THE ABC OF
GARDEN PESTS AND DISEASES
THE ABC OF GARDENING SERIES

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THE A.B.C. OF GARDEN PESTS AND DISEASES

by

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PREFACE

There always seems to have been the need for a book giving details of all the principal pests and diseases which the gardener is likely to come up against.

There are books on the pests and diseases of fruit trees. There are books on the diseases of vegetables. There is at least one book on the pests of greenhouse crops, but up to date there does not seem to be a comprehensive modern work which deals in fair detail with the pests and diseases of fruits, vegetables, flowers, ornamental trees and shrubs as well as glasshouse crops.

When I was asked to write such a book I realised that I should have to consult the works of large numbers of authorities. I want frankly to acknowledge the great help that I have received in the past from numbers of eminent entomologists and mycologists who have helped me when a County Horticultural Adviser and when a Lecturer and Examiner to Horticultural Colleges.

We in this country owe much to the Economic Biologists who have worked silently and unobtrusively (in most cases) in order to find out not only the life history of a pest or disease, but also the best methods of control.

I would like to pay tribute here and now to such men as Dr. A. M. Massee of the East Malling Research Station, Dr. H. W. Miles of Wye College, Dr. W. F. Bewley of the Cheshunt Research Station, Mr. G. Fox Wilson of the Royal Horticultural Society and Dr. H. Wormald, the late Assistant Director of the East Malling Research Station.

It is to men like these that a gardener like myself owes a debt of gratitude. Undoubtedly the good in this book is theirs and if errors should creep in they will be my own!

I should like to thank Miss Gweneth Wood, A.R.H.S., Dip. Hort. (Swanley), Mrs. G. Ellis, Dip. Hort. (Midland), Miss G. Russell, Gold Medallist R.H.S., Miss E. Kerr, Dip. Hort. (Studley), and Miss M. Call, Dip. Hort. (Studley), Cert. R.H.S., all Technical Assistants of The Horticultural Advisory Bureau, for all their help in making this book what it is to-day.

W. E. SHEWELL-COOPER,
Director,

The Horticultural Educational and Advisory Bureau,
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CHAPTER I

THE PEST AND DISEASE PROBLEM EXAMINED

The important points are:

1. Correct diagnosis.
2. Catching the pest or disease in good time.
3. Correct application of the remedy.
4. Suiting the remedy to the trouble.
5. Prevention is better than cure.

Presumably, ever since the time that Adam and Eve were turned out of the Garden of Eden, the gardener has had to cope with pests and diseases attacking his crops. These troubles have appeared to increase rather than decrease and this is probably because, in times of peace, we are very international in the exchange of plants.

The advent of the liner and the aeroplane has brought countries far closer together and there is no doubt that pests have travelled on planes from one country to another. There are evidences, too, that diseases which were known, for instance, to exist only in Australasia have been transported to this country by some means or other and have proved specially troublesome here.

It is true that certain laws have been invoked in order to try and stem the movement of pests and diseases. There is a law, for instance, with regard to the Colorado Beetle which arrived in Europe from America comparatively few years ago and which has spread with alarming rapidity from Spain to France, from France to Belgium, from Belgium to Germany, Germany to Switzerland and so on. It isn’t possible to send plants either to Canada or America without certain certificates from the Ministry of Agriculture.

Despite these restrictions, however, pests and diseases do spread. They may be carried on the legs of migratory birds. They may come over in packages from foreign countries. They may even be brought over on the fusilage of air liners or on the decks of tramp steamers—who knows!

There has been a tendency, too, for an increase in the pest and
disease population of this country owing to a lack of knowledge in pathological control. In the olden days the larger estates were well stocked with gardeners whose job it was to grow the best crops and to keep pests and diseases down. Small houses had little garden space. Nowadays all this is altered. Every house worth calling a house has a good garden to it—but does the owner really bother about pest and disease control when he has got the garden? Too frequently the minimum of work is done in the garden and so the plot may become a breeding ground for all kinds of troubles. The large estates, on the other hand, are being broken up. Land owners cannot afford to keep "the garden" as they did, and so there has been a decline in efficient pest control as a result.

Fortunately, all this time there has been a band of entomologists and mycologists who have been working out the best methods of pest and disease control year by year. It seems only a few years ago when no one knew how to keep down the Big Bud in black currants, but now this pest is easy to control by the use of lime-sulphur. The Club Root disease of the cabbage family was impossible to cure until it was discovered that mercuric chloride could be used for the purpose. Slugs were a perpetual pest until the bran and metaldehyde remedy was introduced.

So the modern gardener has great advantages over the man who had to do similar work one hundred years ago. It isn't just a question of using lime and soot, as a kind of panacea for all ills. It is a question of having a garden medicine chest, as it were, which contains the right remedies and, once having recognised the disease or pest, the correct "medicine" should be applied immediately.

Here is where too many amateur gardeners fail. First of all, they don't recognise the disease or pest until it is really serious and then, having recognised it, they haven't got the necessary remedy at hand. By the time this has been purchased the pest or disease has got a tremendous hold on the plant and it is almost impossible to control it as a result. Remedies, if they are to be effective, must be applied in the initial stages or even as a preventative before the pests and diseases are present.

CARE OF THE SOIL

Sir Albert Howard, who has done so much to point out the importance of humus in the soil, states clearly in his book, An Agricultural Testament, that if the humus content of the soil is built up then "parasites" will disappear. He has demonstrated this in his own garden. It is, therefore, of the greatest importance
THE PROBLEM EXAMINED

to see, first of all, that soils are properly and regularly fed with organic matter. It is surely fatal to apply artificial fertilisers (chemical manures) continually without the use of farmyard manure, composted vegetable refuse, spent hops, or similar material. The Soil Association, under the guidance of its able Hon. Secretary, Lady Eve Balfour, is doing all it can to make people "humus conscious."*

To put it simply—plants need feeding properly in exactly the same way as human beings. When humans are ill-nourished they are much more subject to diseases than when they are properly fed. See, therefore, that your ground is supplied with organic matter each year, and you will not have the same need to use insecticides and fungicides as you will have if you feed only with chemical fertilisers.

DIAGNOSIS.

Half the battle of trying to cure a disease or kill a pest is being able to diagnose the trouble correctly. It is no use trying to kill a pest which obtains its food by sucking the sap in the middle of the leaf—with poison. The only insects that you can kill with poison are those which actually eat the leaves and stems, like caterpillars.

Insects that suck have to be killed with a spray like nicotine or derris which paralyses their nerve centres.

The whole point of this book depends on the diagnoses, so do read the explanations very carefully and make certain before you apply a spray or a dust what the trouble really is. It is always worth while buying a magnifying glass or a little lens in order that a tiny pest may be seen more clearly or a disease brought out in relief.

Don't belong to the class of gardener who classifies all troubles as "blight" or "fly," and never tries to discriminate at all. Don't either be the amateur who always uses one panacea for all ills as I have already said—that of soot and lime. Again and again I have been told—"I applied soot and lime, but that didn't seem to stop it."

Try to recognise the beginning stages of diseases and pests. Look out, for instance, for the eggs of the moths, so as to be able to destroy them before they hatch out into caterpillars. Try and notice troubles such as Scab and Mildew when they first attack the leaves for, if you do, you can "scotch" the trouble right at the beginning.

* Write to me if you would like to join the Soil Association.
CORRECT APPLICATION.

Having learnt to diagnose the troubles, learn to apply the remedies in the correct manner and at the right time. There is an old saying which says: "A stitch in time saves nine," and it is very true with plant diseases. There is usually one vulnerable stage in their life's history. Apply the cure then and all is over. Allow the vulnerable stage to pass and it may be impossible to save the plant.

Spraying or dusting before or after the critical period is useless. Therefore, follow the instructions given in this book exactly. A great deal of research has gone into finding out the best times for controlling all plant troubles.

Take a typical example—the Leaf Curling Aphides of plums or black currants. If the trees and bushes are sprayed with a tar distillate wash in the winter, the eggs will be killed and there won't be any aphides to trouble the leaves in the spring. Once these pests get on to the lower surface of the leaves, they suck them and the leaves curl up, and it is then almost impossible to reach them with any kind of spray.

Be prepared to spray or dust at any time. Keep a sharp look out and don't waste a moment. That is why it is so important, as has already been said, to have a garden medicine chest with the remedies all ready.

SUITING THE REMEDY TO THE TROUBLE

Mention has already been made of the importance of applying the right remedy.

Generally speaking, all remedies may be divided into seven groups. (1) Fungicides; (2) Fumigants and Smokes; (3) Preventatives; (4) Poison Baits; (5) Corrosive Sprays; (6) Stomach Poisons; (7) Contact Paralysers.

**Fungicides.**

These are used for killing fungus diseases, and fungus diseases may be called lowly little plants which live on the leaves, stems or bark of other plants.

Typical fungicides are lime-sulphur (a brown liquid), Bordeaux Mixture, and colloidal sulphur and copper. There are also such dusts as sulphur and copper-lime.

**Fumigants and Smokes.**

Fumigants can only be used, as a rule, in the greenhouse—though sometimes they are used in the soil. They are usually
THE PROBLEM EXAMINED

Gases of one form or another, either applied as a liquid or powder first and, as a result, gas is given off—or occasionally as definite gases in the first place.

"Smokes" are generated by "burning" a special substance in a generator.

A common soil fumigant is carbon bi-sulphide, while fumigants in the greenhouse vary from naphthalene to nicotine, and from cyanogas to sulphur fumes.

Preventatives.

These are used for preventing an insect or a fungus attacking a plant. Whizzed naphthalene may be applied along the rows of carrots, for instance, and the objectionable smell given off keeps the carrot fly away. Grease bands, when put round fruit trees, prevent the females of winter moths (which are wingless) from crawling up the trunks and laying their eggs in the branches. Whenever possible, preventative measures are detailed throughout the book.

Poison Baits.

It is sometimes possible to place baits in the vicinity of plants that are likely to be attacked by a pest and so lure the insects away to their death. These poison baits, for instance, are very useful in the case of slugs, where a mixture of bran and metaldehyde lures these pests quickly to their doom. Poison baits are also used for pests like wasps which are apt to attack ripe fruit in the summer. Jars of syrupy material are hung up in the trees to which a little poison has been added.

Corrosive Sprays.

Corrosive sprays are usually used in the winter, especially in the case of fruit trees. These have a slight burning action and so destroy the eggs of insects as well as any other actual pests which may still be lurking about. It is difficult to use corrosive sprays in the summer for, though the pests would be killed, the leaves of course would be soiled.

Stomach Poisons.

