon, Malay Archipelago, India and China.

*C. bicolor* is an epiphyte with drooping spikes, many-flowered. Flowers are creamy-yellow, stained with splashes of purple.

*C. giganteum* is a native of Nepal, with dull purple flowers, striped with purple.

*C. Lowianum*; *C. aloifolium* and others.

**Cypripedium.**—An interesting large genus of hardy terrestrial plants, with labellum forming an inflated pouch, resembling a lady’s slipper. Hence, called popularly, Lady’s Slipper or Venus’ Slipper. Plants are herbaceous and have no pseudobulbs. They have fairly thick roots requiring plenty of pot room. Hence they should not lack moisture. They do not want to be elevated above the rim of the pots but should be inserted in the same manner as ordinary plants. Propagation is usually by division. Seeds germinate freely.

*C. concolor* is a native of Burma with handsome variegated leaves and large pale yellow flowers.

*C. venustum*; *C. Fairianum*; *C. Spicerianum*; *C. niveum*; *C. insigne* and *C. bellatulum* are a few others.

**Dendrobium.**—One of the largest and most decorative genus of orchids, comprising of several hundreds of species and hybrids and varieties. All are epiphytic and are from many places as India, Ceylon, Australia, New Zealand, Japan, Pacific Islands and Malay Archipelago. Pseudo-bulbs are tufted or arise from creeping stems at intervals. There are two sections, the evergreen and the deciduous; the former should never be
allowed to become dry at the roots at any time and the latter need a resting period, which is easily determined by finishing of growth about November and the swelling of buds about February for flowering. The pseudo-bulbs, after they have flowered, may be removed as they are not of any use to the plant. Flowers are in the majority of species very showy and are produced in long and lax, or short and dense racemes of a drooping habit. Hence, several Dendrobiums may be grown in hanging baskets with advantage. They can be also grown in perforated pots. Some do well attached to trees with a little moss or coconut fibre. The following are a few noteworthy species:

D. calceolaria; Flowers, large, pale yellow, produced 12 or more together on a raceme; throat is brownish crimson. Large robust growing species, native of India.

D. Dalhousianum has stems four to five feet high. Flowers, large, yellow and rose, in racemes. An evergreen species, native of Burma and India.

* D. densiflorum is also an evergreen species, native of India and Sikkim. Flowers are profusely borne in dense drooping panicles, are yellow with orange lip.

* D. dracaenoides; flowers white, with a reddish lip, produced in bunches of six or more.

D. Fairmani; upright, evergreen species, about a foot high, from India and Burma. Flowers have the sepals and petals pale yellow tipped with pink, and the disc of the lip, golden yellow. A beautiful species producing large long pendulous racemes like the densiflorum but with flowers not so closely set together.

* D. fimbriatum, native of Assam. A showy evergreen species, bearing large handsome trusses of bloom. Flowers, about two inches across and of a deep orange yellow colour. Variety oculatum is similar to the above but has a blood-coloured spot on the base of the lip.

D. Macarthiæ is a native of Ceylon, requiring a hot and moist climate. Stems are slender and 2 to 2½ feet high. Flowers are rose-pink, nearly 3 inches long, produced in drooping racemes, containing 3 to 5 blooms.
D. moschatum (musk-scented) is an evergreen species, from East India, with large flowers, creamy-white tinged with rose, borne in racemes of 8 to 14 flowers. Flowers are large, over two inches across, with lip, slipper-shaped, pale yellow, with base darker coloured and ornamented on sides by large eye-like blotches of deep blackish purple.

*D. nobile* is an indigenous lovely plant while in bloom. A beautiful easily grown species, very attractive grown in large pots as specimens. Flowers are freely produced, large, nearly two inches across, white and deeply tinged with violet with two club-formed deep purple spots on the base of the lip.

*D. Parishii*, a deciduous species, bearing flowers, purplish-rose fading into white towards the centre.

*D. Pierardii* is a native of India, a hardy species, with flowers creamy-white or delicate pink with a primrose lip and produced on long pendulous stems.

*D. regium* is indigenous to India and bears large flowers, 2½ inches wide and purplish blue.

*D. phalaenopsis*, native of New Guinea. A charming variety, with graceful flower-spikes, attractive for several weeks.

*D. thyrsifolium*; *D. wardianum*; *D. superbium*; *D. formosum* are a few others.

**Epidendrum.** Genus of varied plants, not all of them attractive; a few are showy, bearing fragrant flowers.

E. radicans is epiphytic; a native of Mexico, with long and scandent stems and terminal flowers of bright orange-scarlet colour.

**Grammatophyllum.** *G. speciosum* is the Giant Orchid, with stems 6 to 8 feet long. A giant Malayan epiphytic species. Flowers are produced in stout erect racemes, 5 to 7 feet in length, springing from the base of the pseudo-bulbs. Flowers are very large, about 6 inches in diameter, yellow, spotted with deep red-purple. Rather a shy bloomer, difficult to grow.

**Laelia.** A very showy group of plants, including some hybrids of Cattleya, bearing large and attractive flowers, borne singly or in two or many flowered racemes, rising from the top of pseudo-bulbs, which have one or two leaves. All are
epiphytes and closely related to Cattleya and requiring similar cultural treatment.

*L. Cattleya* hybrids are very showy and costly plants. *L. grandis; L. purpurata* and *L. superbiens* are some others.

**Oncidium.** Culture of Oncidiums is simple, if needs of individuals are studied.

*O. luridum* is an epiphyte, native of West Indies, growing one to two feet. Flowers are yellow, blotched with brown.

*O. Papilio* is the famous Butter Fly Orchid, bearing large flowers.

*Peristeria.** *Peristeria elata* is the famous Dove Orchid or the Holy Ghost flower. Native of Panama. Tropical American terrestrial orchid, with pseudo-bulbs, four to five inches long, with strong veined leaves, 2—3 feet long, bearing flowers sweet-scented in tall spikes. Flowers are waxy white, globose with the centre resembling a dove. Grown like Calanthe, but does not require so much rest.

**Phaius.** Phaius are vigorous growing terrestrial orchids, natives of Tropical Asia, Africa, Australia, China, Japan and South Sea Islands. They are large growing with ample foliage and tall clustered stems terminating in racemes of very showy flowers. They delight in well drained fibrous soil, supplied frequently with liquid manure, and they delight in moisture throughout the year. Propagated by division of dormant pseudo-bulbs.

*P. grandifolius* is a noble species. Flowers are 3 to 4 inches across; sepals and petals of brownish colour within and white without; lip, white with dark crimson; brown throat. Spikes are 2 to 4 feet tall and many flowered and well adapted for cutting.

*P. Wallichii* is a native of the Himalayas and Assam. A very excellent terrestrial hardy orchid, with folded lance-shaped leaves about three feet long, with large tall upright spikes of flowers which are long, nearly four inches across, orange-yellow with a brown throat. Protection from afternoon sun and good supply of water while growing are necessary.

*P. Blumei* is a native of Java and Ceylon. Is very much
like P. grandifolius but with light yellow flowers with splashes of red.

**Phalaenopsis.** Very attractive epiphytes, known popularly as Moth Orchids. They have short leafy stems and no pseudo-bulbs. Leaves are few, only a pair or so, thick, leathery and mottled handsomely in some species. Flowers are very showy, resembling moths, and borne loosely in long racemes. In a collection, one or more of the plants will be in bloom throughout the year. Plenty of water at growing time should be given as the leaves are broad and as there are no pseudo-bulbs. They are grown in perforated pots, baskets or on blocks of wood. Provision should be made for sufficient moisture always. Propagation of Phalaenopsis is very difficult, the plants seldom affording an opportunity for division. Sometimes young plants form on old flower stems and these should be left until they emit roots, when they may be removed and potted and carefully watered till they are established. The following are some of the handsomest species:—

**P. amabilis** (Lovely) is a native of Malaya and Java. A very handsome species, with large flowers which are often 5 inches in diameter, pure white, spotted with red. Panicles, very fine and branching. Grown in baskets, made of strips of wood and protected from direct sunlight and watered freely throughout the year, best results are obtained.

**P. javanica** is similar to the above. White flowers.

**P. Schilleriana** is a native of the Phillipines. A very beautiful species with flattened frosted roots and leaves, broadly oval-marked, with transverse bands and blotches of light green on rich green. Flowers, slightly fragrant, rosy mauve with dark purple spots on the lip, arranged in two rows along the spike.

**Renanthera.** Showy epiphytal orchids, natives of Burma and Malaya Archipelago, with long creeping stems and flowers borne in loose long racemes.

**R. coccinea** has stems 6 to 10 feet long and creeping. Flowers are borne in long loose racemes. They are pink, spotted with crimson and very showy and borne in profusion in long succession.

**R. Imshaoodiana** is a compact free growing species with showy crimson-rose flowers. Is like Vanda caerulea in habit.
An epiphytic orchid, *Rynchostylis retusa*. (Page 491)
(By Courtesy of Mrs. L. Narain Rao, M. Sc.)
R. arachnites is the Scorpion orchid.

**Rynchostylis retusa.** Popularly known as Fox-Tail Orchid. Formerly known as Saccolabium guttatum. An epiphyte, with two ranked, stiff, leathery leaves and strong thick roots. Flowers are white, spotted with purple-pink, very showy, clustered closely in dense cylindrical drooping or pendulous racemes. Cultivated like Aerides. Does well in perforated pots in ordinary soil composed of leaf-mould, loam, charcoal bits and a little peat. Makes a good show in hanging baskets. Native of the Western Ghats and of hot moist districts from the Himalayas to Ceylon.

**Saccolabium.** Saccolabiums are epiphytic orchids with erect leafy stems and no pseudo-bulbs, increasing in length by growth at the apex. Leaves are distichous, leathery and fleshy. Flowers are generally small but are borne profusely in large dense clusters, exquisite in colour. Saccolabiums are grown like Aerides, Vanda and Phalaenopsis, in baskets or on blocks or attached to trees. Native of Cochin-China, Borneo, India, Java and Philippines.

*S. giganteum* (*Syn. Vanda densiflora*) is a native of Burma. Flowers are sweetly perfumed and freely produced in long dense drooping racemes, and are white spotted with violet.

*S. Wightianum* is a native of Ceylon bearing light yellow flowers, tinged with red.

*S. Blumei* (*Rhyncostylis retusa*). See under Rhyncostylis.

**Spathoglottis.** Terrestrial orchids, natives of East Indies, South China, Malayan Archipelago, Pacific Islands and Australia. They are very hardy and do well in the plains too and are grown like any other ordinary plants. They bear racemes of flowers on erect scapes and have to be treated like Bletias.

*S. plicata* with pink, white and purple varieties. Flowers produced in spikes, 2 to 3 feet long.

*S. aurea* bears bright yellow flowers.

**Stanhopea.** Remarkable epiphytic genus producing pendulous inflorescence. Native of Tropical America. Grown in wooden basket made of spars, using soil composed of coconut fibre, moss, pieces of bark and a little sand and leaf-mould. Moist atmosphere and plenty of water during growth are neces-
The spikes of flowers are often showy and scented but are shortlived. They are peculiarly produced emerging from the bottom of the basket.

S. eburnea bears ivory-white fragrant flowers.

S. tigrina bears flowers of red blotched with yellow.

S. grandiflora bears flowers, orange, crimson and yellow.

**Thunia.** Thunias are terrestrials but supposed to be epiphytic in nature in some places. There are about 6 species and they are natives of N. India, Burma and South Himalaya region up to a height of about 6,000’ feet. Thunias have tall growing bamboo-like stems bearing clusters of flowers at the top. Growth starts about February; then, the plants are given new material consisting of fibrous peat, sphagnum mixed with loam and sand and pots herds and bits of cocoanut fibre. They are put in comparatively undersized pots, setting them rather high in the pots. Watering is done sparingly till growth starts. When shoots make headway, watering is done liberally and weak liquid manure is supplied while growth is rapid and vigorous. Flowers are produced about the month of August and after flowers are over, the leaves fall off and the plants need rest. During the resting season, just so much water is supplied as is enough to keep the plants alive; the old stems act as reservoirs of food for new growths next year and do not bear leaves again although they may remain for a year or two more, unless they are cut away. Thunias are propagated by cuttings of the old stems, about 6 inches in length, and inserted in sand or sphagnum moss. Thunias were formerly confused with Phaius.

*Thunia alba* grows 2 to 3 feet high, with sheathing leaves about 6 inches long, and bears drooping racemes which are 6 to 12 flowered, at the ends of the stems. Flowers are white, with the labellum veined with purple and nearly three inches across.

*T. Marshalliana* is allied to the preceding species.

**Vanda.** One of the most attractive groups of orchids, natives of East India and Malaya Archipelago. They are graceful in growth and flower. All are epiphytic and can be grown attached to trees, blocks of wood or in hanging baskets. They
are treated like Aerides. Following are some handsome and usually grown species:

*Vanda caerulea* is one of the loveliest orchids, with very attractive large flowers, sometimes 5 inches across. They are blue in colour and are borne in large sprays of ten or more flowers. Native of Khasya Hills.

*V. Roxburghii* has stems 1 to 2 feet long and bears erect racemes containing 6 to 8 flowers, which are pale buff or grey with chocolate spots and blue lips. Native of Bengal.

*V. teres* has long and straggling stem and bears rose-magenta and orange-yellow flowers in small racemes. Native of India and Burma.

*V. Hookeriana* with cylindrical stem and crimson-purple and orange flowers.

*V. tricolor* is from Java; flowers are scented, yellow with brown spots.
CHAPTER XXIX

WATER GARDEN

Those, who have in their grounds a small lake or a pond of natural formation, can convert it with the small area around it into a beautiful water garden. There are several aquatic hardy plants which can be very easily cultivated. They do better in fairly still water of 1½ to 3 feet depth than in deep waters. If the pond is deeper, the margins only could be occupied by the plants. Whereas, in the pond itself, such beautiful plants as Nymphaeas and Nelumbiums could be grown, the edges of the pond could be hidden over and clothed with plants such as Myosotis palustris, Calla palustris, Veronica palustris, which, firmly rooting themselves in the soil on the margin, spread out over the surface of the water; beyond the margins of the pond, in the soil which is saturated with moisture and which at times may be periodically submerged under water, such water-loving plants as grasses, rushes, sedges, ferns could be grown. Attractive varieties of Bamboos and Pandanus may form an effective background to the smaller plants in the foreground. Thus, the water garden can be made an enjoyable feature in gardening.

If there is no pond of natural formation as referred to above, a low lying piece of ground might be conveniently selected and a pond constructed there on cement foundation and water may be directed into it from a neighbouring stream or conveyed to it through pipes. What is most essential is a continuous supply of water throughout the year. The supply may be small but it should be steady and un-failing. The bottom of the pond is filled with rich clayey soil to a depth of about 9 inches. Balls of cow-dung, wrapped up and bound in straw thrown into the pond here and there, keep the soil fairly rich. The bottom of the pond should be two feet deep at the deepest point and it should gradually slope up to the edges.

The situation of the pond is a matter of great importance.
It should be in as sunny a situation as possible. It should be adequately sheltered from wind or the plants would suffer by being blown over and they would get mixed up. Much of their beauty would be lost if they are not kept separate.

The pond should be preserved as clean as possible. Once a year, the water should be drained away, the soil removed, and the bed of the pond refilled with fresh soil. The plants which overcrowd should then be lifted, thinned out, and replaced. Voles, water-snails and other water insects are great enemies of water plants and they are kept down by having gold and other fish in the pond.

The best time for planting aquatic plants is about the beginning of the monsoon and the best method of planting them is to put them in suitable soil in shallow baskets and lower these down gently into the pond in desired situations weighting them down by stones tied to them. The baskets rest in the soil of the pond and the roots of the plants grow through the sides and bottom of the basket and ramble at will. Water plants are raised from seed which are sown in soil in shallow baskets, which are immersed in shallow water as described above. Some kinds are however propagated by division of the roots.

The Natural Order Nymphaeae supplies some very ornamental plants suited for growing in ponds in small gardens. They are propagated by division of roots and some of them are raised from seed, which are sown in baskets or saucers and grown as described above. Nymphaeas, as a class, are very ornamental. *Nymphaea caerulea* is a small and very desirable plant, producing beautiful many-petaled flowers, which are blue with a yellow centre and which emit a most delightful fragrance; *N. lotus* has large floating leaves and bears rose or pale pink flowers. *N. stellata* and *N. edulis* are white lilies. *Nelumbium speciosum*, known popularly as the Sacred Lotus is a very beautiful plant when in blossom with large round peltate leaves with very large double rose coloured or white handsome flowers, produced in the hot season. *Victoria regia* produces magnificent blooms, measuring nearly a foot in diameter, in the cold season. Blooms are cream or pink in colour. The leaves are nearly 3 to 5 feet in diameter and lie flat on the water. This
is a remarkable plant suited for large ponds. It is raised by seeds every two years as the plant generally does not thrive for more than two or three years. To the same Natural Order, belongs *Euryale ferox*, which is raised from seed and is remarkable with its curious leaves which have upright spines. Flowers are small and blue in colour and are of no interest.

Aquatics of less merit than the above are the following:

Aponogeton monostachyum and *A. distachyon* (N. O. Naidaceae) are pond weeds with blue or white flowers. *Myriophyllum* (N. O. Haloragaceae) are aquatic herbs, growing in still waters and having floating feathery leaves. *Limnantheum indicum* (N. O. Gentianaceae), popularly known as “Water Snow Flake” is a weed with Nymphaea-like leaves and small white flowers. *Pistia* (N. O. Araceae), known as the “Water Lettuce” is a floating small stemless plant, propagated by offsets.

The following are suited for growing very near the margin of the pond, in the soil saturated with moisture:

*Cyperus papyrus* (N. O. Cyperaceae) grows 8 to 10 feet high, with large handsome brush-like leaves; *Cyperus alternifolius* grows 2 to 3 feet high, with leaves diverging in a whorl (see page 305); *Typha elephantina* (N. O. Typhaceae), popularly known as the “Elephant Grass,” is a very large grass with small flowers gathered into brownish spikes at the ends of long stalks and *T. angustifolia* (Bull rush) grows 4 to 5 feet tall with erect ribbonlike leaves; *Acorus calamus* (Sweet Flag) and *Acorus sittirus* are both aroids with erect leaves and aromatic roots. Some hardy Ferns, Pandanus in varieties, some such Palms as Rhapis, some of the Ornamental Grasses mentioned in Chapter XXIV can also be grown by the margin or the sloping bund of the pond.

*Cyclanthus* and *Carludovicas*, Areca lutescens, *Cyperus*, *Corypha umbraculifera* (Taliput-palm), *Rhapis flabelliformis* and some *Alocasias* can be grown in tubs kept in the midst of the pond.
Collection of Vegetables exhibited in the Horticultural Show at Bangalore.
CHAPTER XXX

THE KITCHEN GARDEN

Selection of site, lay out etc., Select a well drained plot of ground, open but sheltered against winds, free from the shade and roots of large trees. Let it be located at the back of the bungalow or house or in the orchard when the trees are still young. Screen it from the ornamental part of the garden with a tall hedge. Slope the ground gently from the well to the finishing end and divide it into convenient square or rectangular beds, say 25 to 40 feet across by laying permanent paths. Subdivide these beds into smaller beds, about 4 feet across, by narrow paths, to facilitate weeding etc., without trampling. Arrange the water channel and its distributaries in such a manner that the water flows gently in them without erosion of the land. To save water which percolates through the soil under the channels while irrigating, build the channel and its branches in brick and mortar or embed semicircular tiles in them throughout, cemented on to each other.

Improvement of soil. One has got to take the soil as it is, and improve it in the ways suggested in Chapter III. Rich well drained friable loamy soil is the best for growing vegetables. It should be free from alkaline salts as sodium chloride and sodium carbonate and the water too should be free from them. Sandy loam is best suited for raising root crops. Light soils produce early, and heavy soils, late crops. Cultivation to a depth of about two feet would do for most kinds of vegetables.

Rotation of crops. To get the best results, never grow the same kinds of crops, such for instance as cabbage and cauliflower, in the same plot, following each other. Every kind of plant requires certain food elements which it takes from the soil, leaving it poorer in those elements. Rotation of crops is therefore beneficial in retaining the fertility of the land. Further, each kind of crop leaves a toxin in the soil which affects the growing of that crop, if repeated without rotation. Rotation
also helps to keep down insect pests and diseases to which particular plants are subject as they would be 'starved' by an intervening crop on which they do not feed. Alternation of crops has also a wholesome effect on the mechanical condition of the soil, some kinds of plants being more deep-rooted than others and requiring deeper preparation of the land than others. Rotation will depend upon the kind of plants grown. Plants which are deep-rooted as the carrot, beet, and radish should alternate with shallow-rooted kinds as the bean, pea, cabbage and the lettuce. The following rotation is recommended for home gardens:—Cabbage, lettuce, cauliflower, leek may be followed by root-crops as radish, carrot, beet. Peas and beans may succeed the latter with advantage, as they add nitrogen to the soil. (See pages 16 and 32). Potato may be grown to succeed any crop. Fallowing. Land in which vegetables are grown should be fallowed, that is, kept vacant, for a few months in the year, as continuous cropping exhausts the soil. The time to fallow land is the summer in dry and hot countries. The ground should be worked deep and all lumps of earth left unbroken. Exposure of soil to the air has a very desirable effect in sweetening it, in helping it to maintain a stock of nitrogen, and in making the fertilizing constituents of the soil available to the plants grown in the next season. Constant ploughing and fallowing are useful also in exposing the pupae of insect pests to the heat of the sun by which they get killed or picked by insectivorous birds as minas, crows, etc. Spores of fungus pests and other organisms inimical to nitrogen fixing bacteria are also killed.

European and Country Vegetables. Vegetables can be grouped to fall under two heads:—(A) The European or the temperate and subtropical vegetables and (B) the Country or the tropical vegetables. The former do best in the cool moist climate of the hill stations and are generally suited for elevations of above 3,000 feet, though some of them may be grown with a certain degree of success at low elevations including sea-level in the cold season. Hence, they are also known as Cold season vegetables. The latter are best suited for low and intermediate elevations and are grown in the hot and rainy seasons.
in the plains and hence they are known also as Summer season vegetables.

In the plains, extremes of hot and wet weather prevent the growth of vegetables, as a result of which they have to depend for their supply from higher regions having temperate climate and moderate rainfall. To get over the scarcity of vegetable diet, drying of vegetables is adopted. In Western countries, vegetables are preserved by canning or brining.

**Time for sowing.** The cold season vegetables are sown from August to December in the plains and February to June on the hills. The time for sowing hot season vegetables is from January to April in the plains and intermediate elevations. Such of those varieties and kinds of European vegetables which take a long time to mature should be sown sufficiently early in the season. In places where the winter or the cold season is very short, only early maturing varieties should be grown, as for instance, the short horn or the globe varieties of root crops as carrot in preference to the long rooted-kinds. To save disappointment, seeds should be obtained in time from reliable firms and sown in small quantities at intervals of a few days. No sowing should be done when the soil is wet or saturated with moisture. It should be postponed till it gets moderately dry—when a handful of it would crumble into powder, when pressed in the hand and released. Peas, Beans and such other seeds would rot away, if rain sets in for two or three days continuously after sowing.

**Imported and acclimatised seeds.** Cold season vegetables are best raised from imported seeds. Most of them deteriorate by acclimatization and several of them do not seed at all in this country. Of those that may be acclimatized successfully are the bean, pea, lettuce, onion, radish, cress, tomato, Indian corn, etc. Acclimatised seeds of cauliflower are also reported to give very satisfactory results at low elevations. Country vegetables can all be raised from local seeds.

**Mode of sowing.** Refer to pages 56-62, for instructions regarding sowing of seeds and care of seedlings. Some kinds are sown in seed-pans or boxes or in nursery beds, the seedlings are transplanted once or twice, before they are permanently
planted out. Some are sown directly in places where they are to grow, either in filled-up pits or in prepared beds, in rows. Some are grown with suitable stakes as supports when they need them and some without them and some are grown over pandals or trellis. The particular methods of cultivation adapted to different kinds of vegetables are indicated in the following notes on individual plants.

**Manuring.** For suggestions on manuring, refer to Chapter IV generally. Cattle manure in a well decomposed state may be used for growing vegetables. Horse manure may be used with greater benefit in connection with clayey soils. Oil-cakes give very good results. So also small doses of night-soil manure allowed to decompose in a pit for a year with alternate layers of earth. In advanced countries, sewage either in crude state or after decomposition in septic tanks is used as manure. No harm can arise by its use. Unfortunately, it is wasted in many of our cities. In conjunction with organic manure, the following mixture of artificial manure may be found beneficial for growing vegetables for exhibition. Make a mixture in the proportion of 1 lb. of super-phosphate, 1½ lbs. of ammonium sulphate, and ¼ lb. of potassium sulphate. For making liquid manure, 1 lb. of this mixture should be dissolved in 10 gallons of water. About 4 hundred-weights of this mixture may be used for an acre of land. Manuring should be done intelligently according to the needs of the particular plants. Vegetable crops as cabbage, lettuce, etc., which are grown for their leaf should have a liberal supply of nitrogenous manure. Potash is useful for root crops, phosphorus for flower and pod producing crops. Root crops can manage with the residual effect of manuring for a previous shallow rooted crop. Too much feeding would result however in coarse crops, especially those of roots, and in rotting and splitting, as in cabbage and knol-kohl. Do not feed strongly any vegetable grown for leaf till after about a month after germination when it would be about half grown. Manure root-crops when the roots are just thickening.

**Watering.** Kitchen garden plants should be watered regularly and copiously. Supply by irrigation is more desirable.
than hand-watering. The plants should not receive any check in growth for want of water. In the case of vegetable crops, more harm is done by under-watering than over-watering. For instance, if the soil is not kept moist throughout, even by failure to irrigate once, crops of cabbage and cauliflower fail.

Cultivation. Stir the soil now and then, and thus aerate the roots. Keep down weeds. Attend to operations as earthing up, blanching, staking, thinning, etc., where they may be called for. Earthing up consists in drawing the soil towards the base of the plant, affording shelter to the roots and inducing them to grow better. This is done in the case of the bean, pea, cabbage etc. Blanching is done in the case of such vegetables as celery, leek, endive, lettuce, asparagus etc., to make them tender and to remove the green colouring matter which imparts a certain bitterness to them. Blanching is done either by earthing up, or covering the shoots with leaves or sand, or by covering them with a pot or similar vessel cutting off sunlight to the plant, or by tying up the leaves over the centre of the plant.

Growing Vegetables for Exhibition. Dig a trench 2 feet wide and 3 feet deep. Fill the bottom to a depth of about 6 inches with well rotten manure and the top two feet with rich loam which should be mixed liberally with well decomposed manure. Plant seedlings further apart than the normal in the beds. The roots are attracted by the manure at the bottom and thus a large root system is stimulated. This results in its turn in a good shoot system of the plants. Handsome vigorous plants are produced bearing large sized fruits or pods or leaves as the case may be, fit for exhibition. Supply liquid manure as recommended on pages 42 to 44. Thin the fruits judiciously, keeping a few only on each shoot.

The following are the more important cold season vegetables:—

Artichoke, Globe. (Cynara scolymus). N. O. Compositae. Vern. 'Hatchuk.'

A perennial plant on the Hills, grown as an annual at low elevations. Its globular immature flower heads are delicious when boiled. Sow, plains, July to October, and hills, March to
May, in well raised beds. Seedlings give better results than plants raised from suckers or offsets from old plants. Heavily manured, well drained, sandy loam gives best results. Dig beds 2 feet deep and 2 feet wide and apply cattle manure liberally. When seedlings have formed 4 leaves and are about 5 inches high, plant them 4 feet apart in rows 4 feet apart. Keep the ground free from weeds and stir it now and then, in between the rows. Once a week, feed with liquid manure prepared from cow-dung, when the buds are forming. Ready in 6 to 8 months after sowing. Generally unsuited for elevations below 3,500 feet.

Varieties. Early Purple Globe and Green Globe are good.

**Artichoke, Jerusalem.** (Helianthus tuberosus) N. O. Compositae; Vern. 'Hatchuk.'

Hardy perennial, grown for its tubers. Used like Potato and also for making sauces, flavouring and thickening soups. Thrives best at elevations of 1,000 to 2,500 feet and can be grown up to 4,000 feet. Any good soil will do. Plant tubers, plains, March to May and hills, March, three inches deep, 15 inches apart, in rows 2½ to 3 feet apart. Plants grow 2½ to 4 feet high. Earth up main stems when 9 to 12 inches high. Pick off flowers as they appear. Tubers are ready in 4 to 6 months. Too rich a soil and heavy feeding result more in leafy stems than in good sized tubers. As they do not store well, do not lift them till they are required. An acre may produce about 5 tons of tubers. The acclimatised variety is better than imported ones.

**Asparagus.** (Asparagus officinalis). N. O. Liliaceae. Vern. 'Soot Moolee'; 'Palagras.'

Perennial, grown for its tender delicious culms or shoots. Does not produce quite good results at lower elevations. Sow, February to May in the plains, and June to September on the hills, sow fresh seeds, ½ inch deep, in nursery beds in drills, 1 foot apart. When plants are about 8 inches high, transplant them 15 inches apart, into the middle of well prepared and richly manured beds, which are 2 feet wide and are worked 2 to 2½ feet deep. Soil should be rich, friable, and well drained. Water liberally immediately after planting and repeat the sup-
ply every week. Encourage the plants to throw out as many shoots as possible during the first two years, as then only a good undergrowth of roots is made. Top dress the bed every year during December-January with well decomposed horse manure and a sprinkling of common salt and stir gently with a fork. Give copious watering. In March, new shoots appear. Cut the best of these for use and allow the weak ones to grow. The plants reach their maturity in their 5th or 6th year and last for about 10 more years. Bleach the shoots with sand or light soil and cut them only with a very sharp knife as low down as possible. The blanched shoots will be silvery white in colour. Improper blanching will produce green shoots of bitter taste due to development of chlorophyll. Cut shoots right up to October and again dig in manure in winter, applying \( \frac{1}{4} \) to \( \frac{1}{2} \) lb. of salt for every sq. yd. Repeat this every year.

**Varieties.** Mary Washington is very good. Also Palmetto.

**Beans, Broad.** (Vicia Faba). N. O. Leguminosae. Vern. 'Seem;' 'Seeme Avaraikkai.'

Not well suited for elevations below 3,500 feet. Do well on the hills. There are two types:—(1) The Broad Windsor or the large seeded variety and (2) The Long-pod variety. The former is a failure at low elevations. The latter can be induced to fruit by pinching the tops of the shoots, when the plants begin to flower. This also checks attack from aphides. Work the ground 9 to 12 inches deep. Sow seeds, 4 to 6 inches apart, 2 inches deep, in parallel double drills, 12 inches apart. Allow a space of 3 feet between each pair of double drills. Flood with water. If the soil is dry soak the seeds in warm water for a few hours before sowing to ensure quick germination. When plants are 12 to 15 inches high, earth up round the stems slightly and support them with sticks, if it is windy. Sow, plains, during October-November, and hills, March to May. 1 lb. of seed would sow a row 50 feet long. Ready in 3 months. Dried or green seeds are cooked and eaten. Use soap solution with tobacco water against aphids.

**Beans, French or Kidney.** (Phaseolus vulgaris) N. O. Leguminosae. Vern. 'Seem;' 'Hurulikayi;' 'Kollukai.'

Easy to grow, giving good crops, over the greater part of
the country but difficult to grow during the cold winter months and in the rainy season where rainfall is heavy. Requires some shade in hot places. Any good garden soil will do. Work it to a depth of 9—12 inches and enrich it with well decomposed manure.

There are two types of French Beans:—(1) The Bush or the Dwarf kind and (2) the Climbing or the Runner or the Pole kind. The latter is more prolific and has a longer season of fruiting but is more delicate than the former. In both, there are the green and wax-podded or the golden yellow varieties. The wax-podded varieties are better relished but are usually more delicate to grow than the green podded kinds.

Beans are sensitive to wet and cold. Hence, avoid cold weather and rainy season, and wet soil. In the winter the leaves are attacked by minute red leaf-mining caterpillars, which are difficult to eradicate as they burrow into the leaf tissues between the upper and lower epidermis. Best sown in the plains from August to October, and on the hills from March to July. Sow the dwarf kind, 5 to 6 inches apart, 2 inches deep, in rows 18 inches apart. 1 lb. will sow about 50 feet long row. When plants have grown 6 inches, draw up the earth lightly round the stems. Sow seeds of the Pole kind in double lines 12 inches apart, with a distance of 5 feet between each pair of double rows. Provide stakes, 6 to 8 feet high, for the plants to climb on. Put them on each side of the double lines in a slanting manner, so that they meet at the top. If poles are not available, drive strong stakes at each end of a double row and stretch two wires over them, one about 6 inches from the ground and the other 6 feet above it. Then connect these two by tying cheap thread in between for the vines to run on. Space the strings a foot apart. Dwarf kinds are ready in about 45 days and the tall kinds in about 60 days. Harvest the beans when they are tender and about three fourths ripe. The plants die off soon and will not yield continuously if the pods are allowed to mature.

Varieties, several. Try the following Dwarf kinds:—Bountiful, Burpee’s Stringless Greenpod, and Improved Golden Wax. Pole kinds:—Kentucky Wonder and Golden Cluster Wax.
Bean, Lima. (Phaseolus lunatus.) N. O. Leguminosae.
Sometimes called the Butter or the Double Bean. Seeds and not the pods are used. There are two kinds, the Bush and the Climbing kinds. The former is grown like the Dwarf French Bean, sowing seeds 6 inches apart in drills 2 to 3 feet apart, dropping the seeds eye downwards. Grows about 18 inches high. The long blossom shoots, which look like the vines of the climbing type, should not be disturbed. Grow the climbing variety as the French pole kind. The seeds are farinaceous and have a meaty flavour. The Bush type is about 2 weeks earlier than the Pole kind and is ready in about 80 days after sowing. Spray soap water as remedy against aphid. The leaves and beans contain a poison (hydro-cyanic acid) and live stock should not be fed with them. Thorough boiling, eliminates the poison, and renders the beans a good food product.

Can be grown at all elevations. A good root vegetable for salads etc. Sandy loam is best suited. Dig deep and dig in liberally manure, burying it well under. Sow, plains, August to November, hills, March to May. Sow 1½ inches deep, 3 to 4 inches apart, in drills 15 inches apart. Press down the soil after sowing. Thin out to 9 inches in drills and transplant the plants removed. But, the best roots are formed only when the plants are not disturbed. Pull them out when about 3 inches in diameter. Ready in about 2½ months. 1 oz. will sow a drill about 40 feet long.

Varieties:—Crimson Globe, Egyptian Extra Early Turnip-rooted, Early Yellow Turnip, and Long Black Red.

Brussels Sprouts. (Brassica oleracea gemmifera) N. O. Cruciferae. Vern. ‘Choke Kobe.’
Called by some the Bud Bearing Cabbage. Grown for the buds, which look like tiny Cabbages, borne in the axils of leaves. Thrives to greatest perfection on hill stations. Can be grown with success at medium elevations. Grown like the Cabbage, to which it is allied, and sown about the same time. Ready in 3½ to 4½ months. To get really good sprouts, grow the plants without a check, from the time of sowing to the time
they are of full growth. Sow seeds thinly and transplant seedlings 24 inches apart, after formation of the second leaf, with a ball of earth adhering to the roots. When the plants are about 9 inches high, earth up lightly and firm the soil. Carefully remove the lower leaves, as they mature. This induces regular sprouting. Water liberally. 1 oz. will produce about 1,500 plants. Subject to same pests as the cabbage.


Cabbage. (Brassica oleracea, variety capitata). N. O. Cruciferae. Vern. 'Kabee,' 'Muttai-kos,' 'Kosugedde.'

A very popular English vegetable. Several well marked varieties, differing in size, shape, and colour of the conglomerated leaves, called "heads." The following are the distinct types of Cabbage: — (1) The Conical or Pointed kind is an early one. (2) The Drumhead or flat variety is unequalled by any in flavour, size, and hardiness. It is the chief market variety here, though it is used for feeding cattle in England. (3) The Red variety is used for pickling and in French cookery. It does not stand heat well and should be sown early in the season, and (4) The Savoy variety with its crimpled leaves is generally the most delicious and best for table use. It is also peculiarly better suited to the lower elevations than other kinds.

Cabbages form good heads only about 3,000 feet above the sea. At lower elevations, they may be grown for their leaves, which may be picked for use. Rich sandy loam required. The soil can hardly be too rich for cabbage. Dig in plenty of sheep or goat dung, if available. Decomposed night soil or sewage gives excellent results. Sow, plains, August-September, and hills, March to May. An ounce will give about 1,500 plants. Raise them in well prepared seed beds, sowing seeds not more than ½ inch deep. As soon as they have made their first true leaves, transplant them to well raised beds 6 inches apart, setting them down to the level of the first true leaf. When they have made six leaves, plant them out 15—18 inches apart in rows 2 feet apart. The planting distance should vary with the variety grown, the larger growing Drumhead, requiring to be planted even 3 feet apart each way. Lift the seedlings care-
fully with as much earth attached to the roots as possible, and transplant them as quickly as possible, or they suffer check in growth. Hoe frequently between the rows. Earth up plants when about 9 inches high. Ready in 3½—4 months. Imported cabbage does not seed in India.