In this case the spray or dust used—and it is usually a spray—deposits a film of poison all over the leaf and, in consequence, any insect pest which eats the leaf is poisoned. It is perhaps the cheapest form of pest control known. It is usually used against caterpillars and beetles, and some weevils.

Contact Paralysers.

The only way to kill insects which suck—like aphides and the
apple sucker—in the summer is to paralyse them by applying a wash like nicotine or liquid derris. It is no good trying to kill them with stomach poisons.

But, in addition, substances like nicotine and liquid derris will kill other pests such as caterpillars, for their nerve centres will be paralysed also. Many people look upon a liquid derris wash as a kind of standard wash for this reason, and use it throughout the summer as a "panacea". Its great advantage is that it is not poisonous to human beings so there is no fear of killing family pets or of causing the death of young children.

*Soft water better than hard.*

It is always better to use soft water rather than hard water when making up sprays. Rain water is most suitable for it contains hardly any mineral matter. Sea or brackish waters are quite unsuitable, while water from the tap may or may not be hard. It will depend largely on the district. Those who have water softeners installed are very fortunate.
CHAPTER II

HYGIENE IN THE GARDEN

I can help to keep my plants clean and healthy by:

1. Keeping the garden tidy.
2. Burning rubbish.
3. Composting vegetable refuse.
4. Correct feeding and watering.
5. Giving them plenty of room.

Prevention Better than Cure.

In the garden much can be done to prevent the attacks of pests and diseases if every care is taken to destroy the breeding grounds. One of the commonest places for the hibernation of insects is in the rubbish of hedge bottoms. It is necessary, therefore, to clean out all hedge bottoms regularly and to burn the rubbish thus obtained.

Weeds should never be allowed to develop anywhere for these often prove alternative food or hosts to the diseases or pests. Regular hoeing will prevent weeds appearing and will provide the dust mulch that plants so much appreciate.

There should be no dirty corners in a garden. Sometimes you walk round a garden and find everything looking neat and tidy, and then you ask to see the rubbish heap, or the place where the bonfire is made, and you find here the most awful untidiness, heaps of this, and heaps of that, old boxes, old pots and so on, all lying about untidily, providing as a result, breeding grounds for the many troubles which afflict the gardener.

Composting.

It is most important, therefore, to see that the whole garden is tidied up, and that there are no nooks or crannies where plant enemies may lurk. Rubbish heaps should be done away with and compost heaps should take their place. These should be neat and tidy and the material put thereon should be rotted down by the use of a chemical such as calcium cyanamide or, when this is unobtainable, sulphate of ammonia should be used.

Either of these chemicals should be applied at the rate of two ounces to the square yard for every 6-inch thickness of vegetable.
refuse collected. Every now and then a fork may be plunged into the heap and be stirred about slightly so as to let in air, and should the weather be very dry, such a heap should be given a thorough watering.

Dead and Diseased Material.

Dead wood should never be allowed to remain in trees. It should be removed immediately it is seen. Badly diseased branches should be sawn off also.

The same thing applies to other plants. Always remove leaves that are diseased and, in bad cases, take up whole plants and see that they are destroyed. It is advisable, too, to remove the weakly plants for they are much more likely to be attacked by enemies than those which are sturdy and strong.

The bonfire should be used for burning the diseased wood and the badly diseased plants. Bonfires are useful for they provide wood ash and this is valuable potash for the soil. Don't leave the material lying about until you have time to make a bonfire, for all this time the breeding will be going on and the trouble getting worse and worse. If material has to be burnt because it is diseased—burn it immediately.

Correct Feeding.

Much can be done to see that plants grow robust and strong if they are properly fed. The soil should be enriched year after year with well-rotted organic matter and, in addition, it may be necessary to give the three normal plant foods, nitrogen, phosphorus and potash in some form or another. The use of too much nitrogen is often the cause of soft plants, such plants being liable to both fungus diseases and insect pest attacks.

This isn't the time or place to go into full details of manures and manuring, but these will be found in other books of mine such as The A.B.C. of Gardening, The A.B.C. of Fruit-growing, The A.B.C. of Vegetables, The A.B.C. of Flowers, and so on.

Room for Development.

In too many cases gardeners do not give plants sufficient room for development and when plants are crowded together they suffer naturally from diseases. Brussels sprouts which should be planted three feet square are often put in 2 ft. by 18 inches and then people wonder why they are badly attacked by the “blue bug” or by mildew.

Fruit trees and bushes, rose trees, ornamental plants as well
as vegetables, all need light and air, and where a gardener takes
the trouble to thin his plants early and to space them out well,
he never has to spend so much money on insecticides and fungi­cides.

Efficient Drainage.

It is impossible for trees and plants to grow properly if their
roots are standing in water the whole time, or even if their "feet"
are deep in water all the winter and then are dried out in the
summer.

Some method of draining the excess moisture away must be
arranged. On the farm and market garden this is done by agri­
cultural land drains and these are often quite a possibility in an
ordinary garden.

Water Supply.

It is just as important to have sufficient moisture present in
the soil as it is to ensure that the roots are not drowned. Plants
that are suffering from drought are often badly attacked by both
pests and diseases. The gardener therefore should try and see
(1) that sufficient organic matter is dug into the soil, to act as a
"sponge" and so hold the moisture. (2) Hoe the surface of the
ground continually so as to keep the moisture down below and
prevent it evaporating, and (3) try if possible to have an overhead
sprinkling apparatus so that thorough waterings can be given by
means of a hose plus this whirling Rain King, during dry periods.

The Use of Lime.

Soil acidity is often a cause of trouble. Fortunately this can
be corrected by an application of lime and most gardeners find
hydrated lime convenient for this purpose. It should be applied
as a top dressing at, say, 5 to 6 ounces per square yard in February.
Lime definitely helps to keep down the Club Root disease and it
also releases plant foods which help to keep the right balance in
the soil.

The exact amount of lime which should be used can always be
determined in a few minutes by the use of a B.D.H. or a Baird and
Tatlock Soil Indicator. Either one of these can be purchased at
any good chemist for a few shillings.
CHAPTER III

PESTS THAT ATTACK PLANTS

GENERALLY

Did you know that:

1. Para-dichlor-benzene kills wireworms?
2. Woodlice are the same as Pea-bugs or Pill-bugs?
3. Centipedes should never be killed?
4. Leather jackets are the larvae of the Daddy-longlegs?
5. Ants and greenfly often go together?

There are a large number of insect pests which attack all kinds of plants. In order to save repetition, therefore, these will be included in this chapter under their own common names and placed for convenience in alphabetical order.

If it is necessary, for some reason or other, to mention one of the pests specifically in another chapter as well, a note will be found at suitable points connecting the two references.

ANTS.

Ants swarm over plants which are infested with aphides (greenfly) which they seek for the sake of the sweet excretion, the so-called Honeydew. Some species of ants even transfer aphides from one plant to another and some transport Mealy Bugs in glasshouses.

Ants are responsible for the death of many plants in rock gardens, herbaceous borders and in glasshouses for they form their nests among the plants, and the roots, thus being loosened from the soil, wilt and die.

Control Measures. The most satisfactory method of control is to find the ants' nests, make a hole in the centre of each and to pour into it about \( \frac{1}{3} \) fluid ounce of carbon bisulphide—a highly inflammable liquid—or a solution of sodium cyanide—a poisonous substance—and then to tread firmly to conserve the fumes.

Ants' nests in garden paths may be destroyed by watering with a weed-killer or by pouring boiling water, petrol or paraffin into the holes. Pour D.D.T. emulsion into the nests or sprinkle 5% D.D.T. on to their runs. Liquid Derris may be used neat.
A poison bait for ants may be prepared in the following manner (impossible during rationing):

Soak a small sponge with the mixture given below and place small pieces which have been broken off on the beds, or wherever the ants abound. Care must be taken with this bait as sodium arsenate is poisonous.

Dissolve 2 lb. sugar in 1 pint of water, adding \(\frac{1}{8}\) ounce of tartaric acid and boil for \(\frac{1}{2}\) hour. Dissolve \(\frac{1}{4}\) th ounce of sodium arsenate in 2 ounces of hot water. Allow both mixtures to cool and then mix them thoroughly and add 3 ounces of honey.

**APHIDES (Many species)**

Sometimes called Green Flies, Blue Flies, Plant Lice and so on.

Probably the best known and most persistent of all plant pests, both in the open and under glass. There is hardly a plant they won't attack.

Many of the species of aphides have complicated life-stories. They often migrate from cultivated plants to weeds, back to secondary host-plants, and so on. They may attack in the spring, leave in the summer and then come back again in the late summer.

Not only do they suck the sap, distort the foliage, ruin flowers, and check growth, but they also help to transmit diseases like canker in apples and various viruses like the Lily Mosaic.

They usually deposit on the leaves and stems of plants an excretion known as "Honeydew" and this is liked by ants. Ants will, in fact, carry green fly from one plant to another for the sake of the "Honeydew" which they lick. If the aphides are controlled, therefore, the ants will be kept away also.

**Control Measures.** Fruit trees and bushes, rose trees and bushes, deciduous ornamental trees and shrubs should be sprayed in the winter with a tar distillate wash in order to kill the eggs and over-wintering females. Dissolving one pint of efficient tar oil in 10 pints of water is necessary in bad cases; though 1 in 20 is often sufficient.

In the spring and summer it is necessary to spray plants with an insecticide which will paralyse them and kill them. The spray must be applied with force, to hit the under surface of the leaves as well as the upper surface and to cover the whole of the plant concerned.

The best washes used are: (a) Nicotine and soft soap or substitute. (For Formula, see Chapter XV, page 212).

(b) Derris. There are various proprietary preparations which
should be used according to the instructions found on the tin or bottle. Liquid Derris has given good results.

(c) Dusting with nicotine dust or derris dust. It is, however, always better to spray if possible.
Under glass it is, of course, possible to fumigate or to use a “Smoke” and special instructions on the subject will be found in Chapters XI, XII and XV. A good fumigant consists of 1/6th fluid ounce pure nicotine plus 1/6th fluid ounce methylated spirit to each 1,000 cubic feet of greenhouse space inside. This should be vaporised in a small tin placed over a spirit lamp.

Keep down all weeds in the vicinity of the garden or allotment. On these the aphides may breed.

Grease-bands placed on trees will prevent ants from climbing the trunks and either distributing or hunting aphides.

**CHAFER BEETLES** (*Melolontha vulgaris, Phyllopertha horticola, Cetonia aurata*).

For the purpose of this book the cock-chafer, garden-chafer and rose-chafer (the Latin names of which are found above in this order) will be treated as one for the control measures are almost the same.