Dry weather is responsible for aphis attacks. Spraying water on the plants will greatly help in creating a humid atmosphere round the plant. Rich feeding and washing plants well with soap solution will rid them of these insects. The cabbage leaf-eating green caterpillars should be eradicated before the heads are formed by spraying tobacco and soft soap solution (see pages 137-8), or even with lead arsenate. The leaves should be freely washed after the pest is got rid of to remove the poison from them. Cabbage is sometimes subject to the club-root fungus, which produces large nodules on the roots, as a result of which the leaves turn yellow and the plant dies. An application of lime dug into the ground will disinfect the soil. But, the crop should be changed on the ground.

Varieties:—Cape Early Drumhead, Cape Large Solid Late Drumhead, World Beater, Red Drumhead, Savoy Perfection Drumhead, Cape Early Sugar-loaf.

Carrot. (Daucus carota) N. O. Umbelliferae. Vern. “Gajer.”

Popular vegetable. Sandy loam manured richly for a previous crop is best. Fresh manure brings on ‘forking’ of the roots. Does well at lower elevations as well. Sow, plains, September to November, hills, February to May. Sow thinly an inch deep in drills, 9—12 inches apart. 1 oz. will sow about 60 feet. Germination takes about a fortnight, hence firm the seeds in the soil and keep them free from ants. Thin out, when plants have formed 4 leaves, and again when they grow thick, allowing 7 inches between the plants. Ready in 10 to 15 weeks.

Varieties.—Short Horn Chatenay and Half-long Nantes are suited for low elevations; Improved Long Orange is a long rooted kind. There is an acclimatised North Indian variety but the quality is not quite so good as from imported seed.

Cauliflower. (Brassica oleracea var. botrytis cauliflora).

Belongs to the same family as the Cabbage and is very much grown like it. The part used is the dense flower head. Best suited for places above 3,000 feet. Acclimatised seeds from Northern India are reported to give fairly good results at lower elevations. Sow, plains, in July—August, hills, February—April. 1 oz. produces about 1,000 plants. Handle seedlings with care and transplant them when they form 4 leaves. Plant out when 8 leaves are formed. For planting, make deep holes—do not turn up the tap roots. Earth up when plants are growing. Shade or cover the flower heads with their leaves when they are forming to prevent them from becoming green or brown and bitter. The flowers should be snow-white in colour. Ready in 3½ to 4 months.

Varieties.—Early Snow Ball, Large White Cape and Autumn Giant. Early Patna or Shahranpur is a fairly good variety for lower elevations and the rainy season, but the flower heads are not so compact nor delicious as the imported varieties.


Fair stalks can be produced at lower elevations. Thrives best only from medium to high elevations. Richly manured soil and plenty of moisture are primary essentials for success. Sow, plains, July—August, and hills, February—April. 1 oz. will produce about 2,500 plants. Sow in seed pans, as seeds are small. Germination takes 4 to 6 weeks. When large enough to handle, prick the seedlings 2—3 inches apart, in nursery beds or seed pans. Protect from rain. Dig trenches, north to south, 12 inches deep and 15 inches wide and 4 feet from each other, keeping the soil even on either side. Break up the bottom of the trenches and incorporate with the soil plenty of decayed manure, about 5 inch thickness of it. When plants are about 6 inches high, plant them in the middle of the trenches, setting them 12—15 inches apart. Water liberally. Apply liquid manure once in 10 days, when growing. Cut off the tops of the plants before transplanting, once or twice to insure stocky growth. Also while transplanting, cut off the lower half of the roots. Remove outer stalks and gradually earth up with dry
Chow-Chow grown over a Pergola. (Page 509)
(By Courtesy of the Superintendent, Govt. Gardens, Bangalore)
soil after the plants are 12 inches high. A circle of brown paper or aloe chips put round the stems, while blanching is safest. Do the final blanching 2 weeks before the plants are required, when only the upper portion of the leaves will be visible. Ready in 5 to 6 months.


Robust perennial creeper, grown by planting a whole fruit with a bud in it (germinated fruit), in a pit, 1½ feet deep by 3 feet wide, filled with well manured soil. Lead the vine over supports on to a pandal or an arch or even over a dwarf tree. Thrives at elevations of 1,500 feet and upwards. Requires slight shade at lower elevations. Fruits are pear-shaped, pale green or cream coloured,—there being two varieties. Used like vegetable marrow. The yam which is produced underground is also much relished. Green bug and brown scales are common pests.


Quick growing short-lived plant, grown for its leaves, which are used for salads. Can be grown at all elevations. Sow seed in shallow drills, or broadcast them in beds, in the shade, and sprinkle soil over them and keep the soil moist. Ready in 15 to 30 days. Grows throughout the year.


Annual, grown for its head of leaves, used in salads and other preparations. There are two types, one with broad Lettuce-like leaves and the other with curled leaves. Sow, plains, September—December, and hills, March—June. Sow in nursery beds. Transplant very carefully into well prepared soil, 12 inches apart. Water freely. When fully grown, in about 2½ months, draw the leaves together and tie them up, when they are free from moisture on them. Thus, the whole plant is covered for blanching. Use a fortnight later.

Knol-Khol; Khol-rabi. (Brassica oleracea var. caulorapa).

Belongs to the Cabbage family and is grown very much like it. The stem of the plant widens out into a ball-like or ovoid thickening, which is the part used. Combines the flavour of the Cabbage and the Turnip. Resists heat much better than allied members and can be grown successfully at lower elevations too. Sow seeds in drills a foot apart and thin out seedlings 8 to 9 inches apart, transplanting the seedlings removed. Supply liquid manure once a fortnight, or the stems become rough and fibrous. Best for use, when they are of the size of a tennis ball. Sow, plains, August—November, and hills, February—May. Ready in 2\(\frac{1}{2}\) to 3 months.

Varieties.—Green and Purple coloured varieties. Early White Viennia, Early Purple Viennia, Large White Cape and Large Purple Cape.


Worth growing only above 2,000 feet. Requires very rich soil and constant moisture. Sow seeds, August—September at lower elevations and on hills, February—April. Transplant, when 4 inches high, 6 to 8 inches apart, in trenches, 8 inches deep and 9 inches wide, putting the seedlings deep down in the soil. When they are about two months old and increase in size, draw the rich soil on either side gradually, round the stems. For the stems to swell, trim the tips of the leaves constantly. The most important part of the plant is the underground portion which is white and agreeable, when properly blanched. Water liberally. Apply liquid manure 20 days before pulling. Ready in 2 to 5 months. May be allowed to remain over 2 years.

Varieties.—Musselburgh, London Flag, American Flag.


Much favoured salad plant. Does best at high elevations but can be grown at all elevations. Can be grown throughout the year, excepting the heaviest rainy season. 1 oz. will give about 3,000 plants. Soil to be light and rich. Sow in shallow
drills made 12 inches apart in well prepared beds. Thin out 8 to 10 inches apart in the case of Cos and 12 inches apart in the case of Cabbage kinds. Use the plants removed for transplanting into a separate bed for a later crop. Water freely, not on the plants but round the roots only. Tie up the plants of the Cos type, when 10—12 leaves are formed. Ready in 45 to 55 days. There are 3 kinds of Lettuce (1) The Cabbage Lettuce, forming Cabbage-like round heads with broad leaves (2) The Cos Lettuce, forming conical heads, with narrow pointed leaves and (3) The Gathering Lettuce, growing large and loose, the lower leaves being picked for use as they mature.

Varieties.—New York or Wonderful, May King, Paris White Cos All varieties seed well here.


Requires rich sandy loam, well dug and mixed with good quantity of wood ashes, old mortar, and well decomposed manure. Acclimatised seeds give very good results. Does best at medium to high elevations but some varieties may be grown with success at lower elevations too. Sow, plains, August to November, and hills, March to June. Broadcast in beds or sow in drills, which are 9 inches apart. Beat down the soil firmly. Germination is slow. Water freely. When plants are 6 inches high, thin them out 6 to 10 inches apart, transplanting those that are removed. Do not put them too deep, or the bulbs do not develop. When the tips of leaves turn yellow, bend down the stem and lay them flat to prevent plants from running to seed. Ready in 3 to 4 months. 1 oz. of seed will sow a bed, 4 feet by 12 feet.

Varieties.—“Ailsa Craig”, “Prize Taker”, “Market Gardener”, “Blood Red”. Acclimatised kinds as Patna onion and Silver-skinned do well in the plains, as also the ‘Red onion’.


Unsuitable to low elevations. Grows like Carrots but the plants require greater space. Only fresh seeds germinate. 1 oz. will sow a drill about 100 feet long. Medium elevations, sow November, hills, March to May. Ready in 80 to 120 days.
Varieties.—Sutton’s Student.


Only the local acclimatised varieties are suited for low elevations. The European kinds thrive only above 2,500 feet. The Dwarf kinds growing only 12—15 inches high need no supports. The tall kinds grow up to 3 feet and more and they should be supported by brambles to climb upon. The former are early yielders. Rich deep light soil, which has been heavily manured for a previous crop is best. Undecomposed manure causes more stem and less crop and also makes the plants more susceptible to mildew. Avoid a wet season, by sowing before the monsoon. Sow in plains, from October to January, and on hills, from February to May and also in autumn. 1 lb. will sow about 50 feet of row. Sow evenly, 2 inches apart, 1½ inches deep in drills or double drills, which are 9 inches apart. Let the distance between the rows or double drills, be 1½ to 4 feet, according to the height, the variety will attain to, the dwarf kinds needing less space than the tall ones. Water after sowing, if weather is dry. When plants are 4 to 6 inches high, place high twigs on either side of the rows for support. When pods are well set, pinch off the leading shoots to check the growth of vine and to concentrate the energy of the plants to the pods. Raise seeds from the best pods. Cut the pods, not pull them, while gathering. Mildew is the commonest pest in the winter. There are several varieties, the Early, Main Crop, and the late Crop kinds. Only the early varieties are suited for low country. The common country variety with short well filled pods does best in all places. Choose early growing kinds for surer results. Late varieties thrive to perfection on the hills.


Best varieties can be grown only above 3,500 feet. Acclimatised kinds can be grown with success at lower elevations. Require well drained sandy loam, well supplied with organic manure, used for a previous crop. The manure should have been applied a long time before planting. A dressing of ½ oz.
of a mixture of superphosphate, potassium sulphate, and ammonium sulphate in the proportion of 3:1:1 respectively applied for every 10 yards of a furrow trench gives best results. A good supply of potash manure is essential for formation of tubers. Select an open situation without shade. Plant, at lower elevations from September to November, and on hills in January—February, and again in July—August. Do not grow Potatoes on the same plot in succession. Keep them in a cool shady place, spreading them on the ground, till the “eyes” have sprouted. Cut up the tubers to pieces, such that each piece has on it two sprouts. Dip the cut surfaces in a mixture of slaked lime and ashes, and allow the cuts to dry for a day. Then plant out 4 inches deep, 15 inches apart in the plains and 24 inches apart in the hills. Small tubers planted entire, in place of cut pieces with eyes, do give better results. If an early crop is desired to be raised, force the buds to sprout by placing the tubers in a gunny bag, tied lightly and exposing the bag to the sun for a day or two. This operation induces the buds to grow soon, when the tubers will be ready for planting out. Water sparingly at first. Sprouts appear above ground in 7 to 10 days. Give a liberal watering when the stems are 6 to 8 inches high. Then, allow the soil to dry and earth up the stems in ridges about 4 inches high. Water freely again; 15 days later, hoe between the rows and raise the ridges to 9 inches keeping the soil loose. Too much water rots the tubers. Water sparingly from the time the leaves begin to turn yellowish, which indicates that the tubers are reaching maturity. Withhold water when the leaves begin to wither. Dig up the crop when the stems die down completely and store the tubers in a cool dry airy place, the bulbs not touching each other. They would do better if soaked in a solution of 2% sulphuric acid. Ready in about 3 months after planting. There are numerous varieties. For planting, select tubers which are free from ring disease. While cutting the tubers, if any diseased tuber is noticed, reject it, and to kill the fungus attaching to the blade, sterilise it by dipping it in a solution of corrosive sublimate or by passing it over the flame of a lighted torch. One diseased tuber will infect an entire field through the irrigation water. Epilachna beetle is
a pest of this crop also. Spray lead arsenate solution at the early stages, to save the crop. Heavy rains cause warts or protrusions on the tubers, which impair their keeping qualities.


Easily grown at all elevations. Select a cool, semi-shady situation in the plains. Light, well cultivated soil, manured liberally is best. Sow seeds in drills, which are 8—10 inches apart. Thin out 5 to 8 inches apart, according to the variety grown. Water freely. A quick growing crop, ready in 30 to 40 days. Sow at intervals of 15 days for crops in succession. Roots become tough and fibrous, if left too long in the soil. Sow, plains, August to January, and hills, March to May.

Several varieties.—The country variety with long white roots is very good and marketable. Others are White Icicle, Scarlet Globe, Round White, Golden Globe, Red Turnip and Black Spanish.

**Spinach.** (Spinacea oleracea). N. O. Chenopodiaceae. Vern. 'Palak sag', 'Isfaney'. ‘Seeme Basale keere’.

Annual with succulent leaves, which when cooked and dressed form an agreeable vegetable. The leaves are rich in iron salts and are good for anemia and for digestion. There are several varieties, climbing and dwarf types. Sow, plains, September to November, and hills, February to April. Select light rich soil. Broadcast seeds and thin out 9 to 12 inches apart. Water freely. Stir soil frequently. Pinch off flowering shoots. Ready in 2—2½ months. Spinach degenerates considerably from acclimatised seeds. Hence, not worthwhile collecting seeds from imported kinds. Grow the climbers on trellis or on pillars or poles.

**Spinach, New Zealand.** (Tetragonia expansa). N. O. Chenopodiaceae.

Tall hardy annual, leaves of which are used in the same way as Spinach. Sow seeds in nursery beds. When 4 inches high, plant out 2 feet apart, in rows 3 feet apart. Water freely and keep free from weeds. Ready in 45 days.

**Tomato.** (Solanum or Lycopersicum esculentum). N. O. Solanaceae. Vern. “Bilayati Baigan”; Seme Takkali".
Known as the Love Apple. An annual grown for its popular fruits which are rich in vitamins and very nutritious. Thrives best at medium elevations but can be cultivated in the cold season in the plains too. Good results are obtained from acclimatised seeds, but it is worth getting imported new varieties now and then. Can be grown in any kind of soil but well manured loam gives best results. Sow seeds, in July to November in the plains, and on hills, from March to June, in seed pans or nursery beds. When 3—4 inches high, transplant the seedlings, 2 to 2½ feet apart, in rows 3 feet apart. Apply water frequently in dry weather. Support plants with bamboo stakes about 6 feet high or train them against a trellis. Remove all laterals or offshoots and nip off the top, when the stem has reached the height of the support. When fruits are setting, apply liquid manure and potash manure. Thin out fruits in each bunch if large ones are desired. Pull out all diseased plants and burn them to prevent spread of the disease to other plants. Collect all rotted fruits and throw them out of the garden. Wilt disease is the commonest trouble. Syringe the plants every ten days with a very weak solution of permanganate of potash or Bordeaux mixture. This will keep back disease. For wilt disease, soil sterilization by allowing it to rest or fallow, exposed to sun, is necessary. Also wilt resisting varieties should be grown. Remove a few leaves, if necessary to admit more sunlight to the fruits. Do not grow tomatoes successively in the same ground. Collect seeds only from large, mature, disease-free fruits. Dig in lime if the soil is infected. 1 oz. will give about 1,500 plants.

Varieties.—Ponderosa (the largest-sized fruit), Golden Queen, Matchless, Marvel of the Market, Tangerine, and Bonny Best. Pear-shaped and Plum-shaped varieties are also good for home gardening.


Does best on hill stations but at medium elevations of 2,000 to 4,000 feet, fair roots can be grown in the cold season. Sow thinly before the end of each monsoon, in rows a foot apart, an inch deep. Water young plants not too freely. Thin out 6—9
inches apart. Stir soil now and then. Guard against Turnip fly by spraying with soap solution. Ready in 3 months.

Varieties.—Several, of which try, Early Snow Ball, Purple-top White Globe, Early White Milan.


Generally unsuited for places below 2,000 feet. Thrives best on hill stations. Essentially a hot season vegetable, grown very much like the ordinary Pumpkin. Prepare holes, 2 ft. x 2 ft. x 2 ft., fill them with a mixture of well decomposed cattle manure and soil. Let the holes be 6 to 8 feet apart, as the vines spread freely on the ground. Gourdlike oblong fruits are produced. These should be plucked before they reach full size. Pinch the tips of the shoots when flowers open to induce them to set fruit. The plant produces male and female flowers separately and very often it so happens, unless the female flowers are fertilised artificially by pollen from the male flowers, fruits cannot be got. Female flowers are distinguished by having no pollen and by having a large round ovary. Ready in about 3 months. Dust the plant and fruits with ashes to keep off flies, grub, and beetles.

**Varieties:**—Several, of which try Vegetable Marrow, Long White Bush Marrow.

The following are the more important Summer Season Vegetables.


Many types of soft wooded annuals, the leaves and tender stems of which are used as vegetable. They vary in size and colour of leaves. Easily grown on any soil, best results being however obtained in light rich soil. Broadcast thinly in beds if only small stems are required for use. If grown for “thandu” or thick stems, sow thinly in drills, 12 inches apart and thin out to 12 inches. Ready in 30 to 40 days. Can be grown throughout the year.

Perennial climber with soft green or purple succulent leaves, used as a substitute for Spinach. Any soil will do. Sow seeds direct in filled pits and support vines. Ready in 3 months.


An extensive annual climber, allowed to spread on the ground and commonly found on thatched roofs of native houses, bearing large oval fruits covered with an ash coloured bloom. Fruits are watery, and used in curries and for making sweetmeat. Make broad pits, 1½ feet deep, and 3 feet each way, and fill up with richly manured light soil. Let the pits be 6 feet apart. Sow five seeds, in each pit, directly, in February-March. Keep only one plant, the strongest plant, in each pit. Keep the pit and the ground free from weeds. Water regularly. Ready in 3—4 months. Not grown above 4,000 feet.


A woody, perennial, climbing Bean, bearing pods, 6 to 12 inches long and 1 to 1½ inches broad, which when young and tender, are sliced and boiled as vegetable or used for pickling. The red or white seeds are also used. Sow seeds direct in broad pits filled up with rich soil about three inches deep. Let the pits be 6 feet apart. Train the vine over a bamboo support and then over a pandal. The vine may also be allowed to grow up a tree. Sow in March to June. Does not thrive above 4,000 ft. Subject to aphid pest. Ready in 3 to 4 months.


Several kinds are known. The larger fruited kinds are generally mild and the smaller fruited kinds are generally hot and pungent. The very large mild-podded kinds, which are usually grown from imported seeds are treated as rainy and cold weather plants and sown in the plains in October. Sow generally, plains, April to middle of June and hills, April to end of May. Broadcast seeds in beds in the open and when a few inches high, transplant them a foot apart, in rows 1½ feet
apart. Any good soil, slightly manured will give good results.
Ready in 2½—3 months.

The fruits of some kinds are yellow or cream coloured or purple. Some make very ornamental plants for pot culture. The best imported kinds are:—Elephant's Trunk, Ruby King, Bull Nose, Chinese Giant, Cayenne Long Red, Golden Queen. 1 oz. will make about 1,500 plants. Seeds do not keep long.

**Citrullus vulgaris. Water Melon. (N. O. Cucurbitaceae).**
Vern. "Kharbuza."

A trailing gourd, usually grown in dry beds of rivers, producing fruits for dessert. Several varieties some more sweet and juicy than others, and differing in size and shape of fruits. Heavily manured sandy soil produces best fruits. Grown like Ash Pumpkin. Sow about the middle of January to have the fruits in season during the hot dry months. If the collar of the plant is allowed to get too wet, the stem will canker and the plant die. Ready in 4—4½ months. Not grown above 3,000 ft.

**Citrullus vulgaris variety fistulosus. Squash Melon.** Vern. "Dilpasand;" "Tendu."

A variety of the preceding kind, with a fruit about the size of a Turnip, dark green in colour when young and usually lemon-yellow, when ripe. Grown like the Melons, in patches 4 feet apart. Pick fruits when three-fourths grown, pare, cut them into quarters, extract the seeds, boil in water, and then in a little milk, with salt, black pepper and nutmeg. Sow February to March. Ready in about 3 months.

**Cucumis Melo. Melon. (N. O. Cucurbitaceae.)**
Grown like Water Melon in similar soil and under similar conditions. Ready in 3 months. The fruits vary in size and shape according to variety, but usually 7 to 8 inches in diameter. Used as a dessert when ripe. Not grown on hills.

**Cucumis Melo, variety momordica. Melon.** Vern. 'Kachra;" "Tuti."

Grown like the above. A variety of the common melon, with smooth cylindrical fruit about a foot long, green when young and lemon-yellow when ripe. Used like Cucumber for salad when young and eaten like Melon, when ripe, with sugar. Ready in about 4 months.
Cucumis Melo, variety utilissimus. Cucumber. Vern. ‘Kakri.’

Bears long fruits, green while young and yellowish when ripe. Used for salad while young. Grown like Melons, by sowing in pits filled with rich sandy loam, 5 feet apart. Ready in 3 months.


Sow, plains, from the beginning of February to end of June, and hills, from March to May. Dig pits 1½ feet by 1½ feet, at a distance of 5 feet by 5 feet, and fill with well decomposed manure. Plant 5 seeds in each hole and thin out to two strongest growers. Allow plants to trail over the ground. Mulch the roots during dry weather. Ready in 70 days and bears for six weeks or more. Don’t allow fruits to ripen on the plant, as it diminishes its productivity.


Annual of trailing habit, grown throughout India, for the fruit, which is cooked and dressed, both in immature and ripe state as vegetable. There are many varieties, fruits of which are generally large but varying in shape and colour. The colour of the skin varies from greenish-white to brownish-red but the flesh is salmon-red or reddish in all kinds. Make broad pits, 8 feet apart, and fill them with light soil enriched with manure. Grow like other Cucurbitous plants mentioned above. Ready in 3—4 months. Sow from February to June, in the plains, and from March to July on the hills.

Cucurbita pepo. Vegetable Marrow. Squash. See page 516.


A small bushy plant, growing to about 3 feet, producing hairy pods, about 3 inches long, in clusters, which are used as vegetable as French Bean. Ready in 2½ to 3 months. Sow seeds in drills, 1½ feet apart, and thin out 8 inches apart in each row. Sow, February to June.

Erect growing annual, 2–3 ft. high, bearing large leaves, and Hibiscus-like flowers, and horn-like pods, green or creamy green in colour, and 4 to 7 inches long. Gather pods for use while young, when they are free from fibre. Sow, plains March to August, and hills, April to July. Thrives in ordinary soil, if manured well. Sow seeds 1 foot apart in drills 2–2½ ft. apart. Then thin out to 2 feet apart. Make sowings every 3 weeks for regular succession of pods. Ready in 3½ months.

Does not grow above 4,000 ft. A climbing plant, belonging to the Convolvulus family, producing tubers from the nodes of shoots, which are buried in the soil. The tubers are about 6 inches long, pointed at both ends and swollen in the middle, sweet to the taste, and white or red skinned, there being two varieties. Lightly manured sandy soil is best suited. Plant 9 inch cuttings in April–June, 18 inches apart each way, on ridges of shallow trenches. When these are grown, press down the stems every few feet. Ready in 5–6 months. Unless the creeping stem is turned over frequently so that it may not emit roots at every node and produce small tubers, large sized tubers cannot be expected.

An annual creeper, grown on the ground or supported on a trellis, bearing fruits 16 to 24 inches long, of the shape of water bottles or decanters. Unripe fruits are used as vegetable, boiled or curried. Grown like Cucumber. Sow February to March and again August to September, in the plains, and on the hills, from April to end of May. Let the pits be 6 feet apart. Best grown on thatched shade. Ready in 3 months.

Luffa acutangula. Sponge Gourd. (N. O. Cucurbitaceae)
A climber, bearing green fruits, 10–12 inches long, with sharp ribs projecting from end to end. A very good vegetable, when peeled, boiled and dressed with butter, pepper and salt. Sow February to May in filled pits, with a distance of 6 feet in between. Pinch back the shoots to induce the fruits to set well.
Supply liquid manure when fruits are forming. Plants allowed
to trail on the ground or supported on poles on pandals. Ready
in 2–3 months, there being early and late types.

**Luffa aegyptica. Cylindrical Sponge Gourd.** Vern. ‘Ghiya
Tarot;’ ‘Tuppadas herekai.’
A large herbaceous climber, similar to the preceding, bear-
ing fruits 8 to 18 inches long, and used similarly. Grow up a
tree or over a pandal. Plant 6–8 feet apart in well filled pits,
in March to June, at low elevations. Ready in 3–3½ months.
Not grown above 3,500 ft.

**Momordica charantia. Carilla fruit.** N. O. Cucurbitaceae.
Vern. ‘Karela;’ ‘Pavakkai;’ ‘Hagalakai.’
A slender climber, bearing oval shaped warty fruits, of
green or cream colour, and 6 to 8 inches long. They are bitter,
but when properly cooked and prepared, it is agreeable to most
palates. Not grown above 4,500 feet. The hot season variety
is best allowed to trail on the ground. The rainy season variety
is grown on supports. Sow in holes or pits, 4–5 feet apart
from October to March. Ready in 2 to 3 months.

**Momordica dioica.** Vern. ‘Padupakal: ’ ‘Kareli.’ A
smaller fruited species of the above, which is only 2–2½ inches
long and is more favoured than the above species. It does not
thrive above 2,000 feet. Sow from September to November and
grow as mentioned above.

**Physalis peruviana. Cape Gooseberry.** (N. O. Solanaceae).
Vern. ‘Teparee; ’ ‘Guddehannu.’
A dwarf shrub, growing to about 2 feet, bearing a well
known berry, which is enclosed in a dry capsule. It is eaten
when ripe and is also used for making jams Sow in nursery
bed in April to June. When seedlings are about 3 inches high,
transplant in rows of trenches 2–3 feet apart, with 15–18
inches from plant to plant. Earth lightly up stems when about
9 inches high, as the plants do not stand waterlogging. Ready
in about 7 months.

**Raphanus. Radish.** (See page 514).

A perennial soft-wooded shrub, but grown annually
throughout India. Not grown above 4,000 feet. There are several varieties, the fruits differing in size, shape and colour. Sown in September and October and in February-March, for fruits in February—March and August to January respectively. Broadcast in nursery beds thinly. Transplant seeds twice before planting out for best specimens of plants and fruits, at intervals of 15–20 days. Plant them in rows of well filled pits, made 2 feet apart, putting 3 seedlings into each pit. Or, put the plants in rows in well filled trenches 2–2½ feet apart, setting the plants 2 feet apart. Give water once a week and frequently stir the soil. Earth up lightly when about 18 inches high, putting well decomposed manure round the plants. Plants grow 2 to 3 feet and bear in 4 months. Red ants, which bore through the stems, aphis, mealy bugs, and small beetles and stem boring caterpillars are the common pests. Prune back the wilting shoots and branches and burn them, as the caterpillars are in them. For the epilachna beetles attacking the foliage, spray with lead arsenate solution. Cut back the shoots of plants, after the first flush of fruits are over for new growths and further crop of fruits. Since potatoes are attacked with similar pests, do not grow brinjals and potatoes in succession.

Trichosanthes anguina. Snake Gourd. N. O. Cucurbitaceae. Vern. 'Chachinja.' 'Podalangai.' 'Padwalakayi.'

A quick growing gourd bearing large cylindrical snake-like fruits, often 4 to 6 feet long, green or ash coloured with whitish lines on them. Not grown above elevations of about 4,000 feet. Sow five seeds in a broad well filled pit in March-April, or even in May. Let the pits be 6 feet apart. When the plants have begun to grow, earth lightly up the stems and put brambles about 6 feet high, for the vines to climb. Then allow the vine to spread on an improvised pandal. The gourds hang down the pandal. Tie strings to the ends of the fruits, weighted with small stones, for the gourds to grow straight. Ready in about 3 months. A delicious vegetable. There are two varieties, striped green or pure ash grey.

Well known cereal, grown throughout India for its grains and more especially for its cobs, which in the green stage form very agreeable vegetable, cooked or roasted. It is an annual grass growing about 6 feet high, bearing one or more cobs per plant. There are several varieties. Golden Beauty, Golden Bantam, Sugar Corn, Kendal's Giant, Burpee's Delicious are some of the improved good varieties. The first named is the best market variety. For home use for the table, Sugar Corn is recommended. Sow from March to June in the plains, and May to July, on the hills. Acclimatised seeds give best results in the plains. Sow seed in drills, which are 3 feet as under and 3 inches deep, placing the seeds 6 inches apart in the rows. When plants are well up, thin them out to 12 inches apart, and earth up to a height of 4 inches. Ready in 3–3½ months. Sow every 15 days for successional crops.

Some Seasoning Herbs

**Aniseed** (*Pimpinella anisum*). N. O. Umbelliferae. Vern. “Sauf”.
Broadcast seeds in beds or sow in drills, 15 inches apart in October—November. Thin out 6 inches apart. Ready in 3–3½ months. Both seeds and leaves are used for seasoning and flavouring.

**Basil, Sweet** (*Ocimum basilicum*). N. O. Labiatae. Vern. “Gulal thulsi”.
Leaves and tops of shoots are used for seasoning dishes and introduced into salads too. Grows all the year round. Sow in nursery beds and transplant 12 inches apart or grow in pots.

**Caraway** (*Carum carvi*). N. O. Umbelliferae. Vern. “Jira”.
Seeds used for flavouring and in confections. Sow June to November and thin out 9–12 inches apart.


**Dill** (*Pimpinellagraveolens*). N. O. Umbelliferae. Vern. “Sooor”.
Broadcast seeds or sow in shallow drills and thin out 1 foot
apart. Grows to about 2 feet. Aromatic leaves used in soups, sauces, etc., and also for making “Dill-water” for children. Ready in about 3½ months.

**Fennel. (Foeniculum vulgare).** N. O. Umbelliferae. Vern. “Sunf”.

The tall finely divided aromatic leaves are used in sauces, for garnishing, etc. Leaf stalks are used in salads. Seeds used in confectionery and for flavouring liquor. Suited best for elevations above 2,000 feet. Sow in boxes and put out in rows 12 inches apart.

**Lavender. (Lavandula var).** N. O. Labiatae. Vern. “Nurd”.

Succeeds only from medium to high elevations. Dwarf shrub, grown for its pleasantly aromatic flowers which are dried and put into ward robes. Leaves are used in seasoning. By distillation of flowers, Lavender Water of commerce is obtained. Sow in seed pans and transplant when fit to handle into small pots and shift to larger pots later on. When about a year old, plant them out in well drained soil. Apt to damp off in the rainy season.

**Mint. (Mentha viridis).** N. O. Labiatae. Vern. “Pudeena”.

Herbaceous perennial with creeping rhizomes. A valuable seasoning herb, the tops and young leaves used for flavouring, in salads and sauces, etc. Slight shade necessary, and plenty of water. Plants raised by division of roots and underground stems, which are planted 9 inches apart. Moist rich soil gives best results.

**Marjoram, Sweet. (Origanum marjorana).** N. O. Labiatae Vern. “Bantulsi”.

Suited for hill stations. Sow in August—September. Plant seedlings 9—12 inches apart. A perennial, which becomes ready in about 3½ months. The aromatic leaves are used, both green and dried, for seasoning soups, etc.

**Parsley. (Petroselinum sativum).** N. O. Umbelliferae. Vern. “Peterselee or Ajmud”.

Known for its medicinal properties. Universally grown for seasoning and garnishing purposes. Thrives best from medium to high elevations but can be grown tolerably well at lower elevations too. Select rich heavy soil. Secure
partial shade. Sow, plains, August—November, and hills, March to May. Germination is slow, taking about 15 days or more. It can be hastened by steeping the seeds for a few hours before sowing. Mix them with ashes and sand before sowing. Broadcast them or sow in drills and then thin out 9–12 inches apart. Water moderately. When flower buds appear, cut them back. Ready in 1½ to 3 months.


Dwarf shrub, grown for its pleasently fragrant leaves, which are used for seasoning, for making decoction for relieving head-ache and in the manufacture of scents. Suited only for hill stations. Grown from seeds.

**Rue.** *Ruta graveolens*. N. O. Rutaceae. Vern. “Sundub”.

Does best at hill stations. Can be tried at medium elevations. Small undershrub with glaucous greyish leaves, which have an unpleasant smell and a hot bitter taste. Used in garnishing for its carminative properties. Grown from seeds or from cuttings.

**Sage.** *Salvia officinalis*. N. O. Labiatae. Vern. “Seesti”.

A well known seasoning plant, grown successfully on hill stations. Sow seeds in October and November at medium elevations. Transplant into pots when 3 inches high. Grow in pots or plant out 12 inches apart.


Grows best from medium to high elevations. A favoured seasoning plant. An undershrub which prefers a light rich dry soil, and sheltered situation. Sow in drills 8 inches apart and thin out 3 inches apart. Ready in 3½ months.
CHAPTER XXXI

SELECT FRUIT TREES

Suitable positions for fruit trees.—The owner of extensive grounds may with pleasure and profit grow a selection of fruit trees and shrubs. Quite a large number of them which are ornamental with handsome foliage and fruits, may be suitably planted along with the ornamental trees and shrubs. It is needless to mention, however, that they should be provided situations agreeable for their growth and that they should be so placed as not to mar the picture of the garden.

Where grounds are extensive, such large trees as the Jack, Mango, Jamoon, Wood Apple, Rose Apple and its allies, Bael, Star Gooseberry, Phyllanthus Emblica (Nellikai) and the Coconaut are best planted on the confines. Trees smaller than the above as the Sapota, Loquot, Guava, Custard Apple and other Anonaceous kinds, Komrac, Citrus kinds, Tree Tomato and the Mulberry may be grown in the second line along with other trees and shrubs completing the landscape view. Such handsome trees as Litchi, Pomelo, Oranges like the Comquot, Brazil Cherry and the like are best planted to beautify the lawn. The Bread Fruit tree with its graceful spreading habit and handsome large polished leaves would be effective placed in front of the porch or on the sides of the bungalow.

Trees as the Peach, Apple, Fig, etc., can be grown by sheltered walls and hedges. The Papaya which in its young stage is ornamental with its large leaves and attractive fruits hiding the stem, may be planted by compound walls screening them, and their naked stems when old, may be used as supports or pillars for effective display of annual creepers as Convolvulus. Pine Apples make a good show with their ornamental foliage, planted in beds along walks and paths. Thus, it would be seen that several fruit trees and shrubs can be mixed up with those grown only for ornament, without alloting a separate place for them.
Suitable site, soil, etc.—As fruit trees need more individual attention than ornamental trees, it is however economical to grow them in a separate site. Each kind is best planted in a separate bit, as trees of one kind call for similar treatment, as for instance in watering and manuring. The site chosen should command good drainage, be fully exposed to the sun, and be sheltered from strong winds by an effective windbreak of trees like Sesbania (‘Agati’) and Erythrina indica (‘Kalyana murungai’) or the Milk Bush (Synadenium grantii), planted at right angles to the direction of the strong winds. Fruit trees thrive best in well drained deep loam. They also thrive in soil which has a layer of about five feet of loam at top with porous gravelly but not stony soil below. In clayey or very heavy soil, the roots suffer by improper aeration and by waterlogging. In stony soil, the roots cannot travel deep enough in search of food and water, and the trees cease to grow and bear after a few years. Sand and sandy loam are also unsuitable as they cannot retain moisture and manure and get easily heated during the day and cooled during the nights and thus adversely affect the trees. A plentiful supply of water is necessary, especially in summer, for the growing trees. Unless the trees are treated liberally with water and manure so that they may grow well, it is hard to expect them to bear well and for a number of years. Trees neglected by want of seasonal manuring and timely watering seldom regain their vigour and health.