The cock-chafers will be seen flying in the evening. During the day they are still. The female lays 70 or more eggs which hatch out in 6 weeks time into thick greyish-white grubs which live in the ground for 2 or 3 summers. These are 1 ½ inches long and have three pairs of legs. They attack the roots of perennial plants.

The summer-chafer appears in June and July, being two-thirds of an inch long. It is similar to the cock-chafer in appearance. The grubs do similar damage.

Garden-chafers are only ½ inch long, the front part of the body
PESTS THAT ATTACK GENERALLY

being of a metallic lustre, and the wing cases being brownish-red. The beetles eat the leaves of plants and may do a great deal of harm.

The green rose chafer is beautiful, being golden green, the wing cases being covered with white spots. They appear in May and June and are very harmful to flowers.

Control Measures. Fork in whizzed naphthalene at 1 ounce to the sq. yard in the autumn and again early in the spring. This will help to eliminate the damage done by the grubs.

Spray the plants attacked by the beetles with arsenate of lead, using a spreader. For details as to "make up," see Chapter XV.

Adult beetles can be controlled by dusting or spraying the foliage and stems with D.D.T., but the grubs are less easily controlled. Water around the plants with an emulsion of 0.1% D.D.T. or sprinkle 5% dust in the hole at planting time.

CATERPILLARS. See Surface Caterpillars, page 29.

EARWIGS (Forficula auricularia).

Some authorities say that earwigs do little harm while others state that they can cause great havoc by feeding on the foliage and blooms of plants. Though they do attack large numbers of different kinds of plants, they seem to be the principal pest of chrysanthemums, dahlias and sweet peas.

Where, however, they are found in large numbers in any garden, they should be destroyed.

In the spring, the female lays her eggs in a hole she makes in the earth, usually below stones. She lays about 30 eggs in each cache, and watches them hatch out into a small earwig-like white insect. The mother earwig then dies and the young ones feed on her body, departing afterwards to go their own ways. They can usually be found fully grown early in the month of June, and they are often a serious pest from the month of August onwards.

Control Measures. If the pest becomes very bad, the affected plants may be sprayed with nicotine and soft soap (see Chapter XV for formula), or dusted with D.D.T.

All dead and curled-up leaves should be picked off from the base of plants and flower pots stuffed with straw, hay or wood wool should be inverted on bamboos and stood among the plants.
normally attacked. Every morning each pot should be removed and the earwigs present should be shaken out into a tin of paraffin.

Use D.D.T. dust on plants likely to be infested. Indoor chrysanthemums should be dusted as soon as they are brought into the greenhouse. The D.D.T. will also be effective against Chrysanthemum Leaf Miner at the same time.

A poison bait (particularly useful now when treacle is scarce) consists of $\frac{3}{4}$ lb. Paris Green and 2 lb. stale breadcrumbs. Make the Paris Green into a little paste, stir in the breadcrumbs and apply this bait in the affected areas.

**EELWORMS** (Various).

There are a very large number of different kinds and types of eelworms which attack the vegetables and flowering plants of a garden. Plants commonly attacked are potatoes, tomatoes, chrysanthemums, phlox, sweet williams, iris, tulips and narcissis.

Eel worms are minute and are usually invisible to the naked eye. As their name suggests, they are eel-shaped, the body tapering slightly towards the head, and sharply to a pointed tail.

The life cycle varies from plant to plant but the eggs are usually laid somewhere in the plant tissues and the larvae which hatch out resemble their parents.

In the case of phlox, sweet williams and the chrysanthemum, the eelworm swims up the film of moisture around the stems and enters the leaves by the breathing pores. Here they distort the leaf, often causing it to turn brown. The stems may be stunted and split or they may be elongated and whippy.

In the case of bulbs, the eelworms usually enter through the tip and live in the bulb, breeding for long periods. Bulbs thus attacked produce only short foliage and small flowers on short stems, if they flower at all. The bulbs usually become soft, especially when the attack is far advanced (see page 209).

The eel worms which attack potatoes cause the plants to become stunted and produce poor crops. If the roots are examined, little white nodules or cysts will be found on them, these being called “Root Knots,” which gives the pest its particular name of Root Knot Eelworm.

**Control Measures.** In the case of narcissus bulbs the best method of control is by the use of the warm-water bath (see Chapter XIV).

With chrysanthemums the roots should be treated with a hot water bath at 110 deg. F. for 20 minutes just before they are put
PESTS THAT ATTACK GENERALLY

out in the frames or in boxes, to grow cuttings. Another method is to immerse the cuttings in warm water at 110 deg. F. for 20 minutes and to strike these in eel worm free soil.

With phlox control may be obtained if cuttings are taken from washed roots only, for the eelworms live in the stems and leaves and not in the roots.

Other important methods of control are:

1. Regular hoeing to eliminate weeds.
2. The burning of diseased stems and not placing them on rubbish heaps.
3. The carrying out of a rotation of crops in order that susceptible types are not grown on the same piece of ground year after year.
4. Sterilising with steam or boiling water of boxes and frames and, where possible, soil.

The phlox eel worm will attack eonotheras badly.
The chrysanthemum eelworm will attack dahlias, delphiniums, rudbeckias, asters and verbena venosa, etc.

5. D.D. soil fumigant is the latest control for the root knot eel worm. This is a liquid consisting of chlorinated hydrocarbons derived from petroleum, and when injected into the soil it vapourises readily and proves deadly to eelworms, as well as to other soil pests. This fumigant must on no account be used on soil where plants are growing, and the ground must be left vacant for at least a month after treatment before any sowing or planting is undertaken. The best time to apply is in early Autumn.

Application. A special injector gun is obtainable for distributing the liquid in the soil.
The soil should be reasonably moist so that the liquid can permeate readily through it, and the tilth should be fairly fine. The temperature should be roughly 40-45 deg. F. If the glasshouse soil is to be flooded, the injection should be done prior to this. Application is much easier if the ground is first marked out in 15-inch wide strips. Particular attention should be paid to corners and crevices under hot-water pipes, round pillars, along paths and so on.

After injection, it is important to firm the soil in order to prevent the escape of the fumes. This may be done either by rolling lightly or by hoeing the surface of the soil.

Immediately before planting, the ground should be thoroughly dug over to release any fumes which may be left in the soil.

Precautions. Old clothing should be worn for the operation,
and any article of clothing on which the liquid is spilt should be washed thoroughly before wearing again. On no account should the liquid be allowed to get into the eyes or mouth. The hands should be washed in paraffin and the injector thoroughly cleaned after use.

Reinfestation. If infected plants, or other sources of infection are brought into the house after injection has been carried out, re-infestation may easily occur, though this will be a slow process. Seed and potting composts may be sterilised by placing the compost in a closed container and sprinkling on two fluid ounces of D-D to every cubic yard of soil. After a few days the soil should be removed and turned over two or three times in order that the fumes may escape.

LEATHER JACKETS (Tipula oleracea, etc.).

Leather jackets are the larvae of the crane-fly or daddy-longlegs.

In the north they are sometimes called the "Bots." They like damp conditions and they often die in the ground in drought.

They feed on all parts of plants growing underground such as roots, tubers and corms, tunnelling into and eating them.
PESTS THAT ATTACK GENERALLY can do great harm to lawns, vegetables, flowers and to herbaceous borders.

They feed throughout the winter when conditions are favourable and, as the result of their damage, they may let in millipedes and fungus organisms.

They are usually 1 to 1½ inches long, of a greyish-brown or blackish colour, are legless and have a tough, leathery skin.

The eggs are laid by the crane-flies in late August and early September, a single female being able to deposit 300. In 14 days the larvae hatch out and start to feed on the roots of plants, going on doing so through the autumn, winter and the following spring.

Control Measures. See that the soil is properly drained; hoe regularly throughout the spring and summer as continual soil disturbance proves distasteful to the larvae.

Fork into the ground whizzed naphthalene, at the rate of 3 ounces to the sq. yard, and, if dry, water afterwards.

In the evening, apply a poison bait consisting of ¼ lb. Paris Green, 7 lb. bran* and ½ gallon of water. Damp the bran with the water, stir in the Paris Green, and when crumbly, apply over the surface of the ground thinly. This quantity should be sufficient for ¼ acre.

Leather jackets can be controlled on lawns by watering at 1 gallon per sq. yard with 0.025% D.D.T. emulsion or dusting with 5% D.D.T. at the rate of ½ oz. per sq. yard.

MILLIPEDES (Blaniulus guttulatus and Polydesmus complanatus).

Millipedes must be distinguished from centipedes, for the former are harmful and the latter are beneficial. Millipedes, when disturbed, curl themselves up. They are slow to move and have two pairs of legs, to almost all their body segments. Their bodies are rounded and usually darkish in colour.

Centipedes, on the other hand, usually run away when disturbed, being active. Their bodies are flattened and they only have one pair of legs to each segment.

Millipedes feed on vegetable matter, both dead and living—both in the open and under glass. They will attack the baby leaves of seedlings. They will gnaw the underground stems and roots of plants. They will burrow into bulbs, corms and tubers and they will eat seeds. They often follow on the damage caused by other pests such as wire worms or slugs.

* When Bran is difficult to obtain use bone meal or bread crumbs.
They make an entry for the invasion of fungus diseases and bacterial organisms.

The breeding takes place in the late spring and summer, the female laying her eggs inside a sealed-up nest low down in the soil. The eggs hatch out in 10 days.

Control Measures. Whizzed naphthalene may be dug in at 3 ounces to the sq. yard. Incorporate this in the top 8 inches of soil and it will act as a repellent for 2 or 3 months.

Hoe regularly for this pest dislikes surface soil movement.

Trap by means of scooped-out potato, turnips or swedes. Skewer on a length of bamboo for ease of examination, and pull up and look at every 3 or 4 days—dropping into a small tin of paraffin the pests found.

See that all soils are properly drained and give the surface of the ground a heavy dressing of lime at, say, ½ lb. to the sq. yard.

These pests cannot be destroyed by D.D.T. except by copious waterings of liquid mixture, but D.D.T. dust can be used as a deterrent if sprinkled near plants.

**SLUGS AND SNAILS**

There are, unfortunately, many different kinds of slugs and snails, some of which are more numerous than others. The slugs may be classified as follows:

(1) The Large Black Slug, which is less commonly injurious to plants but sometimes causes damage.

(2) The Garden Slug, a small dark species with a yellow foot and a very tough skin, common both in gardens and fields.

(3) The White-soled Slug, also a small species, generally grey in colour with a flattened appearance and with a strikingly white foot.