Preparation of land for planting.—After selecting a suitable site, the first business is to clear it of all weedy shrubs and undershrubs. Plough the land deep and remove all weeds and grass roots, and grow a crop of a Leguminous kind as Ground Nut or a green manuring plant and dig it in when ready, to make the soil soft and mellow, to enrich it with nitrogen, and to keep down weeds during succeeding years. When the land is thus prepared, positions for the pits for planting are marked out. Generally, shrubs may be planted 6 to 10 feet apart, small trees 15 to 20 feet apart, and larger trees 25 to 40 feet apart. When they are fully grown, they should not over-crowd each other; each tree should be free from the shade of the branches of its neighbours and should get an adequate amount of direct sun and air. How pits are to be made and filled with soil has
been dealt with in Chapter VII. For fruit trees, it is desirable, the pits are at least 4 feet long, 4 feet broad and 6 feet deep. The bottom of the pits are best filled to a depth of 6 inches with broken bricks, etc., of a porous nature for drainage and then to a further depth of about two feet with the top soil mixed with a very liberal quantity of organic manure and 5—10 lbs. of crushed bone or bonemeal. The trees are best planted diagonally in rows thus,

**Selection of kinds and varieties to grow.**—One has to take expert assistance in the selection of kinds and their varieties to grow and has to get them from reliable nurserymen. As fruit trees take three to four years or more to fruit, the disappointment will be the keener after growing them so long if the quality of the fruits is not to one’s expectations. Unless the desire be to experiment with uncommon kinds and varieties, only tried kinds and varieties are to be grown for sure results. As seedlings take much longer time to fruit than grafts or budded plants—as many as 8 to 15 years in the case of some kinds, and as there is no certainty of their coming true to their parent, budded or grafted or layered plants are preferred to them. The stocks used for budding or grafting should be suited to the local conditions of climate and soil. The plants chosen should be straight, young and not pot-bound. They should have the buds or grafts put as low down on the stocks as possible. Old pot-bound plants of more than one or two years have nothing to commend them except their size, which is after all of no consequence. In the fruit trade, much fraud is practised nowadays, by grafts being offered which have been obtained by grafting young seedlings on seedlings. It is only scions taken from mature trees bearing fruits of superior quality that give the best results and that fruit quickly. Layered plants are quite as good as graft or budded plants, provided the variety or the kind can thrive on its own roots in the soil of the particular locality.

**Planting.**—With regard to the season for planting, refer to Chapter VII. Imported deciduous trees as the Apple, Peach, etc., may be planted from November to February in the cold weather, when they are in their dormant condition.
SELECT FRUIT TREES

Refer again to Chapter VII for general instructions regarding planting trees. Care is to be taken that the grafted or the budded portion is above the soil. The roots of plants which are shipped from Australia with no soil attached to their roots, are to be cut back to healthy points before planting. The dried branches too should be cut back to healthy stem to prevent ‘die-back’.

Care to be taken subsequent to planting.—The trees are to be suitably staked while planting them. Basins have to be made for watering them. They have to be regularly watered so that they may not suffer any check in growth, especially during the hot months. The basins are to be widened as the trees grow in size. As observed at page 45, the feeding roots are away from the stem and it would be no good at all to water the trees in small basins around their stems. For larger trees, the basins should extend from 2 to 3 feet of the stem to the actual spread of the branches. After each watering, when the soil shows signs of drying up on the surface, it is stirred to a depth of one or two inches providing a dust mulch (see page 28), which helps the moisture to be retained longer in the soil. Once or twice a year the trees are to be manured. The time for manuring is usually before the beginning of the rains. But it should be adjusted according to the needs of the particular kind and done about a fortnight or a month before the blossoms are expected. For manuring, stop watering the plants for a fortnight; then remove the upper layer of the soil in the basins to a depth of 4—12 inches until small hairlike roots are seen which should not be damaged; replace the soil with a mixture of red earth and manure, made in the proportion of one of the former to three of the latter. Sheep manure is best for Apples, Grape Vine, Peaches and such deciduous trees. For evergreens such as Citrus trees, cattle manure is preferable. If good manure is not available, leaf-mould may be used along with a mixture of artificial manure made up of 2 parts by weight of bone meal, 3 parts of potassium sulphate, 6 parts of ammonium sulphate, and 3 parts of super-phosphate. ½ to 1 lb. of the mixture may be used for a tree 1 to 2 years old and 2 to 5 lbs. may be used for older trees according to their age and size. The mixture of
chemical manure should be mixed with one or two times its bulk of ordinary soil and then applied. Whenever chemical manure is applied, watering should be very liberally done, as otherwise, ex-osmosis will take place and the trees will wilt, or even die. The area under the fruit trees should be ploughed every year to clear weeds and to enable the land to take in as much rain water as possible.

Pruning.—Pruning of fruit trees has been dealt with in Chapter X. It should be emphasized that barring Grape vine, pruning of fruit trees in this country should be confined to the removal of over-crowding and dead and diseased branches. The advantage of pruning with the knife such trees as the Apple, Peach, Pear, etc., in the temperate climate is effected naturally in this hot country by the severe sun. For want of a long winter, the sap is active always and the trees have no rest. So pruning in this country causes bleeding and consequent weakening of the plants. On the Hill Stations, the methods of pruning adopted with reference to several kinds of trees may however be tried and these methods are indicated under the respective trees.

Failure to fruit.—Sometimes large trees fail to fruit. This may be due to too vigorous a growth of the wood and foliage, which may be checked by such operations as root-pruning, girdling and wintering which have been described in pages 121-3. It may also be due to want of phosphorus in the soil, in which case, a liberal application of 3 to 5 lbs. of superphosphate for each large tree would induce it to bear. Want of pollination due to absence of male trees near by, absence of certain insects which fertilise the flowers, unfavourable weather conditions, as rains during the blooming period washing away the pollen are also responsible for failure to fruit. When the sexes are on different trees, it is helpful to grow more than one tree of the kind in question to be sure of pollination of the flowers. Too much water, very poor soil, very rich soil, and bad heredity are also causes for sterility among fruit trees.

Fruits, how collected and stored.—Fruits which ripen on the tree are generally of a finer flavour and colour than those which are picked before they are ripe. Though they may soften and ri-
pen later, they may remain to some extent acid and astringent. There are several pests as squirrels, rats, birds, etc., which necessitate, however, the removal of fruits before they get ripe naturally. Fruits are forced to ripen by wrapping them in straw or by allowing them to remain in trays in dry rooms without touching each other. Rotting of fruits is chiefly caused by the death of cells due to mechanical damage such as severe handling, fall from the tree and heaping. Special hooks, bags, etc., should be used for harvesting fruits without damage. Certain kinds as the plantain, are cut in bunches when just changing in colour from green to yellow and smoked in a closed atmosphere. It is only the disease-free mature fruits which are collected unbruised that keep well. An efficient cold storage may not be within the reach of amateurs, though it is an excellent method of preserving fruits over a comparatively long period.

Pests.—Refer to Chapter XI for insect and fungus pests of plants. Spraying in the right time with Fish Oil Rosin Soap or Honge Oil Soap solution will eradicate sucking insects as green bugs, aphis, etc., and reduce the danger from sooty mould in the case of such trees as Citrus, Guava, Sapota, etc., which are usually attacked with it. Fungus attacks as mildew, leaf-spots, rusts, etc., are prevented by spraying with Bordeaux Mixture, first when the trees are naturally without leaf or when they are wintered, secondly when they break out into fresh foliage before they bloom, and thirdly, when the flowers have opened and the fruits are set and are about the size of a pea. To prevent certain fungus attacks of the fruits, as discolourations or rusts or spots on them and sometimes to prevent them from dropping away before they ripen, the fruits are sprayed with Bordeaux Mixture again when they have advanced fairly far in size. The several kinds of fruit flies which give rise to maggots inside fruits and which bore holes through them are best treated preventively by collecting and destroying the affected fruits by burning them and thus ensure a better crop next season.

Climatic conditions favourable for growing fruits.—Fruit trees may be broadly divided into two classes, (1) tropical and
subtropical, which thrive in varying altitudes from the sea-level to about 3,000 feet and (2) the temperate kinds which require a higher elevation in this country—say 3,000 to 5,500 feet or more above the sea for satisfactory results. Even in these two classes, there are kinds which show wider adaptability to climatic conditions than others. For instance, Citrus kinds thrive well at places on sea-level to 6,000 feet above it, and the Mango up to 3,500 to 4,000 feet. The Mangosteen, on the other hand, will not thrive above 1,500 feet, preferring as it does a warm humid atmosphere. It may be generally observed that all fruit trees prefer a dry atmosphere where they produce well and bear sweet and luscious fruits, to a very humid atmosphere. Humidity of the atmosphere, too much rain and too much of watering cause acidity in fruits. It is observed that fruits which ripen in summer are sweeter than those produced during the rainy season.

The following are select fruits:—

**Acras sapota. Sapodilla Plum. Sapota. Naseberry. N. O. Sapotaceae.** Vern. 'Chikku', 'See-me iluppai', 'Sapota'.

Very hardy, evergreen, slow-growing, well shaped tree, 20 to 25 feet high, with polished small elliptical leaves. Fruits are oval or round, 2 to 3 inches in diameter, have a rough nut-brown skin, enclosing soft yellowish brown, very sweet flesh, which is fragrant and possesses a fine flavour. Firminger said, "A more luscious, cool, and agreeable fruit is not to be met with perhaps in any part of the world". Unless fully ripe, it is unfit to eat, on account of the milky latex and the tannin present in it. In U. S. A., the latex, known as 'chickle' is used commercially for making chewing gum. Collect the fruits unbruised when the skin has become smooth and the spinelike dried part of the flower has fallen off the apex. Keep them in a dry place for about a week to ripen. The tree thrives best in rich sandy loam up to an elevation of about 3,000 feet and yields twice a year, about August and March. The large round fruited variety bears almost throughout the year. Seedlings take 10—15 years to fruit. Hence, grafts are to be preferred, which bear in 3 years. For grafting, the stock used is mostly *Mimusops hexandra* ('Pagade', 'Pulai'). Layering takes a
very long time. Plant 20 feet apart. The fruits are becoming increasingly popular in the market. The tree is being generally grown all over S. India though it was known only in Bengal till sometime back. A native of Tropical America and West Indies. One of the best and hardiest fruits to grow in the plains.


A very useful spiny tree, allied in appearance to the Wood Apple. The fruits vary in size from that of a cricket ball to a melon. They have a hard green shell, enclosing an aromatic doughy pulp, which is squeezed in sugared water for making 'sherbets'. The fruit is well known for its medicinal properties, especially as a specific for dysentery. Refer to Watt's Dictionary of Economic Products of India for the medicinal and other uses of the various parts of the tree, on account of which the tree may be given a place in a large garden. Thrives in any garden soil up to an elevation of about 3,000 feet and bears in March to May. Get the large fruited thin shelled variety. Propagated from seeds, taking 6 to 8 years to bear. Native of India.


A tree, indigenous to Tropical America, adapted to the dry and wet coastal regions up to an elevation of about 3,000 feet. Thrives in any kind of soil. It is awkward and ungainly in habit, evergreen, spreading, and reaching a height of about 35 feet. A relative of the Mango. The fruit consists of two parts, viz., (1) the cashew apple, the swollen pear-shaped receptacle, which is fleshy, very juicy, about 3 inches thick, and is often eaten raw. It is astringently acid and used in preserves and to make a drink; (2) the nut, which is kidney-shaped, about 1 inch long, brown in color, and situated at the extremity of the fleshy part. The edible kernel of the nut is of an agreeable taste after the nut is roasted, and it is used in confectionery and for flavouring purposes. Propagated from seedlings, which are planted out 9 to 12 months after sowing. The first fruits may be gathered in 4--5 years. The tree begins to die in 15 years, exuding a gummy substance. Fruits ripen in December——
January. About 120 lbs. of fruit may be got from a tree. It is attacked with very few pests. This is a good tree for wasteland plantation. There is large export trade of the nuts to America and Europe as they are used as a substitute for almond in confectionery.

Ananas sativus. Pineapple. N. O. Bromeliace. Vern. 'Anaras,' 'Ananas'.

Stemless perennial plant, 1½—2 feet high, with long narrow fibrous leaves, usually spined. A native of Tropical America and widely grown in warm countries. Largely grown in Malabar and Travancore in India. The fruit is borne in the centre of the plant on a stalk. After fruiting, the plant dies. It is propagated by the numerous suckers which it throws out from the base as also from the 'crowns' of the fruits. The 'crowns,' that is, the shoots which are on the top of the fruits, take three years or more to fruit, hence it is best only suckers from the base of the plants are used. After removing the lower leaves from them, they are left in a cool place for 4—5 days, to form a hard callus and then planted in a raised bed made of leaf-mould and sand to root. Though naturally, the Pineapple grows as an epiphyte on rocks and in the forks of trees, it is cultivated in very rich loamy soil with a large amount of humus and lime in it. The soil is well drained and plenty of organic manure is incorporated into it. Trenches are made 2 feet deep and 2 feet wide, and 3—4 feet apart and filled with soil enriched with manure and bonemeal. A small ridge is made in the middle of each trench and the rooted suckers are planted on it, after trimming off the lower leaves, 2—3 feet apart. The trench is then irrigated with water once in 7—10 days. Fruit buds appear in 10—12 months after planting, when the soil is top-dressed with fresh manure and an application of potash manure is given. Fruits take about three months more to ripen. When they turn yellowish, they are cut and allowed to ripen. After the crop, the trench is dug up and replanted with fresh suckers. After 2 or 3 years, new trenches are made in between the old ones for fresh planting, as the fruits would otherwise deteriorate. The usual flowering period is March and the fruits are ready in July to October. The Pineapple
thrive best in a dry climate up to an elevation of 2,000 ft. But it can also be successfully grown in moist hot districts in well drained land. Grown in a partial shaded situation, sheltered from winds, it produces large luscious fruits. The best varieties to grow are the Giant Kew, Queen, Cayenne, and the Red Spanish.

**Anona squamosa. Custard-apple. N. O. Anonaceae.** Vern. 'Sareefa,' 'Seethaphal,' 'Duranji.'

Also known as the Sweet-sop or the Sugar-apple. A semi-deciduous small tree, 10 to 15 feet high, a native of Tropical America and known from early times in India. It grows best in rocky well drained soil in a hot, relatively dry climate, such as that in low-lying interior plains. Thrives up to an elevation of about 2,500 feet. Withstands drought. The fruit is yellowish green in color. There is also a light purple coloured variety. It is heart, shaped or roundish, has a rind with a tuberculated surface, looking as though it is made up of scales. The pulp is sweet with a slightly acidulous flavour. Fruits need protection from squirrels and birds for which they may be covered with muslin bags. They may be plucked and kept 3—4 days for softening. Essentially dessert fruits. Not adapted for travelling long distances. Probably the best of the Anonaceous fruits. Propagated from seeds. The tree bears in 5 to 6 years. Get the "Mammoth" fruited variety. A variety from Hyderabad is large and sweet and is largely imported. Plant 12—15 feet apart. The leaves are often used to make a decoction to exterminate certain insect pests as epilachna beetles, mealy bugs, etc.

**Anona muricata. Sour-sop. N. O. Anonaceae.** Also another small tree of Tropical American origin, bearing large fruits weighing up to 6 lbs. They are ovoid or heart or kidney-shaped, and have a white flesh which is somewhat cottony in texture, juicy, and highly aromatic. The flavour suggests a combination of the Pineapple and the Mango. But the fruit is not relished by many and is only used to make refreshing drinks. The tree yields very sparsely, about a dozen fruits a year. It is more tropical in requirements, and is more tolerant of moisture than the Sugar-apple and can be grown in moist low regions. Yields in 4—5 years from seed.
Anona reticulata. Bullock's Heart. N. O. Anonaceae. Vern. 'Ramsita.' Another Anonaceaeus fruit which is inferior to the Custard apple and the Cherimoya. Also a small tree, indigenous to Tropical America, with heart-shaped or oval fruits, with a smooth reddish brown or yellowish surface divided by impressed lines into broad areoles. The pulp is white, granular, sweet, and custard-like. The tree prefers deep rich soil, with plenty of moisture. Is not so partial to a dry climate as the Sugar-apple. Thrives up to 3,000 feet.

It is a member of the Custard apple Family, little known but bearing delicious dessert fruits, which are generally heart-shaped, irregular in form, 4 to 5 inches in diameter and about 3 lbs. in weight, and greenish yellow in colour. The flesh is white, juicy, sub-acid, and of butter-like texture. The fruit is superior to the Custard apple in point of flavour. A small erect or somewhat spreading tree, about 20 feet high, with handsome foliage and scented flowers. A native of the highlands of Equador and Peru in S. America. Essentially sub-tropical in requirements, thriving only above an elevation of about 3,500 feet, in places where the climate is cool and relatively dry. Rich loamy soil gives best results. Not a free yielder, as pollination is scanty; bears only about a dozen fruits a year. Propagation from seed is not recommended. Secure plants grafted on Anona reticulata. Bears in about 5 years after planting.

Artocarpus integrifolius. Jack. N. O. Urticaceae Vern. 'Kathal,' 'Pala,' 'Halasu.'
A very large tree, growing 40—50 feet high, bearing one of the largest fruits in existence, on its trunk and older branches, sometimes at the base of the trunk or even underground. It is a native of South India and Malaya and it is suited best for moist or semi-dry places up to an elevation of 2,000 feet. The tree grows into large proportions and is suited only for large gardens. Though it thrives in any ordinary soil, it thrives luxuriantly in red loamy soil, bearing large fruits. There are several varieties. Choose one which has soft rind, large hard fibreless brittle pulp of honey-like sweetness and small seed.
The fruit is not relished by some as it has a strong smell and is hard to digest. Unripe fruits may be cut up and made into curry. The seeds are roasted and eaten like chestnuts. Both the fruit and the seeds furnish articles of diet to the poorer classes. Raise seedlings from seeds of large fruits of superior quality. Plant 40 feet apart. Seedlings bears in 8 to 10 years but grafts may yield in 4—5 years.

**Artocarpus nobilis.** (Vern. Kottai Seeene Pala) is very much like the Bread Fruit tree but the fruits have some round white seeds. It grows to noble proportions, often growing 40—50 feet high with large leathery leaves. Best suited for moist low country up to an elevation of 2,000 feet. Raised from seed.

**Averrhoa Carambola. Karambola Tree. N. O. Geraniaceae.**

Vern. 'Comrac,' 'Tamatanga.'

A very ornamental tree growing to a height of 20—30 feet, with beautiful evergreen foliage and clusters of pale purplish or white flowers, borne in short racemes from the bark of the old and young branches. The fruits are translucent, yellow or pale golden brown in colour, are elliptic in outline with three to five ribs running longitudinally. The fruit contains a clear watery pulp, astringent when green and tasting like sorrel or green gooseberries, but pleasantly acid when ripe, or even sweet, with an agreeable fruity flavour, and a strong perfume like that of quince." When fully ripe, it may be eaten fresh. When slightly unripe, stewed or made into an agreeable jelly or used in pickles. The juice contains potassium oxalate, which removes stains from linen. The tree is tropical in its requirements and prefers a warm moist climate. It thrives in deep rich soil but it can grow well in any soil with good drainage. Seedlings take about 5 years to fruit. Young plants are delicate and need attention. Secure grafts made from the sweet-fruited variety. Plant 30 feet apart. The tree is believed to be a native of the Moluccas but is known in India especially in Malabar from a very long time.

**Averrhoa Bilimbi. The Cucumber Tree. The Bilimbi. N. O. Geraniaceae.**

Allied to the Carambola, it is a small ornamental tree, about...

A well known quick growing ornamental herbaceous tree, which requires no description to introduce it. On account of its ornamental value and its utility, it may be grown with advantage even in small gardens. Though originally it is supposed to have come from Tropical America, it has become indigenous to India and Ceylon. Here also, as in its native home and elsewhere, it is of great value to the poorer classes, furnishing them an article of diet. Higgins and Holt say of it, "Excepting the banana, there is no fruit grown in the Hawaiian Islands that means more to the people of this territory than the Papaya, if measured in terms of the comfort and enjoyment furnished to the people as a whole." Unripe fruits are cooked and used as vegetable like pumpkins. Ripe fruits are excellent for dessert and breakfast. They are refreshing, sweet and pleasant, and digestive. Papayas are grown commercially for the extraction of pepin, a digestive ferment like pepsin, from the unripe fruits. This property of the fruit and even the leaves is known and made use of to soften meat in cooking it, by wrapping it in a leaf or putting a piece of unripe fruit along with it.

The tree is tropical in its requirements but adapts itself to a wide range of territory and thrives up to an elevation of about 3,500 feet. Shelter from winds is necessary. It is apt to rot away in ill drained soil. With proper attention to drainage, Papaya will grow in almost any kind of soil. It is easily raised from seeds, which should be collected from large sweet fruits which are well flavoured and possess a small cavity. Prefer oblong to round fruits as they are produced on self-pollinated flowers. Sow seeds thinly, 2 inches apart in seed pans or in nursery beds. When 1-1½ feet high, water the bed well and remove the plants very carefully with

20 feet high, producing sour fruits about three inches long and resembling green cucumbers. They are borne on the trunk and the oldest branches in clusters and are used for pickling, for making preserves and jams and cooling drinks. Used in certain places as a substitute for tamarind. Thrives up to about 3,500 feet and is raised from seed or by layers.
as little disturbance to the roots as possible, and transplant them into pits, made ready for them. Let the pits be at least 3 feet each way and 10 to 12 feet apart. Flowers are borne in about 5 months. The male plants bloom earlier than the hermaphrodite and pistillate flowering types and are distinguished by the cup-shaped flowers which are borne on pendent racemes, which are 2–3 feet long. It is only the trees which bear female and hermaphrodite flowers that will fruit, though the male tree may sometimes produce a few female flowers which may develop into small inferior fruit. Experiments have shown, that even male trees, when headed, produce female flowers and fruits on the new shoots that come up. A male tree need not be kept on with the idea of supplying pollen for fertilizing female flowers. Researches at Poona have shown that seedless Papaya fruits can be obtained without pollination. Fruits are ready in 10–12 months after sowing and the trees become old in 5 years, after which they are not worth keeping. Papayas are subject to a fungus pest, which shows itself by the leaves drying up and drooping down and ultimately falling off leaving the entire stem naked to die in a short time. Collect such affected leaves from the trees and burn them to prevent the spread of the spores. Pick the fruits when they show colour, if there is trouble from squirrels and birds. Liquid manure at the time of fruiting improves the flavour. Thinning of fruits and regular watering ensure large fruits.

Select one of the following kinds:—Honey Dew, Singapore or Mammoth Java. They are all well flavoured and delicious. The variety Brobdignag, though it produces very large oval fruits, is not good for eating on account of its unpleasant smell. A very dwarf variety with very large almost round fruits sweet and of excellent flavour is now available.

There is no certainty of the plant coming true to type from seed and therefore, raise plants from cuttings to perpetuate select trees. If no cuttings are ordinarily available, the best thing would be to cut the top of a good tree and thus induce it to produce side shoots.

A native of the highlands of Central America is suited for growing at elevations of 6,000 feet and above. It grows 8—10 feet high, resembles the Papaya in form, the leaves and the fruits being smaller. The fruits are sweetish and are best eaten with a little sugar as they are slightly acid. They make good jams and jellies and like the Papaya are considered good for dyspepsia.


Evergreen small trees and shrubs with polished green foliage, bearing fruits used in a variety of ways. They are accommodating in requirements of climate thriving from sea-level to about 6,000 feet, particular varieties and kinds being however better suited to particular soils and climatic conditions than others. Heavy moist soil, very light soil, and soils with an impervious layer of rock below are all unsuited for Citrus cultivation, as for most other trees. Well drained alluvial soil or rich loam gives best results. In the hot plains, most Citrus kinds do best in partial shade, such as that which is obtained in between plantains. They are planted 10 to 15 feet apart, according to the growth they make. Pits at least 3 feet cube should be made for planting them and filled with soil enriched with about 4 large baskets of farm yard manure. Watering should be done very regularly, twice a week in summer and once in 10 days at other times in the absence of rains. For watering, large basins should be made round the trees, commencing from about a foot from the stems and ending with the actual spread of the branches. Care should be taken that the budded or grafted portions are above the soil and the shoots that come out of the stock from below the graft or the bud are clean cut off. Seedlings should be allowed to grow straight without side shoots to a height of about 2 feet and then allowed to branch out. No pruning is necessary except the removal of overcrowding branches and dead and diseased parts. After cutting back to healthy parts, the wounds should be coated with a splash of coal tar or preferably white lead. Once a year, about May (the time will vary with the place and the variety or the kind grown) before the monsoon rains, the trees should
be manured liberally, by digging trenches 1—1⁴ feet deep at the edge of the basins and replacing the soil with a rich mixture of farm yard manure, bone meal and red soil, and by forking well decomposed manure into the basins. Before manuring, it is best the trees are wintered for about a week (see page 122). Old trees which have become sick by overbearing should be well fed with liquid manures and applications of oil-cake powder mixed with soil. As all Citrus plants love lime in the soil, some time after the application of manures, it would be beneficial to apply about 4 lbs. of lime rubbish for each tree. The water should be free from alkaline salts.

Among the diseases of Citrus trees, the worst is "die-back" (see page 129). There are several contributory causes for the leaves turning pale and yellowish in colour, getting smaller in size, and then the stems dying back. Presence of 'hard pan' in the soil, mal-nutrition, want of drainage, improper cultivation, manuring with undesirable fertilizers, want of iron in the soil, stock not being suited to the particular soil, exhaustion due to overbearing etc., are some of the chief causes. A deep trench about 4 feet deep and 1⁴—2 feet broad should be dug up all round the trees and filled with a rich mixture of red soil and manure. The trees should be liberally watered. If they do not improve and throw out fresh green foliage and shoots, it is no use keeping them. Gummosis is another common trouble with Citrus trees. (see page 129).

At times, Citrus trees, especially Lime trees, are attacked with an orange coloured rust, which spreads on the branches killing them. Cut away the small branches and burn them and spray the tree with Bordeaux Mixture. Among insect pests, the commonest are green and brown bugs, scales, aphis, leaf-eating slimy insect, and stem borer, known as the Citrus borer. The boarer is the larva of a beetle which gets into the stems from the tips of the shoots and tunnels down the stems, throwing out the pith or wood in the form of fine dust. The borer is killed by the creosote-chloroform mixture recommended at page 129. See chapter XI for other pests and remedies. Sometimes the fruits drop down before they ripen. Spraying the fruits when they are quarter developed with Bordeaux...
Mixture may prevent this. For Green bugs, sooty mould, and fruit-spots, lime sulphur solution applied as a spray is the best remedy.

Raise seedlings of Sour Orange or Pomelo, by sowing plump large seeds collected from ripe fruits in nursery beds. Transplant them into beds when about 4 inches high, 9 to 12 inches apart after cutting off the tips of the tap roots. As the plants grow, keep clean the lower 10 to 12 inches, without side growths. When the seedlings are about the thickness of a pencil (½ inch), when they would be about 18 months old, bud them with scions taken from select trees. Bud the scion not more than 6 inches above the ground level on the stock. The bud begins to grow in about a month. Then cut back the stock to 6 inches above the bud. When the latter has made a growth of about 9 inches, cut the remainder of the stock to the bud. Lift the plants from the beds with balls of earth carefully before planting. Oranges, Grape Fruit, Pomelo and the Lemon are best as budded plants. Grafts may be secured only when properly budded plants are not available. Layers do well also if the soil is suited for the particular kind. Seedlings though they are hardy and live long are not recommended as they sometimes do not come true to the parent and are thorny, with attendant disadvantages in collecting fruits, etc. Further, they take 4 to 6 years to fruit.

The following are the more favoured kinds of the Citrus family:

**Citrus aurantia. Orange.** There are two main types of the Orange, the loose jacketed or skinned and the tight skinned types. There are several varieties of each of these types. The Coorg orange is the best of the loose jacket type. There is a mistaken impression that this variety thrives best only in Coorg. It can be tried with success in all regions which get a fair amount of rain fall. It seems to do better in partial shade than when quite exposed to the sun. The Nagpur Orange (Santra) is the next best, being very largely grown in the Central Provinces and the Bombay Presidency. Both the above varieties have a very agreeable sweet flavour, which is also pleasantly acid. The Santra enjoys a hot dry climate. It will
also thrive in places where the rainfall is as high as 100 inches, if the soil is rich and well drained. It does well up to about 3,000 feet. The Mandarins and the Satsuma orange of Japan are imported varieties of the loose skinned type, which thrive in places with an equable climate, above an elevation of about 2,000 feet. The Mosambi, also known as the Mosambique Orange, is the most largely grown orange of the tight-skinned type. It bears large oval fruits of light orange yellow. It has not the rich flavour of the Coorg or the Nagpur. Though it can be grown in hot moist places, it enjoys a milder climate, such as that which prevails at Poona, where it is grown on a large scale. The Satgar (Sathukudi) is a large fruit, with a greenish yellow or yellow rind, with juicy sweet pulp. This should thrive in the hot plains of South India. The Washington Naval Orange is known as the 'King of Oranges.' It possesses a very fine flavour and has splendid keeping qualities. The fruits are distinguished by a naval-like mark. This variety thrives at elevations above 3,000 feet. Late Valencia is another imported variety of great merit, resembling the Mosambi but thriving only at places where the Naval orange can be grown. Jaffa is another good variety. It can be grown from 1,000 feet onwards. 'Batavian Orange' is another very good variety, introduced by the Dutch, and grown largely in the Andhra country.

Citrus decumana includes the Pomelo (Vern. Pappas, 'Bombalimas,' 'Chakkōtri,') and the Grape Fruit. The inside may be white or pink. There are good varieties of both kinds. It is necessary to get the best variety from known places, as inferior kinds are acid and bitter. There are certain local varieties as from Davanhalli in the Mysore State, which are excellent. Layered plants do very well. They should not be allowed to bear fruit within 3 years. The Pomelo is hardy and thrives up to an elevation of about 5,000 feet. Shaddocks are imported varieties of Pomelo, which are less hardy and shorter lived in our climate than the Pomelo. Plant 15 feet apart. The Grape Fruit produces fruits in bunches as in grapes. They are sour, bitter, very juicy and are of high medicinal value, being recommended for complaints of liver and
dyspepsia. On account of their medicinal value, Grape Fruits are now being grown on a large scale. The best varieties are Marsh's Seedless and Triumph. They require the same treatment as imported Orange trees.

*Citrus medica* is found in several distinct varieties. They are:—(1) *Citrus medica* proper, known as the *Citron* (Vern. 'Madalada hannya,' 'Mahalung,' 'Turanj') is a large shrub or small tree growing 8—12 feet high and planted 12—15 feet apart. The fruits are large, about 6 inches in diameter and 6—10 inches long; they have a thick rind, which is the part used for making sweets, and in confectionery. The fruits are valued for their medicinal properties. Secure well grown seedlings which bear in 4—5 years or budded or grafted or layered plants. (2) *Citrus medica* variety *acida* is the ordinary *Lime* (Vern. 'Nimbu,' 'Elumichhai,' 'Nimbe'). Very useful small, oval or round fruits, with thin rich yellow skin, borne in plenty all over the small trees. Seedlings are hardy but secure grafts for early yield and to be certain of the variety. Grown like the Orange. Susceptible easily to rust, aphis, scales, sooty mould, and die back. Slight shade, plenty of water and good drainage are necessary, as also shelter from winds. Plant 10—15 feet apart. There are many varieties. Select the smooth skinned large fruited kind. The seedless and the spineless varieties are also available. Aiyampettai in Tanjore District is noted for its Limes. They grow easily in the plains and up to an elevation of about 3,000 feet. (3) *Citrus medica* variety *limetta*, known as the *Sweet Lime* (Vern. 'Sakhar Limbu,' ) is a distinct variety bearing fruits of the size of an orange with a smooth pale green rind. It is sweet and juicy and is refreshing, when made into a drink. The tree is slightly yellowish in appearance. (4) *Citrus medica* variety *limonum* which includes the *Lemons* is used very much like the Lime, for pickles and for making drinks. The imported kinds, Lisbon Lemon, Villa Franca and Eureka, bear superior fruits of good flavour in great profusion and they are best grown at elevations of above 2,000 feet. Secure budded or grafted or layered plants. The Jamburi which bears wrinkled and somewhat loose skinned
fruits is exceedingly acid and is used as a hardy stock for budding oranges. Malta Lime and the country variety of it known as the ‘kadaranga’ or the ‘dodda herale’ are also good as stocks for budding.

**Cyphomandra betacea. Tree Tomato. N. O. Solanaceae.**

A small tree, five to six feet high, with large fleshy evergreen leaves. The fruits are egg-shaped, about two inches long, and borne in clusters of two or more at the ends of the branches. The colour is either reddish yellow or deep purple, there being two kinds. The skin is smooth. In character, the fruits resemble those of the Tomato. They are sub-acid and succulent, enjoyable and refreshing, eaten raw or better still as stewed food. They are also used to make jellies and jams. The tree is raised from seeds, grows quickly, is ready for planting out in about 3 months, and begins to bear fruits in 2 years, and remains productive for several years on the hill stations. At medium elevations of about 3,000 feet, it lives for five or six years. The tree thrives only at elevations of 2,500 feet and upwards. Plant 10 feet apart and water liberally in summer and in the absence of rains. A native of Peru, where it grows from 6,000 to 10,000 feet above sea-level. This tree is now commonly grown on our hill stations. A pretty tree for planting on the lawn.


A slow growing medium sized deciduous tree with handsome leathery leaves. A native of Japan and China, where it is grown extensively, being considered one of the best fruits. The tree is usually dioecious, bearing male and female flowers on different trees and hence presenting difficulty in pollination. In the absence of male trees nearby, the female tree does not set fruits. The fruits are smooth skinned, shining, bright orange or pink or dark purple in colour, globular or pear-shaped, 2—3 inches in diameter and weighing 3—6 ozs. each. The pulp is soft, sometimes almost liquid, orange coloured, sweet and has a pleasant flavour, which is suggestive of an overripe Apple with a little of the taste of the Melon. From unripe fruits, a preserve is made. The best varieties are dried by the Japanese.
and the Chinese and they are said to be equal to dried figs. The
fruits ordinarily contain 2 seeds or more up to 8 but seedless
kinds are also known. Secure seedless best varieties grafted on
seedlings. The tree is subtropical in climatic requirements and
is worth trying in this country at medium elevations and on hill
stations, where rainfall is not heavy. The tree is not exacting
in soil requirements, does well in varieties of soil, with suitable
drainage excepting the clayey soil. It loves moisture at the
root and hence does best in dry regions with a good supply
of water for irrigation. Distance apart for planting is 15—18
feet. Head the plants when about 2½ feet high for specimen
formation.

Eriobotrya japonicus, Loquat.—See under Photinia.

Eugenia jambolana. The Jamoon, or the Jamul Tree. N. O.
Myrtaceae. Vern. 'Jamoon,' 'Nerale,' 'Naval,' 'Naka'.
A large timber and shade tree, native of Tropical Asia. The
fruits are blue black in colour and have a purplish juicy pulp
enclosing a large stone or seed. The fruits are reputed for their
cooling properties and for their anti-diabetic medicinal value.
The tree is very hardy, requires very little cultivation and
thrives best on river banks and such places where the water is
within ten feet of the surface. Secure grafts of superior kinds
which bear large fruits, 1—1½ inches long and ½ inch in dia-
meter, with very small seeds. Grows about 35 feet high. Plant
35 feet apart.

'Gulab jamoon', 'Pannerale', 'Seeni jambo'.
An ornamental evergreen tree growing about 25 feet with
a spreading habit, bearing flowers with numbers of white long
stamens and fruits about the size of small Limes. The thin
pulp which encloses a polyembrionic large seed is sweetish in
taste with a pleasant rose flavour. The tree is indigenous to
India and Malay and thrives in warm moist regions, as also in
the cool dry subtropics if supplied with water plentifully. Best
for avenues, for shade and fruit in gardens. Propagated from
seeds. Secure grafts of best specimens.

'Malaya jam'.
A native of Malaya Archipelago. Very ornamental conically shaped tree growing 30 to 40 feet and endowed with large leathery, shining, elliptic-oblung, acuminate leaves. Flowers are borne in clusters and they have numerous long rosy-red stamens, which when they drop down spread a bright carpet under the tree. The fruits are pear-shaped, white or crimson in colour, 2-3 inches long and 1½-2 inches in diameter. The skin is thin and the flesh crisp, "applelike", white, juicy, with refreshing sub-acid flavour, enclosing a fairly large seed. The tree is tropical in requirements and fruits best up to an elevation of about 2,000 feet in moist hot regions. Seedlings take about 8 years to fruit but layers or gooties fruit in 3 years.

**Eugenia fragrans** is a large shrub or a small tree, and bears white fruits smaller than *E. malaccensis*. Requires plenty of water.

**Eugenia Micheli. The Brazil or Surinam Cherry.** *N. O. Myrtaceae.*

Indigenous to Brazil. Small shrubby tree branching close to the ground and bearing small dark green leaves. Attains a height of 12-15 feet in good soil. Fruits are deep red in colour, about an inch in diameter, flattened at the ends, round and ribbed, soft and juicy with a sweetish acid aromatic taste and good flavour. Excellent for jellies, preserves, or stewing—also for dessert. Fruits are resinous and pungent before fully ripe when they are scarlet in colour. Raise from seeds. Sow 2 inches apart and transfer to nursery beds when about 3 inches high. Plant out 10 feet apart. Remove all suckers. Water freely. Unless watered freely when the fruits begin to change colour, they do not develop in size.