(4) The Field Slug, variable in colour but usually mottled grey
PESTS THAT ATTACK GENERALLY

with a reddish or yellow tinge; it is probably the most uniformly and generally injurious slug throughout the country.

(5) The Keeled Slug, dark brown or grey with body keeled along the back. A very troublesome species, largely subterranean in habit, feeding on the underground parts of plants and often specially injurious to potatoes.

The snails are:

(1) The Large Garden Snail, the most common and widely distributed species of snail, easily distinguishable by the large grey-brown shell with paler markings.

(2) The Banded Snail, more injurious to farm crops than to garden crops as a whole. The shell may be white, grey, pale yellow, pink or brown with one to five spiral darker bands.

Generally speaking, slugs and snails are night marauders and eat anything fresh and green and succulent. Some seem to prefer roots and tubers and so attack below ground—others go for the parts of the plant above ground level. Slugs will burrow deep down during the winter in order to escape the frost. Snails, on the other hand, collect in large numbers, as a rule in a dry sheltered place.

Slugs usually prefer a soil rich in moisture—the heavy soils and clays. They also congregate in decayed vegetable matter.

Natural enemies. Birds eat them greedily, especially rooks, starlings and blackbirds. Ducks love them, and some people allow their Khaki Campbells or Indian Runners to roam the vegetable garden in the winter when there are few crops to harm. Toads and moles eat slugs, whilst snails are devoured by thrushes.

Control Measures.

(1) Hand picking. Place used orange or grapefruit skins upside down on the soil, pick up the slugs that collect under them and put them into a tin of paraffin.

(2) Copper sulphate and lime method. Use powdered copper
sulphate and hydrated lime, mixed together in equal parts. Dig
this mixture in when bastard trenching, using one ounce per square
yard or even a slightly heavier dressing than this. A second
similar dressing may be worked in 15 days before sowing seeds or
setting out plants. The danger, of course, is the copper sulphate
which if overdone may poison the soil.

(3) The metaldehyde method. A bait that never fails under
almost all conditions is made by mixing powdered metaldehyde
bars with dryish tea leaves, dried lawn mowings, fine bone meal
or powdered bread crumbs (before the war bran used to be used).
One metaldehyde bar crushed to fine powder is enough for half a
pint, i.e. a tumblerful of bonemeal or whatever material is used
as the "carrier." Metaldehyde powder, obtained by crushing the
bars, should be very thoroughly mixed with the "carrier" chosen.

\textit{Amount to use.} For the average size garden use, say, ten bars
of metaldehyde to 4 or 5 lbs. of fine bonemeal or steamed bone-
meal flour or tea leaves. For large allotments 20 bars will make up
10 lbs. of bait, while for larger areas 50 bars will provide 25 lbs. of
the slug killer, which normally proves sufficient for approximately
one acre of cultivated ground. Put down small heaps of the bait
about the size of an egg-cup, 2-3 feet apart all over the area
cconcerned; or the mixture can be "broadcast" or put down
in thin lines between the plants.

In the glasshouse place the bait in tin lids or saucers on and
below the staging.

\textit{General advice.} Metaldehyde is insoluble in water and thus is
not taken up by plants, but the mixture should not be scattered
over plants intended for human consumption such as vegetables,
salads, strawberries and the like.

Metaldehyde bait is strongly attractive to slugs and snails and
has a rapid initial action, killing off the pests quickly.

Metaldehyde is dangerous to human beings if eaten, and as the
bars somewhat resemble sweets, they should be kept out of the
reach of children.

Further, in order to avoid risk of harm to domestic animals
and pets, the heaps of bait should be covered with pieces of slate
or tile.

Metaldehyde can be purchased at chemists, seedsmen and
ironmongers.

(4) The barrier method. Some of the copper sulphate and
hydrated lime mixture or metaldehyde bait may be used from time
to time along the edge of gardens or allotments to prevent the
passage of slugs onto one’s own particular portion of ground. The barriers will, however, be washed away by heavy rains and must then be renewed. Metaldehyde is excellent, however, under continuous cloches and in frames because there it cannot be washed away.

For those not wishing to prepare their own slug-killing mixture, there are several well-known proprietary brands of “Slug-Bait” containing metaldehyde. These are both very effective and inexpensive.

SURFACE CATERPILLARS, sometimes called Cut Worms (Euxoa segetum, E. exclamationis, Graphiphora pronuba).

These pests feed at night on the underground parts of plants, on the lower leaves and on the stems. They often nibble a plant just above or below ground level. The result is that such a plant will snap off or wilt.

During the day they hide away under the surface of the soil and under leaves and stems.

The caterpillars are either a dirty grey with blackish dots on their sides or yellowish greenish-grey, having black or greenish stripes along the sides of their bodies.

The first damage is usually seen in August but the trouble continues throughout the autumn and winter.

They usually are full fed and pupate any time during the months of February, March and April.

Control Measures. In the case of small outbreaks, look for the caterpillars after dark with the aid of an electric torch. Look especially for them in the vicinity of wilting plants.


Hoe regularly between all plants.

As the cutworms work after dark D.D.T. dust sprinkled around their haunts will destroy them.

THRIPS (Heliothrips hæmorrhoidalis (Common thrip). Thrips tabaci (Tobacco thrip)).

On the whole, thrips are far more common under glass than they are in the open, but they do attack a great number of plants causing, in the case of flowers, distortion of the blooms and mottling of the leaves and, in the case of peas and beans, they

* When bran is difficult to obtain use bone meal or bread crumbs.
attack the stems, leaves and pods, causing the latter to look silver in the early stages and later turn brown.

The adult thrips are slender and elongated. They are seldom a tenth of an inch in length and they may be black, brown or yellow in colour. They lay their eggs in the leaves, pushing these eggs below the leaf surface with a special egg-laying apparatus. Small transparent insects hatch out and feed on the leaves and, where they feed, white areas are seen, surrounded by little black dots—their excreta.

The adults which fly get into sheltered places throughout the winter and, in the hot summer conditions, many generations are produced in a short space of time. In the greenhouse these insects breed continuously.

Outside they may attack seedlings, sucking the sap from their growing points and thus distorting the plants, and preventing them from growing healthily. They are worse in a dry season than in a rainy period.

A simple method of telling whether a plant is attacked by thrips or not is to hold a clean white handkerchief close to the plant and then watching to see whether, on tapping the plant sharply, tiny little black specks drop on to the material. These little black specks will be found to wriggle and, if examined with a magnifying glass, will be seen to be of the shape already described.

Control Measures. Keep plants growing healthily by seeing that the soil receives sufficient moisture, by not overcrowding and by not allowing them to suffer from draughts. Syringing regularly with clear water helps to kill the insects for it washes them off the leaves on to the soil where they die of starvation.

Spraying with nicotine, using 4 ounce to 10 gallons of water, plus a spreader (see page 217), three times at weekly intervals has proved very effective. By this method the eggs within a leaf have the opportunity of hatching out and the third spraying catches the remainder of the population.

Dusting or spraying with D.D.T. has proved effective.

In the greenhouse fumigation with nicotine vapour is usually effective if carried out once a week for three weeks. In the case, however, of carnations, cyclamen and arums, grade 16 naphthalene should be sprinkled along the paths at the rate of 10 ounces per 1,000 cubic feet. Hydro-cyanic gas has also proved death to these pests but it is not a nice gas to use in a conservatory near the house. These methods have now been superseded by the use of D.D.T. "smokes."
PESTS THAT ATTACK GENERALLY

WIREWORMS (*Agriotes lineatus*, *Agriotes obscurus* and *Athous hamorrhoidalis*).

The wireworm is the larva of the click beetle and is perhaps the most widely distributed of all the soil pests. The click beetle or skip-jack as it is sometimes called is brown in colour and possesses the faculty of being able to bend the fore part of the body away from the hind part, suddenly straightening itself again with a clicking sound. In this way it can jump vertically into the air, and when placed on its back can easily right itself.

The click beetle will be seen flying about in the sun during the months of May and June. The eggs are laid in grass, either singly or in clusters, during the months of June and July but occasionally egg-laying can be found in cultivated land. The larva, which hatch out in a month's time, feed on the roots of the grass or on decaying vegetable matter, and it is only when they are a year old that they really begin to feed on the underground portions of all kinds of plants. Unfortunately they continue to remain and feed in the soil for four or five years before turning into beetles again. They can during this time do a great deal of damage and, as they live underground, they are extremely difficult to poison.

Their main feeding periods appear to be the spring and autumn though, in some years, they continue feeding right the way through the season. During the winter—so it has been found—the wireworms burrow lower into the soil so as to avoid being frozen, and then they come up to the surface again in the spring when the young plants are growing and are susceptible to injury.

Wireworms may be distinguished from millipedes and centi-
pedes by the number of legs. A wireworm has only three pairs of short legs situated on the first three segments of its body. Millipedes and centipedes have legs all down their bodies. Wireworms, too, as their name implies, are very wiry, and difficult to kill by squeezing between the fingers.

**Control Measures.** Great care should be taken when purchasing turf for greenhouses or frames for wireworms may be introduced in this and so start the trouble. Before buying turf two or three of the sods should be pulled to pieces to see whether any pests are visible.

Newly broken grassland which is infested can be "cleaned" in one year by growing a potato crop which should be lifted in late summer and the wireworm riddled tubers fed to pigs.

Sowing mustard thickly on infested ground has also proved useful. This should be dug in when about 18 inches high.

Naphthalene may be applied at three or four ounces to the square yard and proves a deterrent to this pest. It doesn't actually kill but it drives them away.

It is possible to trap wireworms by spitting pieces of carrot or potato on the end of a stick and burying these two inches deep in the ground. These traps should be removed at weekly intervals and the wireworms picked out and placed in a tin of paraffin.

Make holes in infested ground with a crowbar or walking stick 2 feet apart and 8 or 9 inches deep, and drop into the bottom of each hole a piece of para-dichlor-benzene, the size of a French bean. Tread down the holes immediately afterwards. The chemical volatilises through the soil, killing the wireworms. It is possible to make the holes in between rows of crops in the spring and early summer,* or on vacant ground in the autumn or winter.

Gammexane gives fairly good control when applied at the rate of, say, 1 oz. per sq. yd. The drawback to this method is that root crops cannot be grown on treated ground for two or three seasons or they will be tainted.

**WOODLICE.**

Sometimes called Pea-bugs, Pill-bugs, Sow-bugs, etc. Abundant in town gardens. Prefer shady situations and decaying organic matter to live in. Hide away in the day time in crevices beneath stones, in brickwork, in decaying stumps of trees, under boards and wooden edgings of paths and under heaps of leaves.