**Ficus Carica. Fig.** *N. O. Urticaceae.* Vern. 'Anjur'.

A large shrub or a small tree, 15 feet high. A native of the Mediterranean region and Turkey, where it is very extensively grown. It is a fruit of the warm temperate zone and can be grown up to an elevation of about 3,500 feet in places with a dry climate. Places which get heavy rainfall during the S. W. monsoon are not suited for growing the fig, as rain during the ripening period of the fruits is not conducive to ripening or good flavour. The fig is propagated from cuttings of
well ripened shoots of the previous year’s growth or even older wood; pieces containing 3-4 plump buds are inserted in loose sandy soil in nursery beds, 9-12 inches apart. After rooting, the plants are taken out carefully and planted in filled up pits, 12-15 feet apart. Deep, well drained, rich, loamy soil is best. The site should be fully exposed to the sun but should be well protected from winds. A certain amount of root restriction too is relished by the trees; this explains why trees planted by walls fruit and thrive well. During the first year, the plant should not be allowed to fruit. The tree for the future years should be built up during the first two years in the following way. First only a straight vigorous shoot is allowed to grow about two feet of ripened wood. Then, its top is pinched to encourage it to send up 3 to 4 side branches. When these have grown about 18 inches, they are also pinched back to make them branch out again. This kind of treatment ensures good shaped strong shrubs. But pruning in Bangalore and South India has not been successful. Here it is better to leave the plants to their natural growth. Plants bleed profusely if pruned as a result of which there is severe set-back in their growth. Watering should be freely done when the plants are bearing. When the fruits are beginning to ripen, watering should be stopped. Liquid manure applied while the fruits are ripening increases their size and quality. Thinning out fruits also produces similar results. As figs are surface feeders, decomposed cattle manure should be applied to the basins and dug in gently once or twice a year. ‘Poudrette’, which is obtained by allowing night soil to decompose amidst layers of soil and ashes for 9-12 months has given best results. Figs fruit on young wood like the Grape. Hence, new strong shoots should be encouraged by pruning back old branches. Superfluous shoots and suckers should be pruned away. As not all varieties fruit well, only local varieties which have been tried successfully are to be secured for cultivation. Non-fruiting of certain Smyrna kinds is due to the difficulty of pollination on account of the absence of the natural agent, a fly.

A good sized tree with sparse small foliage, growing 40—50 feet. A native of Ceylon and India. Can be given a place in a large garden for the fruits, which are of the size of a cricket ball, and have a hard woody shell enclosing a mass of soft brownish mealy aromatic smelling substance which is sweet and acid when ripe. The fruit is cooling in property and has medicinal value. Thrives in dry as well as moist low regions. Propagated from seed.

*Fragaria vesca.* Strawberry. N. O. Rosaceae. A low herbaceous perennial, creeping on the ground and increasing itself by runners. Improved cultivated kinds are many and they are grown with success only above an elevation of about 3,000 feet. At lower elevations, the plants may be grown for a season only bearing inferior fruits lacking in flavour. The fruits are heart-shaped, 1—1½ inches long and 1—1 inch in diameter, very juicy, pleasantly sweet and rose scented, from which the name "fragaria" is obtained. The soil required is very rich loam. It should be dug up to a depth of at least 15 inches and it should be well drained. A waterlogged position is fatal to Strawberries. A warm sunny aspect is best. Long beds 3—4 feet broad are made, manure is liberally dug into the soil, and healthy suckers or rooted runners are planted firm in rows, 18 inches apart, with 15 inches from plant to plant. Planting should neither be too deep nor too shallow. The crowns of the plants should be showing above the soil. Planting should be done with the help of a trowel, making large enough holes for spreading out the roots before firming the soil on them. The bed should be kept moist by irrigating it once in three days. If watering is done from above as with a watering can, care should be taken that the water is not poured on the plants, especially when they are in bloom. The soil near the plants if drenched well would moisten the soil under the plants by percolation. The only points to be attended to are periodical and careful hoeing only with a view to keep down weeds, removal of runners during the season of fruiting, and regular watering and feeding with liquid manure when fruits are forming. The soil should not be stirred at any time as the roots are on the surface and would get damaged. Weak
doses of cow-dung water or guano used as liquid manure are attended with beneficial results. Fruits are borne in April to May and the runners should be planted in September to December. Planting should be done on the hills from February to April. The beds need attention even after the fruits are picked. Neglect results in weaker crowns and poorer crops during the next year. About August, new roots are formed around the collar from the crowns and these are the roots which feed and sustain the plants next year. These roots should not be damaged while top dressing the soil in December for the crop in March—April. The beds need to be renewed every two years. Of the diseases, the "rust" which is caused by copper coloured spores is dangerous. The only remedial measure is to pull out affected plants and burn them and dig lime into the soil.

**Garcinia Mangostana. Mangosteen. N. O. Guttiferae.**

A small conical ornamental tree, 20—30 feet high, very slow in growth, with large leathery deep green leaves glistening in sunlight. Flowers are polygamous. The fruit is of the size of an orange, round and slightly flattened at each end, with a smooth thick rind of beautiful purplish rich red. The rind when removed, reveals a delicate snow-white juicy pulp, which is the part eaten—surrounding and adhering to the seed. The tree is a native of Malay Peninsula and Sunday Islands and is extremely limited in distribution. It is little grown in India but is grown in Ceylon to some extent. The fruit is considered to be "the most delicious fruit of the tropics; delicately and finely flavoured". Propagated from seed, from which it takes about 12 years to fruit. Secure 2 feet high plants. Great difficulty is experienced in raising plants on account of the weak root system. Propagation by gootying is possible. It is a strictly tropical tree with its demands with regard to soil conditions also definite. Heavy loam with lot of soil moisture, and light shade throughout the life of the tree are essential. Suited only for a humid climate from sea level to about 1,500 feet.

**Mangiferus indica. Mango. N. O. Anacardiaceae.** Vern. 'Am', 'Manga', 'Mavu'.

Quite a big volume may be written on the Mango, its uses,
varieties, cultivation, etc., but here for want of space only certain important information can be given regarding it. The Mango is a very popular tree, held sacred on account of its great uses. The fruit is called "The King of Fruits", "the apple of the tropics and a friend of the rich and the poor alike". While green, it is made into chutney, pickles, etc., and when ripe it is excellent for eating "out of hand" and for making jelly and marmalade.

The tree is indigenous to India and is tropical in requirements thriving best in hot dry country up to an elevation of about 3,500 feet or more. At higher elevations, it does not bear fruit satisfactorily. It is a hardy tree which adapts itself to a variety of climatic conditions. It is known to fruit and grow well at Saharanpur where the temperature comes down to 20 degrees F, and also in places where the temperature goes up to 120 degrees. It is known to grow in wet Malnad districts, in hot dry places, and in the hot humid atmosphere along the sea-coast. It, however, thrives best in places which get a rainfall of 33 to 50 inches from June to September. In places with less rainfall, it can be grown near tanks or in irrigated land. The flowering season is from January to March and the fruits ripen from May to July and August. Rain at the time of blooming prevents pollination and setting of fruits.

There are numerous varieties of the Mango, differing in size, shape, colour, quality, etc. Inferior varieties have a certain turpentine smell, with the pulp full of fibre and are sour. The best kinds are large in size, have a small seed with plenty of fibreless pulp, of fine flavour and have a thin rind, and keep long. The naming of varieties of the Mango has been much confused, the same varieties being called by different names in different districts. Among the noteworthy varieties may be mentioned the Badami, Mulgoa, Raspuri, Kalkanda, Neelum, Sundarshaw or Thothapuri and Rumani of South India and Mysore; Alphonso, Cowasji Patel of Bombay; Fazili of United Provinces; Langra, Baramasia, Gopalbag, Kishenbagh of Bengal; Banganapalle and Jehangir of Krishna and Godavari Districts. There are certain excellent varieties of purely local importance as the Padiri. Except the Baramasia, which bears
twice a year. It is however observed that wherever the trees are grown on river banks or tank bunds where their long tap roots reach a supply of underground water, fruiting takes place without fail every year.

The tree grows to a height of 30—40 feet and should be planted at least 35 feet apart. Seedlings grow tall and vigorously. Grafts do not grow very tall but they spread out. The Mango is adaptable to a variety of soils. Being deep rooting, it requires deep soil. If there is an impervious layer of rocky soil below, the tree stops growth, fails to fruit, and gets sickly. Like other fruit trees, the Mango requires a well drained soil. Make large and deep pits, at least 3 feet long and broad and 5 feet deep and fill them at the bottom with a mixture of the top soil and plenty of farm yard manure and about 10 lbs. of bone meal or crushed bones. Choose stocky plants with deep green foliage. Get grafts of superior varieties. Beware of the fraud practised by certain nurserymen who sell grafts of seedlings on seedlings, which will bear fruits of doubtful quality only after 10—12 years. Genuine grafts will flower and fruit in a year but it is advisable to remove all the flowers till the fourth year. Water the young trees in summer and at other times in the absence of rain. Mangoes require good treatment like other trees. Keep the land clean in between the trees and free from weeds. Secondary crops may be grown in between the trees for the first four years. Then, plough up the land once before the rains and once at the end of the rainy season. Cut away all dead branches. Have an eye on the trees for the parasitic plant, Loranthes, the Indian Mistletoe (Vern. ‘Bandarike’, ‘Banda’) and remove it. Water the trees from the time the fruits set till they ripen, once in a month or fortnight. Manure the trees liberally at least once in two years.

The Mango hopper is a pest. Smoking under the tree is reported to scare them away. Other enemies are sooty mould, green bugs, mildew on young foliage, etc., but spraying for these is too costly to be tried with benefit. A good rain will free the trees from many of the pests.

_Monstera deliciosa._ (N. O. Aroidae).
SELECT FRUIT TREES

See page 333, under Philodendron pertusum. The chief draw-back of the fruit is the disagreeable itching caused in the throat by the small spines which are attached to the inside portion of the fruit.

Morus indica and nigra. Mulberry. N. O. Urticaceae.
There are several varieties of the Mulberry bearing long white or long purplish black or oval small purplish black fruits. The trees are small and require no special treatment. Once planted, they grow without much care. In winter, the trees may be cleared of all the overcrowding branches intertwining each other. Plants grown from cuttings bear in two years. Grown on a large scale for feeding silk worms in silk industry.


The cooking varieties are generally known as the Plantains and the table varieties are known as Bananas. All varieties can be used as vegetables in their unripe stage. Here, all kinds are called generally Plantains. They grow quickly, 10 to 20 feet high, with a straight herbaceous stem made up of succulent leaf-stalks. Fruits are seedless in all cultivated varieties. They are borne 10—15 months after planting. The flowers are in clusters alternating with reddish succulent scales, which drop off, when the fruit-stalks develop, and the fruits are borne in combs or clusters. Plantains are of value both for ornament and for their fruits.

There are several varieties and the same variety is often called by different names in different places. The following are recommended:—Raja Bale, Rasa Bale, Yalakki Bale, Gular Bale, Putta Bale, Chandra Bale, Pache Bale and Menasu Bale, for fruits and Madharama and Burdu Bale for cooking. The above are from Mysore State. The Mondon is the best cooking variety of the Tanjore District, and the Nendarangai of Malabar. Rastali, Peyan, Pacha nadan, are good fruits from Madras. The Red Banana is synonymous with Chandra Bale, the Golden Banana with Raja Bale, the Chinese Plantain is probably the same as the Putta Bale or Musa Cavendishii, (a dwarf-variety growing only 6—8 feet high).

Plantains are found up to an elevation of about 5,000 feet
fruiting at all times of the year. They thrive best in places where heat and moisture are available in a high degree, in rich alluvial soil, as on river banks which is rich with the silt brought down during the rains. It should however be mentioned that they are not delicate in respect of soil, the only type unsuited being rocky calcareous soil. Loose porous soil with plenty of humus in it gives best results. Though moisture in plenty is essential, the soil should be well drained. Into the prepared pits or trenches, at the bottom, a layer of at least one foot of bulky manure such as partially decomposed manure and leaf-mould is best put a long time before the actual planting. As the plantain has to produce plenty of foliage and a huge weight of fruit in a short time, it should be manured liberally. The hot weather is the best season for planting, rooting then taking place quickly and the roots being enabled to utilise the rains coming later on. If planted during the rains, some of the plants are lost as the weaker rooted ones rot away. The suckers are separated from the parent by a clean cut. The roots are trimmed back to healthy parts, and then the suckers are planted firm one in each pit or in trenches, 15—18 inches below the level of the soil, and 9—12 feet apart according to the growth of the variety. The plants should be sheltered from wind from all directions. Excepting the dwarf Cavendishii variety, all others should be supported by bamboo tri-pods made by tying up three bamboos at the top, especially when in fruit, or, a year’s labour would be wasted. It is advantageous to cut off the pendulous ball of flower bracts, when the fruits are all set and are developing. It is also beneficial to retain only two suckers on each tree, if fruits of large size are desired. Cutting of the green leaves tends to weaken the plants and the resulting bunches of fruits would be small and inferior. As the Plantain is generally a surface feeder, apply oil cake powder or ammonium sulphate and ashes to the pits or trenches and dig them in. Water once a week at least, very liberally, so that the water soaks through the entire soil. Replant in new trenches or pits once in 2—3 years.

The Plantain is subject to very few diseases and pests. The stems of trees which have borne fruit should be removed clean
or they begin to rot in the ground spreading the rot to healthier plants. Sometimes a little whitish fungus appears on the stem, the evidence of a decaying stem. It is best to cut the affected stems and burn them.

**Nephelium Litchi. The Litchi. N. O. Sapindaceae.**

A native of South China and commonly grown in Northern India. Very ornamental, growing about 30 feet high, with a round-topped head of glossy evergreen foliage. The fruits are borne in loose clusters at the ends of the branches, 10-20 or more in a cluster. They resemble Strawberries in appearance, are oval in shape, about 1½ inches long and 1—1½ inches in diameter, are green-yellow to deep rose in colour when fully ripe. They consist of a hard brittle rind with a rough surface divided into small areas, a fleshy aril, which is free from the seed which it surrounds. In superior varieties, the aril is thick and the seed very small or absent. The edible part is the aril, which is white, firm, juicy, and pleasantly sub-acid in flavour. Fruits are best in the fresh state. The canned or preserved product is said to "resemble preserved Muscat grapes in flavour". The sun-dried fruits, known as "Litchi Nuts" in America, are somewhat like raisins. For drying, gather clusters of fruits with parts of branches attached to them, as individual fruits removed from the bunches do not keep for more than 2 to 3 days.

Litchi is essentially tropical in its requirements. But it can be grown up to 3,000 feet above the sea. It requires a deep rich soil, plenty of soil moisture, a humid atmosphere and freedom from frosts. It however adapts itself to a variety of soils and drier climate in well irrigated areas.

Secure layers or grafts of superior varieties as McLeod's, Bedana, Rose-scented or Muzafferpore. These fruit in 4—5 years, while the seedlings may take 8—12 years or even more. Seeds should be sown within a week after the fruits are removed from the tree, as they lose their viability very soon. Plant 30 feet apart. Feed the tree with liquid manure, when the fruits are set. Manure liberally every year. The only serious disease is the rust, which at times curls the leaves rendering it brown and thick. Cut away the diseased branchlets and burn them.
Passiflora edulis. The Passion-Fruit. See page 332.
Passiflora quadrangularis Granadilla. See page 332.

The Avocado is “one of the undeveloped sources of food which the tropics offer at the present day.” The tree is being increasingly grown. It is a food in central America, “four or five corn cakes, an avocado and a cup of coffee constitute the meal of an Indian in Guatemala.” The fruit is noted for its nutritious properties, containing a comparatively large percentage of proteins, mineral salts and vegetable oil or fat. In the form of a salad along with onion, lettuce, and other vegetables, it is much relished. It can be eaten by scooping out the flesh with a spoon and flavoured with salt and pepper or with sugar.

The fruits vary in shape from round to pear shaped or oval, in weight from 1—3 lbs. in colour from green to purplish black. The trees grow 20—25 feet high and bear 4—5 dozens in large fruited kinds and more, 200 to 300, in small fruited kinds.

Horticulturally, Avocados are divided into 3 races, the Mexican race (1) P. drymifolia, (2) the West Indian Race (P. americana) and (3) the Guatemalan race (also P. americana). In the first type, the skin of the fruit is thin and the leaves are anise-scented. This type is subtropical in requirements and thrives only from 2,500 to 5,000 feet above the sea. In the other two types, the leaves are not anise-scented and they differ in the thickness and texture of the skin of the fruits. The West Indian race is best suited for low elevations in the tropics. It thrives best in moist regions from 1,000 to 3,000 feet. Dry conditions are not suited for all the types. They all grow best in deep rich moist loam, with the water table near the surface.

Raise seedlings from seeds which should be sown fresh. As seedlings do not come true to parent, bud them when about $\frac{3}{4}$ inch thick with buds taken from a select tree. Plant the budded plants about 25 feet apart. Cut back terminal shoots. This encourages them to branch out and spread. A good spread helps to keep the soil below cool and moist, which the trees want. Being rapid in growth, they are gross feeders and so
dig in plenty of manure making the basins larger and larger as the trees spread out. Water liberally never allowing the soil to get dry. Mulch the soil in summer. As the roots are on the surface, don’t cultivate the land deep. It is a hardy tree with very few pests.

**Photinia (Eriobotrya) japonica. Loquat. Japanese Medlar.**

Indigenous to China and Japan, a small tree about 23 feet high with an ornamental crown, oval or round in form and normally compact and dense. Flowers are borne in terminal panicles and are very fragrant. Fruits are in loose clusters, oval or round, 1—2 inches long, pale yellow to light orange in colour. The skin which is downy surrounds the flesh which is firm, white or orange in colour, and is juicy, subacid and of a pleasant flavour. Seeds vary in number from 1 to 10. Seedlings take 8—10 years to fruit. Secure gooties or grafts from good large fruited kinds. These bear in 4 years. Budding by inverted T method succeeds well.

Select heavy well drained soil. Plant 15—18 feet apart. Water freely, but the tree also resists drought. Thrives from 1,500 to 5,000 feet, being subtropical in requirements. Frost is injurious. Manure well as it exhausts the soil. Best pruned after each crop reducing the number of internal branches to admit of light and air to the centre. Thin out for fruits of good size.

**Phyllanthus distichus. Star Gooseberry.** N. O. Euphorbiaceae.

Vern. ‘Siru-nelli’ ‘Kiri-nalli’.

A small tree with long graceful feathery leaves, bearing fruits in clusters from the old wood. They are used for pickles and for making a delicious preserve cooked in sugar. Bears twice a year, in April and August. Propagated from seed. Thrives up to about 3,500 feet. Plant 20—25 feet apart.