Live chiefly on decaying vegetable matter but often attack

* If used in the summer between root crops or potatoes may cause them to be tainted.
PESTS THAT ATTACK GENERALLY

living plants, gnawing and devouring the stems. Will eat out irregular holes in the leaves of a large number of plants under glass and in the open.

Young woodlice are delicate looking and whitish.

**Control Measures.** Use a poison bait consisting of 14 lb. dried blood, ½ lb. Paris Green. Put this in little piles where woodlice are found. Take all precautions against this being eaten by dogs, cats or poultry.

If 5% D.D.T. dust is sprinkled about where woodlice are seen, it is a very good alternative to poison baiting.

Spray with liquid Pyrethrum or dust with Pyrethrum powder after dark when the creatures are moving over soil surface.

Place scooped-out potato tubers or turnip roots upside down on surface soil. Creatures will hide in these and may thus be collected.
CHAPTER IV

DISEASES THAT ATTACK
PLANTS GENERALLY

Diseases are more insidious than pests.
1. Club root attacks all the Crucifer family.
2. Spotted Wilt is a virus.
3. Viruses are serious.
4. The cure?—nobody knows.

CLUB ROOT.
This disease is often known as "Finger-and-toe" or "Anbury" and will attack the roots of any member of the family Cruciferae, i.e. cabbage, cauliflower, turnip, radish, wallflowers, stocks, and some weeds like charlock and shepherd's purse.

The roots of affected plants swell and become knotted and distorted. When broken open these swellings are found to contain rotten, evil-smelling material. The plants are dwarf, they look sickly, and never really come to anything.

Control Measures. The Corrosive Sublimate Method.
First of all, clean healthy plants must be raised and so the seed-bed should be watered with Corrosive Sublimate (Mercuric Chloride), using 1 ounce of the chemical to 12 gallons of water. Mercuric Chloride is somewhat difficult to dissolve in water and it is, therefore, a good plan to use ½ gallon of hot water first of all and then to add the rest of the water to make up the correct solution. Mercuric Chloride can now be obtained in the form of tablets which are very easy to use, merely being crushed and dissolved in water.

The seed bed should be soaked a day or so before sowing the seed, and again 14 days after the seed has been put in.
Thus you can guarantee the plants you have raised to be free from the disease. If a garden or allotment is badly infected, ⅓ pint of a similar solution should be poured into every hole at planting-out time.

Corrosive Sublimate is very poisonous and must be used with care. Also it will eat away metal vessels if left in them too long.
DISEASES THAT ATTACK PLANTS

Do not use any vessels that have contained the solution for household purposes afterwards.

**VERTICILLIUM WILT (Verticillium albo-astrum).**

This disease occurs on many herbaceous as well as ornamental plants, and causes them to wither in the middle of perfect growth. When the stems are cut through the wood vessels appear dark green or brown in colour. The fungus over-winters in the soil on diseased plant tissues, or in tubers of such plants as dahlias, and can be disseminated by means of the cuttings. Asters, chrysanthemums, dahlias, antirrhinums, lupins, poppies, carnations and peonies may all be attacked by this disease.

**Control Measures.** Plants attacked should be removed and burnt. Susceptible plants should not be grown on infected areas for several years. Propagate from healthy stock.

**SPOTTED WILT.**

This is a virus disease. It is usually transmitted from plant to plant by means of insects and may be recognised by the concentric ring, sometimes yellow and sometimes white, on the leaves, or a marking similar to that of "Streak." In very young plants the virus may cause them to die. If plants show any mottling when examined, and rings of a darker or lighter colour are seen, the presence of Spotted Wilt should be suspected. Even if the plants are not growing satisfactorily and no such rings are seen: Spotted Wilt may still be suspected.

The principal plants attacked are tomatoes, cucumbers, melons, climbing French beans, asters, chrysanthemums, dahlias, zinnias. While working amongst plants it is possible to carry the disease from plant to plant by hand.

**Control Measures.** As this disease is so serious, directly it is suspected the attack should be confirmed by consulting immediately a recognised Horticultural expert.

Badly affected plants should be burnt at once and weeds such as the common plantain, which can act as a host-plant, should be rigorously kept down.

Keep down all the pests that may be the cause of carrying infection, particularly aphides (green-fly), capsid bugs (tarnished plant bugs), thrips and the like.

**THE VIRUS PROBLEM**

Spotted Wilt, mentioned above, is a virus disease but it is
so serious that it has purposely been placed under a separate heading. There are many other virus diseases, such as Yellow Edge and Crinkle in strawberries, Reversion in black currants, Mosaic in raspberries, Yellow Stripe in narcissus, Stripe in Iris, and Break in tulips. These are dealt with in some detail under the individual plants themselves.

It is very difficult to explain exactly what a virus disease is. It may, however, be said to be an infection present in the plant juice. Dr. Kenneth Smith in his book *Beyond the Microscope* says, "The symptoms of the diseases they cause are almost the only way we have to know that viruses exist at all. They may therefore be what are called 'obligate parasites,' which means that they are incapable of existing independently." Latterly he has been treating the viruses like organisms and more like chemical substances. Dr. W. M. Stanley of the U.S.A. actually succeeded in isolating the virus from a diseased Tobacco plant, the final result being an unusual protein which crystallised into long thin needles. At the present time it does seem as if viruses must be looked upon as a kind of chain connecting such "things" as bacteria with chemicals!

Virus infection spreads extraordinarily quickly from plant to plant. It is for this reason that it is so important to burn badly infected plants so as to prevent the disease from being transmitted.

It is equally important to keep down pests, particularly sucking insects such as aphides and, in the case of black currants, the Big Bud Mite. The incidence of virus diseases is undoubtedly one of the most serious problems that faces the gardener to-day.

The infection sometimes causes dwarfing, sometimes distortion, sometimes definite streaking, sometimes tipping of the foliage and stems and sometimes blotching of the flowers and foliage.

**Control Measures.** No cure is known. The only thing to do is to (1) start with virus-free material; (2) keep down the pests already mentioned and (3) destroy affected plants.

It is possible to-day to obtain certified virus-free strawberries, virus-free raspberry canes, virus-free black currants and so on.
CHAPTER V

THE PESTS OF VEGETABLES

This chapter tells me that:
1. Nicotine is best for aphids.
2. D.D.T. is very useful.
3. Parsnips are seldom troubled by pests.
4. Colorado beetles are dangerous.
5. Turnip gall weevil may be confused with club root.

In the chapter dealing with "Pests that attack Plants Generally" (Chapter III) details are given of pests that attack many vegetables. Care should be taken, therefore, to study Chapter III first.

No excuse is made for emphasising this point.

This chapter deals with the principal pests that attack vegetables, together with the best methods of control. In some cases reference is made to other pests.

ASPARAGUS

ASPARAGUS BEETLE (Crioceris asparagi).

The asparagus beetle has a black head, black and yellow wing cases, but the second portion of its body is bright red. It is, therefore, quite easy to recognise. It is usually $\frac{1}{4}$th to $\frac{1}{2}$ inch in length. It lays its eggs from June onwards, first on the asparagus shoots and later on the foliage after it has developed. The eggs are spindle-shaped, oval, greenish-brown in colour and are fixed by their ends to the plants. They usually occur in rows of 3 to 5.

The eggs hatch out in 5 or 7 days, into a grub $\frac{1}{2}$ inch long, usually slate-coloured but sometimes almost yellow. This grub feeds on the asparagus plant as does the beetle, and disfigures the shoots and stems.

In very bad attacks the shoots become defiled and useless from the masses of eggs and because of the sticky fluid emitted by the grubs.

The beetles spend the winter hiding among any rubbish that will
give shelter. From the spring onward, there may be 2 or 3 generations in one year.

**Control Measures.** Keep the beds dusted regularly with a good nicotine dust in order to kill the larvae and the beetles. When the foliage is cut down in the autumn, collect it carefully and burn it in order to destroy both beetles and grubs.

D.D.T. dust should be applied lightly on calm evenings or early mornings. A simple and effective remedy.

Leave small portions of a bed uncut to act as a trap crop. The insects thus disturbed during the original cutting congregate on the stems that are left and may there be destroyed by nicotine spraying.

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**BEAN, BROAD**

**BLACK APHIS OR BEAN APHIS** (*Aphis rumicis*).

The black aphis—commonly known as the Black Blight, or Black Dauphin—large clusters of which form at the tops of broad bean plants and increase at such a rate that the shoots become covered with fly and with a sticky excrement.

During the winter the black aphis may be found on the shrub *Euonymus europaeus* (the spindle tree) in the egg stage. These eggs hatch out sometime during the month of March and the females then fly to the beans where they multiply exceedingly.

**Control Measures.** Any euonymus trees in the garden should be sprayed with a 5% solution of a good tar distillate wash in the winter. It is well worth while spraying neighbours' trees and bushes with a similar wash if they will give permission for this to be done. Those who do not wish to spray should grub up the bushes and burn them together with any other spindle trees in the vicinity.
This aphis may over-winter on old mangolds and on sheltered self-sown plants. It is more difficult, therefore, to ensure winter control in the country than it is in the town.

On the broad beans themselves, spray with liquid derris when the black fly is first seen.

Other pests that attack broad beans are: thrips, weevils and beetles. For details see under Pea. See page 49.

**BEAN, RUNNER**

**RED SPIDER MITE** (*Tetranychus telarius*).

Runner beans may be badly attacked with red spider mites in the summer. The attacks are usually particularly bad during drought years and it is then that control measures are necessary.

The leaves turn a brownish shade and if the underside is examined it will be found to be covered with minute white webs and, if a magnifying glass is used, the yellowish-red mites will be distinguished.

**Control Measures.** It is always worth while, in gardens, to spray runner beans with clean water both in the evening and morning. The spraying should be done with as great a force as possible under the leaves.

Where it is impossible to syringe regularly, the plants may be sprayed with liver of sulphur, using 1 ounce of liver of sulphur to 8 gallons of water. Stir in, in addition, a little spreader or soap.

Other pests that may attack runner beans are: black aphis (see Broad Bean).

**BEETROOT**

**MANGOLD FLY** (*Pegomyia betae*).

This fly is very similar in appearance to the ordinary house-fly. It may be seen flying around the rows of beetroot or settling on the leaves. It lays its eggs in small groups on the underside of leaves, and the larvae tunnel in the same manner as the celery fly, causing blisters to appear. As there may be three generations in one year it is most important to control the trouble at the start, when it is often seen on baby plants, even on the cotyledons.
Control Measures. Spray with nicotine and soft soap (or substitute spreader) directly the trouble is seen. Give another spraying a week later. Spray on a warm day if possible.

Formula: \( \frac{1}{4} \) ounce liquid nicotine, \( \frac{1}{4} \) lb. soft soap, \( 2 \frac{1}{2} \) gallons water.

Spraying with D.D.T. has proved effective.

This pest also attacks spinach.

Other pests that may attack beetroot are: eel worm (see Pea), flea beetles (see Cabbage), black aphid (see Broad Bean).

CABBAGE

APHIS, MEALY CABBAGE \( (Brevicoryne brassicae) \).

This is a very serious pest which attacks all members of the cabbage family. So serious is it in the Counties of Bedfordshire, Cambridgeshire and Huntingdon that the Ministry of Agriculture have issued compulsory orders with regard to its control.

The aphid is of mauve-coloured, mealy colour. It distorts the leaves of plants and reduces the rate of growth. It is usually found on the under-surface of leaves and in the case of Brussels sprouts, gets right into the hearts. The aphids, too, may be found in blisters on the underside of foliage.

Control Measures. As the aphides often live on Brussels sprouts, etc., all through the winter, and may lay eggs on winter greens, it is suggested that all sprout plants and seed plants which provide the main source of infestation, should be sprayed or dusted with nicotine early in May. The summer planted crop should be dealt with as the infestation arises.

The spraying with nicotine and soft soap should always be done at least a fortnight before cutting, so as to allow the nicotine to be vaporised or washed off before the sprouts or cabbage are used for food.

Derris sprays may be used by those who fear to use nicotine.

BEETLES, FLEA.

Flea beetles are small and generally black or dark grey in colour. They damage young plants when they are first coming through the ground and they may nibble them off just below the ground. They attack the leaves of larger plants, causing them to look punctured and distorted.

They can be easily recognized because they hop away quickly
and hide themselves when disturbed. They will even do this when the shadow of the gardener falls upon them. Large numbers of them attacking plants may cause them to look quite black.

Flea beetles spend the winter in dry, vegetable rubbish such as is found in hedge bottoms and under stacks of straw. They commence attacking plants early in May and may continue to do so well on into August.

Control Measures. The seeds of all members of the cabbage family, including turnips, swedes and radishes, should be wetted with paraffin at the rate of \( \frac{1}{4} \)th pint per \( \frac{1}{2} \) lb. of seed used. The seed should then be dried overnight and sown the next day.

Gammexane dust applied liberally is perfectly effective. It should be applied on to the rows as soon as the seedlings have appeared through the soil. A second dusting is advisable a week later according to weather conditions. Alternatively the seedlings may be dusted with a 2% D.D.T. dust.

CABBAGE ROOT FLY \((Delia brassicae)\).

This pest is very widely distributed and is perhaps the most important of all those that attack cabbages, cauliflowers, Brussels sprouts and broccoli. There are at least two generations a year and under exceptional conditions a third may occur.

The maggots attack the cabbages in the roots and stem. The eggs are laid at soil level and the larvae on hatching out then burrows up and down in the pith. Attacked plants remain small as the root is unable to develop.

Control Measures. There are three good methods of controlling this pest:

1. 4 per cent. calomel dust should be sprinkled at the rate of 1 ounce to each 10 plants immediately after setting out, and again 10 days later. A further dressing is advisable 10 days after this.

2. Mix a 5% D.D.T. dust with water to form a thick cream, say at the rate of 1 lb. dust to 1 pint of water. The plants are then puddled in this mixture before being planted out. The roots and stems up to the first leaves should be covered with the mixture.

3. Mercuric chloride (Corrosive Sublimate) should be mixed with water at the rate of \( \frac{1}{4} \) ounce to a 2 gallon can. This poison-
ous solution should be poured into the holes when putting out the plants at the rate of \( \frac{1}{4} \) pint to a hole. It is seldom that this method fails and may be said perhaps to be the most successful of the three. It is not popular, however, because mercuric chloride is poisonous, though it does not pass on its poison to the plant in any way.

**CABBAGE WHITE FLY \((Aleurodes brassicae)\).**

These white flies are similar to those found in the greenhouse. Actually the glasshouse species is quite different from the white fly which attacks members of the cabbage family. These white waxy flies are usually found on the under surface of leaves. They suck the sap and make the plants unpalatable because of the “frass” they exude.

**Control Measures.** As for Mealy cabbage aphis (see page 40).

The routine applications of D.D.T. dust as recommended for Cabbage Caterpillars . . . check White Fly.

**CABBAGE CATERPILLAR \((Cabbage Moth, Mamestra brassicae)\). White Butterflies. \(Pieris brassicae\) and \(P. rapae\).**

The caterpillars that attack all members of the brassica family including cabbages, Brussels sprouts, cauliflowers, nasturtiums, stocks and such weeds as charlock, arise from white butterflies and cabbage moths.

The damage they do is similar. The foliage is eaten and the plants are ruined by objectional excreta.

In the case of the butterfly caterpillars, there are two broods, the second occurring in August and September. The caterpillars tend to feed together and, as a result, they often strip the leaves, leaving only the main ribs and main veins. They usually concentrate on outer leaves.

The caterpillars of the cabbage moth, however, tend to burrow down into the hearts of cabbages and do greater damage in a shorter time than their “cousins.” They do the greatest amount of damage from June to September.

**Control Measures.** In both cases the caterpillars can easily be controlled by spraying with liquid derris or dusting with fresh derris powder. It is important to make applications directly the pest is seen for the younger caterpillars are more readily killed than their maturer brothers.

Another effective control is by the application of a dust containing 2% or more of D.D.T. whenever the caterpillars are
seen. The Cabbage Moth caterpillars should of course be dusted before it has eaten its way into the heart of the cabbage where it is inaccessible.

Where a mature caterpillar is found lying comatose surrounded by a mass of little yellow cocoons—this should be left. The cocoons will be the means of ensuring more parasitic "wasps" which are the natural enemies of this pest.

**CARROT**

**CARROT FLY** (*Psila rosae*).

Undoubtedly this is the most serious pest of carrots. It will also attack parsley and celery. The fly is small, dark and of a deep shiny bottle-green colour. The females lay their eggs near the surface of the ground and the larvae burrow under the soil and tunnel into the roots. Large numbers of yellowish maggots may be found in each carrot. The foliage then goes reddish or rusty, the tops may wilt, and the growth of the whole plant is arrested.

**Control Measures.** Crude or whizzed naphthalene should be applied in between the rows at the rate of one ounce per yard run, just before thinning and again ten days later. A further dressing should be made a week after this.

Carrots should always be thinned early and the soil compressed along the rows afterwards so as to prevent egg-laying and subsequent movement of larvae. All thinned carrots removed from the rows should be put on the compost heap for rotting down.

Routine spraying of the foliage with a concentration of 0.2% to 0.5% D.D.T. as an emulsion has given good results. Begin
when the carrots have about four leaves and carry on at regular intervals of about 10–14 days till mid-September for maincrop carrots. D.D.T. dusts are less effective.

**CARROT APHIDES** (*Cavariella* spp.).

The green aphid—commonly known as green fly—may attack the leaves of carrots in the summer and cause the leaves to turn yellow.

**Control Measures.** Spray the foliage with nicotine and soft soap, formula \( \frac{1}{4} \text{ ounce nicotine, } \frac{1}{4} \text{ lb. soft soap, } 2\frac{1}{2} \text{ gallons of water.} \) Give a good soaking on a warm day if possible.

Dusting with a good nicotine dust is also successful, if done on a warm day.

**CAULIFLOWER**

**CABBAGE STEM FLEA BEETLE** (*Psylliodes chrysocephala*).

This pest is more serious in the South of England than in the North. The grubs of this beetle tunnel into the stems of young plants and then into the leaf stalks. The plants flag and amateurs often pull them up without noticing where the damage is done.

As the pest will attack young plants in the nursery beds it is possible to put out plants into their permanent position after the grubs have started burrowing. Whole crops have been ruined because of this.

**Control Measures.** The soil in the nursery beds should be given a good dusting with one of the best proprietary naphthalene dusts before seed sowing. Directly the plants are through, a further dusting should be given and yet another ten days after this. This work should be done early in the morning in each case. Many gardeners now dust with naphthalene as an "insurance" every year.

It is worth while trying Gammexane for this pest, see page 213.

*Other pests* that attack cauliflower are: root fly, cabbage aphid, cabbage white fly and caterpillars. For description of control see *CABBAGE*.

**CELERY**

**CELERY FLY** (*Acidia heraclei*).

The first flies appear in April or May and three broods arise during the season. The first usually in May or early June, the second in late July and the third in September.
THE PESTS OF VEGETABLES

The celery fly lays its eggs on the under-surfaces of the leaves. These hatch out into maggots which burrow between the upper and lower surfaces of the foliage, causing blisters. Inside the blisters the maggots feed and grow. It is usually by these blisters, either large or small, that the trouble is first recognised.

The attack generally takes place in the seedling stage, though it is usually not recognised until the second brood appears.

Control Measures. It is most important to protect the young plants in the frames or greenhouse by keeping them sprayed with nicotine and soft soap (formula: \( \frac{1}{4} \) ounce nicotine, \( \frac{1}{4} \) lb. soft soap, to 2\( \frac{1}{2} \) gallons of water). Hand picking and pinching to destroy the maggots may, of course, be done on a small scale.

Attacked plants may be given a stimulant such as Chilean potash nitrate, in order to encourage quick growth. The slightest sprinkling will do.

Once the plants are in their trenches, spraying with nicotine is necessary early in June, as a rule, to control the second generation. If this is properly done, there can be no third generation in September.

An excellent modern method of control is to use a D.D.T. dust which should be applied to the celery plants as soon as they are set out, and renewed from time to time. It is also quite a good idea to apply the D.D.T. to the boxes of young celery plants as soon as they are put outside to harden off.

Other pests that attack celery are: aphides and carrot fly. For control of both of these, see CARROT.

CUCUMBER

RED SPIDER (Tetranychus telarius).

A tiny reddish yellow mite—lives on the under-surfaces of the leaves, sucking the sap and spinning minute white webs. These can usually only be distinguished under a magnifying glass. As a result, the leaves soon turn yellow, and finally a reddish brown colour.

Control Measures. During the summer see that the under-surfaces of the leaves are syringed regularly with water. Apply the spray with as much force as possible.

In bad cases, it is possible to spray with a summer petroleum oil, used according to the manufacturers' instructions. In greenhouses the use of an aerocide gun is most effective.†

* Or spreader; † Aerocide guns are made by Pan Britannica Industries.
ROOT KNOT EEL WORM (*Heterodera radicicola*).