**Phyllanthus Emblica.** N. O. Euphorbiaceae. Vern. ‘Nalli-kai’, which is well known and used for pickles and sweet preserves, as ‘morubba’. Grown from seeds selected from trees which bear fibreless large fruits. Plant 30 feet apart.

**Physalis peruviana. Cape Gooseberry. Peruvian Cherry.**

See page 521.
A roundish fruit with smooth exterior about the size of a Rose Apple with a stone shaped like an Almond. The tree fruits only on hill stations. Even at Bangalore, though the tree grows well, it does not fruit freely. Method of cultivation is the same as that of the Peach. It bears its fruits on young wood and hence an annual succession of young shoots should be aimed at by cutting back crowded and very old and ill shaped branches. Fruits are borne in May to August. The ‘nut’ trees are suited only for the Himalayan regions in North India where there is a natural distinct winter season.

Prunus domestica and bokharensis. Plum. N. O. Rosaceae.
Only successfully cultivated on the hills. Grown like the Peach. Fruits are borne both on spurs and young wood and hence pruning is lightly done, only clearing out the centre of the tree, reducing very old growths and removing only thin and useless branches and side growths. The tree is to be wintered in January and manured thereafter. Even at Bangalore, the tree does not fruit freely. One or two varieties of Blue Plums fruit here. P. bokharensis is a kind grown in parts of Northern India and at high elevations.

Prunus persica. Peach. N. O. Rosaceae.
The Peach also thrives like the Plum and the Apricot only on hill stations. Peach, Plum, Apricot as also the Apple and the Pear are a class of trees which are only suited for cultivation at higher elevations, some thriving and fruiting at comparatively lower elevations of about 2,500 feet than others. The Apple seems to require a lower elevation than others, the best fruits being produced at Bangalore with an elevation of about 3,500 feet. All these trees require a long enough period of rest, a long winter, for successful fruiting. At places where this does not obtain, the trees are artificially wintered as described in page 122 by withholding water to the roots and exposing them to the sun and even cutting back some of them when filling in the basins with fresh earth. Rainfall during the period of bloom prevents pollination and consequently setting of fruits. All the kinds mentioned above need full exposure to the sun and
shelter from strong winds. The soil should be deep loam and should be well drained. They do not require copious watering except when the fruits are developing. Planting is best done during the cold weather. The plants establish by the time the rains set in. If planted during rains, they may suffer from collar rot and die. To prevent this, the trees may be provided with collar pots, as stated in page 128. Reference may be made to pages 120-1 for pruning these trees. The apple, in this country, takes very unkindly to pruning, the trees never recovering from the shock, refusing to grow after pruning and dying ultimately. All the above trees have almost the same common fungus and insect pests. A reference may be made to Chapter XI for remedies as occasion arises. Preventive spraying (see under Apple) with Bordeaux Mixture helps to keep them in check.

Peach, bears fruits which are fleshy, health-giving and delicious. They have a large stone inside. The superior kinds bearing large and luscious and 'melting' fruits cannot be grown in India, except on hill stations which do not get much rain. At medium elevations, only the 'Indore' variety thrives and fruits satisfactorily. Get layers from free fruiting trees or budded or grafted plants and these bear in two years. Seedlings take 4 to 5 years to fruit. Plant 15—20 feet apart. The trees make very vigorous growth of wood and foliage and hence for ripening the wood and to make the trees take rest and fruit well, they should be severely wintered. Wintering is best done for a period of a month in November or January. After wintering, the new shoots are cut back to two thirds their length. Peaches bear on one year old stems. These are cut back to about 6 buds. Watering is sparingly done till the blooms appear. When the fruits set and are developing, watering is done liberally, and this is continued till the fruits ripen. Watering is discontinued thereafter. Trees younger than three years should not be wintered. Peaches usually bear too many fruits for them to be able to bring all of them to maturity, as a result of which many drop off while yet young. To prevent this wastage, fruits while still very small are best thinned, keeping only one fruit for every six inches of branch. On trees older than three years
more fruits may be retained. Gummosis and leaf-rust are two common pests.


Hardy, valuable, large shrub or small tree, 15 to 20 feet high, growing without much care and attention. A native of Tropical America, naturalised in India. Fruits are round, oval or pear-shaped in form, commonly yellow in colour, with pink or white flesh inside, in which are found several hard seeds. There are one or two varieties with very few seeds. In one particular variety, the seeds are ‘paper shelled.’ The flavour is sweet, musky and distinctive. Fruits may be ‘eaten out of hand’ or made into fine jelly or jam.

The tree succeeds well in almost every type of soil from the sea level to about 5,000 feet. Secure layers or grafts of best varieties, in preference to seedlings which do not often come true to parent. Plant 15 to 20 feet apart. Irrigate during the dry season. Bears two crops a year. Thin out fruits while still small to secure large fruits. The Allahabad, Benares, and the Seedless are a few of the best varieties. Guava is a heavy bearer and ripens its fruits over a long period. Common pests are scales and fruit flies.

**Psidium cattleianum. The China Guava, The Strawberry Guava.** A native of China, growing 10—20 feet high, small and ornamental. The fruits are small, many seeded, only an inch in diameter, borne in plenty, of a deep claret colour, and with flesh which is sweet and aromatic, palatable, soft and juicy. Thrives at medium elevations from 1,500 to 4,000 feet. Mostly used for making jam and jelly.


Very popular hardy bush or small tree, 12—18 feet high, supposed to be a native of Persia and the Mediterranean region, but known here from very ancient times. The roots, seeds and the rind of the fruits are used in medicine, especially for cough and bowel complaints. The pulp surrounding the many seeds is juicy with a delightful subacid flavour and is very refreshing. The variety with acid pulp is useful medi-
The Pomegranate is not particular about soil and grows in elevation of up to 4,500 feet. No climate is too hot for it, provided water is available. Though the tree is drought resistant, it can tolerate a certain amount of wetness of soil. In certain places, the tree is used for fencing on account of its hardy nature and freedom from attacks from cattle and also the usefulness of the fruits. Good fruits are only obtained in semi-arid regions where there is high temperature accompanying the ripening of the fruit, which extends over a long period. Deep heavy loam suits its best.

The seedless Bedana and Kabul varieties are the hallmark of quality but they do not fruit in the plains. Here, the fruits contain a large number of seeds, the superior varieties possessing more pulp and less seeds. The Nagpur variety is considered to be very good. In the Mysore State, Madhugiri, Chintamani, and Bangalore produce fruits of good quality and size. Seedlings take 4 to 6 years to fruit. Propagation is easily done from cuttings and layers too. Grafts give quickest results, fruiting in less than two years. But it is best the trees are well formed and make stocky growth during the first 2 or 3 years. Plant them 15 feet apart. Grow them to single stems up to a height of about 3 feet. Cut them back to 2—2½ feet from the level of the ground, and out of the new shoots that start from stems, retain three to five of the strongest, well spaced and symmetrically placed ones. When these scaffolding branches have grown about four feet, cut them back reducing them to about half their original length. Allow only 2—3 shoots on each of these primary branches and remove the others. Thus pruned, in the first two years, the trees grow into fine specimens with a strong frame work, and thenceforward, pruning is only restricted to the removal of the suckerlike growths from the base, of the overcrowding or intertwining branches and of the dead and very old branches. The trees yearly increase in size and bear increasing crops for about 15 years. They may be renovated by cutting the branches back to about 2 feet from the base and retaining only a few shoots. As Pomegranates bear fruits on short spurs produced on mature wood, a vigorous pruning of the branches results in failure to fruit for about two years.
till the new shoots mature into bearing wood. Manure the trees once a year and water once in 10—15 days moderately. Fruits are produced thrice a year. They are large only if the trees are allowed to fruit annually.

The commonest and the worst pest is the "Anar caterpillar," which is the larva of a small blue moth. When the trees are in flower or when the fruits are of the size of a small betelnut, the moth lays its eggs in them. These hatch and the caterpillar-like small larva enters the fruit boring a hole and attaining full size in the growing fruit, as a result of which the fruit becomes useless. If there are only one or two trees in a garden, it may be worthwhile to examine flowers and small fruits and wipe off the eggs and if the eggs have hatched, remove the flowers or fruits too. Enclosing the young fruits in small cloth bags prevents at least 50% of the fruits from being spoiled by caterpillars. The same bags may be used over and over again for about 2 years. The infected fruits should be collected and burnt. A regular destruction of the fruits combined with clean cultivation should be helpful to get over the trouble from the Anar caterpillar in 2 or 3 years.

**Pyrus communis. Pear. N. O. Rosaceae.**

The Pear thrives only on hill stations, at an elevation of 3,500 to 7,000 feet with a rainfall of 50 to 70 inches and is hardier than the Apple. The fruits produced at medium elevations are hard and not "melting." The Pear prefers a light to a heavy soil. Grown like Apples.

**Pyrus malus. Apple. N. O. Rosaceae.**

The Apple seems to be most delicate of the class of temperate trees mentioned above. It requires a dry atmosphere when the blooms appear, a pretty long winter, and an elevation of 3,000 to 5,000 feet for best results. The climate of Bangalore is very well suited for growing Apples and numbers of Apple orchards are now being grown round about Bangalore. The variety which is considered the most hardy and suited for the climate is Rome Beauty. Other varieties as Red Rome, Cleopatra, Ribston Pippin, Cox's Orange Pippin, Nonpareil, General Carrington, and several others are giving good results. In Bangalore, the Apple trees reach a height of about 10 feet or more.
and are grown in the form of bushes. They are planted 10 to 15 feet apart in well made and filled pits, the soil best suited being red loam. Perfect drainage of the land is very essential; the plants will die after three or four years if drainage is imperfect. Every year, thousands of plants are imported from Australia. They are budded on Northern Spy stock, a stock which resists the Blight which ruined many of the old Apple Orchards of Bangalore, 20—30 years back. Grafts are made locally, by grafting imported scions on suckers taken from mature trees. Root-grafted plants give excellent results and are easy to raise. One has only to select thick large roots from a mature tree, cut them into lengths of about 6 inches and whip- or side-graft them with healthy scions, and insert them in soil for rooting. The trees should not be allowed to fruit for the first 3 years. The ideal trees are those which have clean single stems up to a height of 1½—2 feet and then allowed to branch out to form a goblet formed bush. Pruning is attended with disaster to the trees. The branches begin to die back, or they refuse to grow and bear. Wintering is done generally when the plant is resting. In Bangalore, for about 10 days in January, after a crop is removed, the irrigation is stopped, and the soil is removed from the basins as described in page 122. Care is to be taken that the small fibrous roots are not cut or damaged as they are responsible for developing the fruit buds on the tree by supplying nourishment to them. The basins are refilled with fresh compost made up of 2—3 baskets of decomposed sheep manure, 5 lb. of oil-cake powder, 3 lb. of bone meal and red earth. If artificials are applied, only superphosphate, sulphate of ammonia, and sulphate of potash are to be used along with organic matter as leaf mould or manure. The stems are enclosed in collar pots as shown in the plate to prevent collar-rot. Irrigation is done in the basin outside the circular pot, so that the stem in contact with the soil is kept dry. Collar pots are also helpful in keeping away white ants, especially when they are filled with rough sand, or left unfilled round the stem from the level of the roots upwards. The basins are irrigated copiously once a week, stirred up lightly on the surface for aeration three days after each irrigation. The time for
wintering has to be so adjusted that the blooms do not get caught in a rain, as it would result in the complete failure of a crop. The trees may be wintered again in August or September in Bangalore so that the flowers may be produced in October or so, when the rains cease for some time. In Bangalore, it should be mentioned the Apple behaves more like an evergreen and can be wintered at will, to produce fruits at a particular time, provided the blooms do not get washed out in the rains. To keep the trees in healthy condition, it is necessary to spray them once when they have been wintered and stripped of their leaves, again when fresh leaves have appeared, and again when the fruits are set and are of the size of a marble. Spraying should not be done when the trees are in flower. Mildew, sun-scald, collar-rot, rust and leaf-spots are some of the diseases. The stem-boring caterpillar which damage the stems and the Cockchafer beetles which eat the leaves are common insect pests. For controlling these, refer to Chapter XI. The worst fungus disease at Bangalore is what is called “Silver Leaf disease.” The spores are introduced through the wounds made in the stem by a flat grasshopper which has the same colour as the bark and which severely girdles it. The fungus first attacks the heart-wood which becomes brown and then it gradually comes to the surface bark giving it the characteristic black colour of the sooty mould, as if burnt by a torch. The bark also splits and rots. This is very difficult to eradicate. Constant spraying and feeding the plant can do some good. For fruits of large size, thinning has got to be done. The time to pick the fruits is indicated by one or two sound fruits falling to the ground of their own accord. The fruits have to be collected unbruised and kept in an airy place, without touching each other.

Rubus. (sp ?). The Wild Raspberry, N. O. Rosaceae.

A straggling prickly bramble, which can be grown easily from medium to high elevation for hedging being armed with spines and bearing useful edible fruits. The old stems should be cut back for fresh healthy shoots which bear the flowers and the fruits. The stems are covered with a white down. The fruits are wooly in appearance, black-purple in colour, about
SELECT FRUIT TREES

½ inch long and broad, pleasantly flavoured, and eaten fresh or made into a jam, though they contain many small seeds. The plants respond to good treatment, thriving well in rich good soil, which is regularly watered. Propagation may be made from seeds or by cuttings or layering. The easiest method of making large plants in a short time is by holding down the tips of the shoots in the soil which is kept moist. Soon, roots are emitted and shoots start from below, when the new plant is severed from the parent.


Small tree with handsome foliage. The fruits are oval-shaped and are of the size of a small hen's egg; the large seed in the centre is enclosed by very acid fibrous pulp which has the flavour of the Mango. The fruits are soft and almost fibreless when they are still young with undeveloped seed and they are used for pickling like tender Mangoes. The tree grows without care. Suited best for moist low country. Raised from seed. Takes about 5 years to fruit.


The Grape Vine is extensively cultivated in Southern Europe (its native home), Australia, Africa, and Southern United States. Good fruits are also grown in Afghanistan and it is these fruits that flood our markets nowadays. In India Grapes are grown near Poona, Kashmir, Aurangabad, Krishnagiri, Bangalore, Pequkunda and some other places. The fruits commercially grown in India are of inferior quality and variety and cannot compare with those imported from Afghanistan and elsewhere. Grapes thrive up to an elevation of about 5,000 feet. They need a warm dry atmosphere when the flowers are borne and the fruits are setting and ripening. They also need a cold winter, for resting. They dislike a wet climate though they love moisture at the roots, which should be supplied by regulated and plentiful irrigation. Grapes thrive best in well drained deep loamy soil. But it is ordinarily of no consequence, as very large pits about 6 feet each way are made for them and filled with the desired compost. At the bottom
of the pits is put the top soil mixed with plenty of cattle or sheep manure and crushed bones.

In the plains, the fruits are rather sour. The hardest kind to grow is the Black Aurangabad. The white fruited Krishnagiri kind bears once a year and is sour, being produced in the rainy season. Among the imported kinds which are known to give fairly good results at medium elevations are the Muskat of Alexandria, Black Hamburg, Gross Colman and St. Peters. These can be kept on for a few years with very careful cultivation and spraying for diseases like anthracnose, mildew and scales. Unless, the foliage and the young fruit bunches are sprayed preventively with Bordeaux mixture, the foliage gets attacked with mildew and anthracnose fungi, and the fruits drop off or split and rot.

Grapes are grown in a variety of ways. They may be grown in bush form about four feet high and cut back every year. They may be grown as standards supported by stout stakes or stems of the Erythrina tree as in Poona, or they may be trained along the wires of a trellis, or on a pandal. For growing on a pandal which is the method adopted in several places in India, the plant is grown to a single stem after planting, all shoots developing from the sides being removed. When the stem has reached a height about two feet more than that of the pandal, which is ordinarily 4—4½ feet high, its tip is cut off, inducing it to throw outside shoots. Out of the resulting shoots, some four are taken along the several directions on the pandal are grown like leaders, removing side growths. When these leaders have travelled nearly three quarter of the length of the pandal, about 7 feet, they are cut back. Now onwards side growths are encouraged on these leaders and these fill the pandal. These are cut back to one or two buds for fruiting, as the flowers are only produced on new shoots. In the trellis system of training, after reaching a height of 1—2 feet, the stem is allowed to branch out into two shoots, one of which is taken along either side of the stem on the trellis on the bottom wire and tied up. These two shoots are grown without side growths till they reach nearly the end of the trellis on either side. Then, shoots are encouraged to grow vertically along these two
leaders and they are tied up to the vertical wires. These are shortened back at pruning time for fresh shoots to bear. Similarly even when the Vine is grown as a bush or a standard, the method of pruning adopted is to first cut away all dead and decaying wood and then cut back all shoots from the laterals, leaving only the main stem and its leaders and healthy lateral branches. The latter are finally pruned back clean to a few healthy plump visible buds, usually one to four. Pruning is to be done only after the wood had ripened. The fruits are borne on new growths on the previous season's wood, which should be cut back to 1 to 4 buds according to the strength of the branch. All small weak shoots should be removed. In grape cultivation, the three essentials are wintering and pruning, cultivation and watering. Pruning is done when the plant is deciduous. Wintering is accomplished as described in page 122. After wintering, the basin is manured liberally, using sheep manure, failing which cattle manure, and copiously watered. No watering is done for about a week or ten days. When the shoots grow out, watering is more liberally done and more frequently too, keeping the soil just moist always. When the fruits have ceased to grow in size and are about to ripen, water is withheld from the plants, or the fruits do not become sweet.

Mildew and anthracnose are two serious fungus pests of the Grape. For Mildew see page 127. Anthracnose affects all the green parts of the vine, leaves, shoots, blossoms, and berries. Cankers or scars are produced on leaves and young shoots. Affected blossoms appear as if charred. Bird-eye spots are caused on berries, the centre being greyish and bordered by red purple circular zone. Mildew and anthracnose are more prevalent in wet weather than in dry weather. Hence pruning should be so timed in the particular locality that the berries and new shoots are not borne during the wet rainy season. These two diseases are best treated pretentively by spraying with Bordeaux Mixture and dusting of sulphur. Spraying is best done once soon after pruning and again when the shoots are growing and before they bear flowers. Thereafter, dusting with sulphur is done twice or thrice till the fruits ripen.
Zizyphus jujube. Indian Plum. N. O. Rhamnaceae. Vern. 'Jujube,' 'Elanda,' 'Elachi,' 'Baer.'

A small thorny tree which thrives up to an elevation of about 2,000 feet. The fruits are produced from February to April. The variety from Calcutta is considered to be the best. They are round or oval, there being two kinds. They contain a large seed enclosed in acidulous sweet pulp. It is hardy and is easily grown. The fruit is a great favourite among Indians.
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