A minute eel worm attacks the roots of cucumbers growing in frames and glasshouses. The plants wilt and, if the roots are examined, knot-like galls will be found. Growth is stunted, both above and below ground.

For general details with regard to eel worms see Chapter III.

**Control Measures.** No effective method of control is known other than soil sterilisation by heat or steam. For details, see Chapter XIV.

D-D soil fumigant may also be used. For details see Chapter III.

LETTUCE

**APHIDES** (*Myzus lactuca*, etc.).

Green aphides (green-fly) suck the under-surfaces of the leaves of lettuce. The leaves are distorted and the plants are stunted. The trouble usually happens when the plants are young.

For further details on aphides, see Chapter III.

**Control Measures.** Spray with nicotine on a warm day. Formula: $\frac{1}{4}$ ounce nicotine, $\frac{1}{4}$ lb. soft soap* to 2½ gallons of water. Spray the soil all round also, so that nicotine fumes will arise and kill the insects. Nicotine dusts may be used.

**ROOT APHIDES** (*Pemphigus bursarius*).

This aphis, which is white and mealy-looking, attacks the roots of lettuces and feeds on them. The result is that not only are the roots checked but the plants become stunted in consequence and refuse to grow.

It has been found that these aphides migrate to the lettuce roots from galls which they form on poplars. The trouble usually occurs late in the summer rather than early in the season.

**Control Measures.** Before planting out lettuces in the summer or sowing lettuce seed, crude or whizzed naphthalene may be forked into the ground at 3 ounces to the square yard. This will usually keep the aphides away.

A further dressing may be hoed into the ground when the plants are an inch high or so, if necessary.

*Other pests* that attack lettuces are: slugs (for control see Chapter III).

* Or spreader.
MUSHROOM FLYS.

Many species of flies will damage mushrooms, the Sciara and the Phorid being the most important. They are similar in size—the larvae tunnel into the mushrooms as they appear, ruining both the stems and the caps as well. Their ravages make the mushrooms quite unsaleable, and bad attacks can easily destroy the whole crop.

Control Methods. Relatively low temperatures in the house may prevent egg-laying and retard the development of the flies. The temperature should be kept just below 60 deg. F.

Strict cleanliness should be observed.

The maggots of these pests can easily be destroyed by incorporating a 5% D.D.T. dust with the gypsum base used during composting.

Alternatively, apply D.D.T. dust at 1 ounce per square yard to the beds before spawning, and again when the casing soil is in place over the spawned bed.

A MUSHROOM FLY AND LARVAE (much enlarged)

MUSHROOM MITES.

There are a large number of mites that may be found in a mushroom house. The slow-moving species are usually the most harmful, while the active ones are normally harmless.

They attack as soon as the mushrooms start to appear, holes being found in the stalks and the caps. These holes, when examined under a magnifying glass, will be found to contain numerous eggs and mites. These mites may injure the spawn as well, so cropping may thus cease.
Control Measures. Fresh manure is probably less likely to contain injurious mites than that which has been stored for a long period.

D.D.T. dust is said to control this pest.

ONION

ONION FLY (*Delia (Hylenyia) antiqua*).

The onion fly is similar to the ordinary house-fly. It is a little over 1/2 inch long, dark grey in colour, and has tiny red eyes and black legs.

The female lays several eggs on the soil or on the neck of the onion early in May. She is attracted to the onion rows by the strong smell. The maggots usually hatch out in five to seven days. They are dirty white in colour, have no legs, and when full-grown are about one-third inch long.

The first indication of infestation is usually theflagging of the plants and the yellowing of the leaves.

Control Measures. Crude naphthalene or whizzed naphthalene should be applied along the rows at the rate of 2 ounces to the yard run. The first application should be just before thinning, and a further application ten days later.

Another effective method of preventing an attack of maggots is to dust the rows with 4% calomel dust at the rate of 1 lb. to 50 yards. The dust should be applied in such a way that, at least, 2 inches of ground on either side of the plants receive a dressing. The first application should be given when the seedlings are 1½ inches high, and the second ten days later.

Yet another method is to water heavily at the rate of 1 gallon per square yard or 10 yards of onion row with an emulsion of at least 0.5% D.D.T. This should be done when the seedlings are at the "loop" stage, or, in the case of box-sown onions, as soon as they are planted out. The treatment should be repeated two weeks later.

It is important when cultivating between the rows of onions not to damage the plants and, after thinning, the rows should be firmed.

Any mature bulbs attacked, together with the maggots in the soil surrounding them, should be lifted and burnt.

Other pests that attack onions are: eel worms (for control see Pea).
PARSNIP

Parsnips are attacked by the celery fly but it is seldom that the trouble is very serious. As, however, this may prove a breeding ground for attacks on celery, it is worth while controlling it.

For instructions, see CELERY.

Other pests that attack parsnips are: carrot fly (for control, see CARROT) and aphides (for details see Chapter III).

PEA

PEA AND BEAN BEETLES (*Bruchus* spp.).

The beetles lay eggs on the pods and the maggots which hatch out in a few days burrow into the peas themselves and feed on them.

When sowing pea seeds, little beetles may be found among them.

Control Measures. Where infected seed is suspected it should be placed in a little muslin bag which can be hung from the end of a stick into boiling water for five seconds.

Be sure that the water is boiling and do not leave the peas in the water longer than the specified time.

With small lots of seed, especially for human consumption, it will be sufficient to add a pinch of D.D.T. dust and mix well till all the seed appears to bear an obvious deposit. For larger quantities of seed, about 1% by weight of 5% D.D.T. can be given, particularly for seeds not intended for human consumption.

PEA MOTH (*Cydia* [*Graphoipha*] *nigricana*).

The female of the pea moth lays its eggs on the young pods, and the larvae soon burrow into the pods and destroy the peas. Three or four larvae may be found in a pod, feeding on the seeds. When these are fully grown, they drop to the ground and pupate in the soil.
The moths emerge from these cocoons early next summer.

**Control Measures.** The young pods should be sprayed with nicotine as the flowers are setting. Any moths about are then killed and the larvae or eggs on the outside of the pods are killed also.

Spray with an emulsion of not less than 0.1% D.D.T. at pod forming and repeat 10 days later when a dust is used. It should be applied three times at weekly intervals.

Continuous cultivation is also important for by this means the larvae are exposed when they drop to the ground and will be eaten by birds.

A rotation of crops should be carried out as this hinders infection.

**PEA AND BEAN WEEVILS** (*Sitona lineata* and other *spp.*).

It is thought that the larvae live in the soil and feed on the little white nodules which are found on the roots of all members of the pea and bean family. The weevils themselves eat semi-circular notches out of the sides and edges of the leaves. A great deal of damage can thus be done to young plants.

The weevils are dark grey in colour and are almost indistinguishable in the soil. For this reason the damage done is often attributed to birds.

**Control Measures.** By regular hoeing ensure a fine tilth along the rows and thus remove the clods of soil which are the natural hiding place of the weevil. Regular cultivation disturbs them also and they dislike this.

As soon as the weevils are evident, dust with 5% D.D.T. dust.

**PEA APHIS** (*Macrosiphum pisi*).

This is a small aphid (green-fly), green in colour, similar to the fly which attacks broad beans. Usually attacks peas when they are young or three-quarters grown. Seldom attacks fully grown plants.

**Control Measures.** Spray with nicotine and soft soap. Formula: ½ ounce nicotine, ½ lb. soft soap to 2½ gallons water, directly the first aphides are seen.

Or, spray with liquid derris giving the rows a thorough soaking.

**EEL WORMS** (*Heterodera schachtii* and *Anguillulina dipsaci*).

For general instructions, see EEL WORMS in Chapter III.

Heterodera attacks the roots, forming little cysts on them similar to, but smaller than, the bacterial nodules found on the roots of all pea and bean plants.
Control Measures. No control is at present known. Peas should not be grown on the same ground for four years.

**PEA AND BEAN THRIPS** (*Kakothrips pisivorus*).

For general information, see *Thrips*, Chapter III.

Pea and bean thrips first attack the seedlings, sucking the sap from the growing points. The plants are thus distorted and the growth is limited. Later, they attack the leaves, stems and pods and, in a dry season, they multiply rapidly.

The pods become silvery-looking, and later turn brown. The trouble usually begins near the base of the plants and, in bad attacks, the pods are small and distorted.

**Control Measures.** Hoe regularly along the rows. Before planting, apply hydrated lime at 5 ounces to the square yard.

Three weeks before picking, when the majority of the flowers have set, spray the rows with nicotine and soft soap—formula: \( \frac{1}{4} \) ounce nicotine, \( \frac{1}{2} \) lb. soft soap to 2\( \frac{3}{4} \) gallons water.

Use D.D.T. dust as soon as the flowers have set and again once every fourteen days if necessary.

*Other pests* that attack peas are: slugs (see Chapter III).

**POTATO**

**THE COLORADO BEETLE.**

At the present time the Colorado Beetles have only been found in the south in this country. They are, however, a very dangerous potato pest.

The beetle spends the winter buried in the soil to a depth of ten inches. Late in the spring or early in the summer it works its way to the surface and flies to the nearest potato plant. It feeds
on the potato leaves, the females laying clusters of eggs at the same time. These hatch out into grubs which feed on the leaves also. In three weeks these are fully grown, and they burrow in the soil to pupate. Ten days later they may emerge again as adult beetles. They will then burrow up to the surface and produce a further generation.

In bad attacks all the tops of the potatoes will be eaten and no tubers worth digging will be formed. The beetles are similar in size and shape to ladybirds, but are bright yellow and have black stripes running from one end to the other of their bodies. The larvae are reddish-orange in colour and have three pairs of legs.

Control Measures. Any suspected Colorado beetle or grubs should be placed in a tin box with no holes punched in it, together with a piece of potato leaf. This should be sent immediately to the Ministry of Agriculture, 28 Milton Road, Harpenden, Herts, with a letter stating the exact place where the insects were found and the name and address of the finder. No other steps should be taken until the Ministry give instructions.

For Slug Attacks, Wireworm, etc., see pages 26 and 31.

RADISH

CABBAGE WHITE FLY, FLEA BEETLES AND ROOT FLY.
For details, see under Cabbage.

SPINACH

MANGOLD FLY.
See Beetroot, page 39.

TURNIP

TURNIP GALL WEEVIL (*Ceuthorhynchus pleurostigma*).
This gall weevil attacks all members of the cabbage family, such as cabbages, savoys, Brussels sprouts, kales, kohl-rabi—as well as turnips. When attacked the plants produce large rounded galls which grow out from the root, usually near ground level. These galls or "hard blisters," when cut open, will be found to be hollow and to contain a white grub. This may be white or yellowish—is legless and has a brown head. When found it is usually curled up.
The beetle itself is only \( \frac{1}{4} \) inch long, is black above and greyish underneath.

Many people confuse turnip gall weevil with Club Root, but it is the presence of the little curled-up maggot in the galls that helps to show the difference. The "galls" produced by the Club Root disease are usually larger and when cut open are very evil smelling. (See Club Root, page 34).

Control Measures. Use affected turnips as soon as possible, as in this way the maggots can be destroyed before they leave the galls and pupate in the ground.

All cabbage stems, etc., affected by these galls should be burnt, if possible, so as to kill the maggots.

Dust along the rows in August with whizzed naphthalene at 1 ounce to the yard run.
CHAPTER VI

THE DISEASES OF VEGETABLES

Remember:—
1. Resistant varieties.
2. Rotation.
3. Clean seed.
4. Good cultural conditions.
5. Sterilised soil.

ASPARAGUS

ASPARAGUS RUST (Puccinia asparagi).

This rust usually appears after mid-summer. First of all, rusty spots are seen on the stems which look blistered. The little leaves which should be glossy green turn yellowish brown. As the autumn approaches, the spots look darker.

Control Measures. The foliage should be cut in the autumn, before the little leaves, known as needles, fall. The material should then be burnt immediately. The cut should be made just below soil level, so that no portion of the stem is left above ground to serve as a source of infection the following year.

Young plants should always be raised as far away as possible from the established beds, with the object of preventing infection taking place. Two resistant varieties are Martha Washington and Mary Washington.

Special Note.—Gardeners sometimes call a streaky looking discoloration of the white stem at cutting time, rust. This rust is just a blemish and should not be confused with the disease.

VIOLET ROOT ROT (Rhizoctonia crocorum).

This root rot attacks the underground portions of asparagus plants and is commonly called by gardeners "Copper-web" or "Coppery-web." The crowns become covered with a brownish purple spawn and, as a result of an attack, the plants are soon exhausted and die. Unfortunately the disease is often not noticed until the plants are seen to be dying off in circular areas several feet in diameter.
THE DISEASES OF VEGETABLES

Control Measures. Contaminated soil may be treated by forking in bleaching powder at the rate of 2 ounces to the square yard either late in the spring or early in the summer. All affected roots should be burnt; in bad cases the whole of the asparagus bed should be scrapped and burnt.

Special Note.—This disease also attacks beetroot, carrots, mangolds, potatoes and, on farms, clover and lucerne. None of these crops should be grown on land which has grown infected asparagus.

BEETROOT

BLACK LEG (Phoma betae, Pythium de baryanum, Pythium aphanidermatum and Corticium solani).

All these diseases may cause young seedlings to damp off and the stems to become blackened as a result. Large numbers of seedlings may die at a time. In bad attacks the roots, instead of being thick and round, are thread-like.

The trouble is usually contracted from the seed.

Control Measures. The seed should be treated with one of the well-known proprietary organic mercuric compounds, using ¼ ounce per 1 lb. of seed. After treatment, spread the seed out to dry before sowing.

HEART ROT.

In July the leaves in the crown of the beetroot turn black and die and, in bad cases, the outer leaves will be killed also. Subsequently the root will rot away.

It is a particularly bad disease in dry summers and on soils that have been heavily limed.

Control Measures. It is better to grow beetroot on land that contains sufficient organic and moisture-holding matter. Heavy dressings of lime should not be given.

Borax should be applied to the ground at the rate of 1 ounce to the square yard before sowing the seed on land which is suspected of producing Heart Rot. It is said that this disease is due to a deficiency of boron.

LEAF SPOT (Cercospora beticola).

This trouble is usually present wherever beetroot is grown. On farms it is found also on sugar beet and mangold wurzel.
Spots will be found on the leaves, first of all brown, with reddish-purple borders and then, when these reach \( \frac{1}{3} \) inch in size, they become grey in the centre. Later, the dead tissue will drop out leaving a ragged hole.

**Control Measures.** After an infected crop has been harvested, all the leaves should be burnt or dug in at least a spade's depth.

In severe cases spray the rows with a Bordeaux mixture using 1 lb. of powdered copper sulphate, \( \frac{1}{2} \) lb. hydrated lime to \( \frac{12}{2} \) gallons water. It is necessary to spray again a fortnight afterwards and again a fortnight after that.

A proprietary Bordeaux may be used for the purpose.

As the disease is seed-borne, all seed thought to be infected should be soaked in formaldehyde—formula: 3 parts formaldehyde to 200 parts of water—for 7 minutes. It should then be rinsed with water and either dried or sown at once.

*Other diseases* which will attack beetroot are: Crown Gall, which may cause large ugly swellings. No method of control is known. Violet Root Rot. Control—see *Asparagus*. Common Scab. For details, see *Potato*; and Rust (*Uromyces betae*).

**BEAN, BROAD**

**CHOCOLATE SPOT.**

The stems, foliage and pods of the broad beans are covered with dark brown spots, blotches or streaks. The trouble is usually worse in rainy seasons.

**Control Measures.** Applications of potash before sowing the seed seem to make the plants more resistant to the disease.

Therefore, fork in sulphate of potash at 2 ounces to the square yard, plus superphosphate at 3 ounces to the square yard, giving the surface of the soil a dressing of hydrated lime at 5 ounces to the square yard afterwards.

N.B.—Where it is impossible to obtain sulphate of potash, wood ashes should be used instead at \( \frac{1}{3} \) lb. to the square yard.

*Other diseases* that may attack broad beans are: Rust (*Uromyces fabae*). This seldom gives trouble until the plants are fully grown, when it does little harm. It can be controlled if necessary by spraying with colloidal copper. Leaf Spot (*Cercospora fabae*), for discussion, see *Beetroot*. 
ANTHRACNOSE (*Colletotrichum lindemuthianum*).

This disease is found all over the country. It is sometimes called Canker, other times Rust, and even Blight. Small dark specks will be found on the pods, leaves and stems. They are usually surrounded by reddish lines. The spots get larger and become more regularly shaped, looking like sunken brown patches. These, in their turn, are covered later with a thin whitish crust. The disease is at its worst during cold, wet weather.

Badly affected plants are often shrivelled and spotted beans, when sown, may either not germinate at all or produce a stem which drops its cotyledons. The cankers on the stems sometimes are so numerous and so deep as to cause the plant to fall over. It is, however, the spot on the pod which is most obvious and which does the greatest amount of harm.

**Control Measures.** The plants should be sprayed as a precaution, before the first pods set, with Bordeaux mixture at half the normal strength, i.e. $\frac{1}{2}$ lb. of powdered copper-sulphate, $\frac{2}{3}$ lb. hydrated lime, to 12$\frac{1}{2}$ gallons of water.

Further sprayings should be given, if necessary, with liver of sulphur, dissolving 1 ounce in a 2-gallon can of water. It is never, however, advisable to spray after the pods are half-grown.

HALO BLIGHT (*Bacterium medicaginis*).

When attacked by Halo Blight the whole of the plant or part of it suddenly wilts. Small, angular spots surrounded by a lighter "halo" appear, not only on the leaves, but also on the stems and pods. Sometimes a milky fluid exudes from the spots.

**Control Measures.** It is most important to sow clean seed. Affected seeds are wrinkled, blistered and/or have yellow spots on them. All affected plants should be removed and burnt directly they are seen.

The variety Black Wonder has been shown to be fairly resistant.

MOSAIC.

A virus disease which produces irregular light yellow areas, and dark green patches on the leaves. This mottling or mosaic effect causes the leaves to become puckered, especially along the mid-rib. The leaf usually curls downwards.

As far as is known, the virus lives through the winter in the
seed. It may be transmitted from plant to plant during picking or by the ravages of insects.

Control Methods. No control methods are known at present.

BEAN, RUNNER

See Dwarf Bean.

Special Note.—Halo Blight does not seem troublesome.

CABBAGE

CLUB ROOT (*Plasmodiophora brassicae*).

For details see Chapter IV, page 34.

CANKER (*Phoma lingam*).

Sometimes called Black Leg. It attacks all types of cabbage, as well as turnips, kohlrabi, mustard, radish, cress, and even sweet Alyssum.
The plants may either become infected in the seed-bed or later in the summer. A depressed light brown canker will be found near the base of the stem. This enlarges until the stem is girdled. The tissue will then turn black, while light brown circular spots may appear on the leaves.

In bad cases the plants will wilt or, if the attack is late in the season, the weight of the plant may cause it to lean over.

Control Measures. No member of the cabbage family should be grown on affected land for three years.

Where trouble has been experienced in the past the seed should be immersed in a corrosive sublimate solution, formula: 1 ounce mercuric chloride to 7½ gallons water. Seed may be tied in a muslin bag and hung from a stick for ease of dipping.

After treatment the seed should be rinsed in clean water and then spread out to dry.

Another method (usually a better one) is to dip the seed in water at a temperature of 122 deg. F. for 30 minutes. The seed should then be removed, dipped in cold water to cool and be spread out to dry afterwards. Unfortunately this treatment reduces germination.

RING SPOT (*Mycosphaerella brassicicola*).

A disease mainly of the South and South-western Counties of England, though it occurs also in Wales. Prefers to attack broccoli.

Circular brown spots surrounded by a green border appear on the leaves, varying in size from ⅛th inch to ¼ inch. Mainly abundant on the lower leaves.

Control Measures. Remove the older leaves and the outer leaves immediately any sign of the trouble is seen. Burn all refuse removed from affected plants. Do not grow members of the cabbage family on the same piece of ground for three or four years.

DOWNY MILDEW (*Peronospora parasitica*).

This damages seedlings rather than well-grown plants. Particularly bad on cauliflowers, especially so in the case of plants raised under glass.

The leaves turn yellowish green in colour and when examined closely, white downy patches will be seen on the under-surfaces.

Control Measures. Spray with Liver of Sulphur. Formula: 1 ounce potassium sulphide to 2 gallons of water.
Avoid over-crowding at all costs.

Other diseases that may attack cabbages are: Leaf Spot, Soft Rot, White Blister, and Grey Mould. None of these is very serious and no practicable control measures are yet known in connection with any of them.

CARROT

SCLEROTINIA ROT (Sclerotinia sclerotiorum).

A rot which occurs in storage bins, in clamps, "burys," "hales," "hogs," and pits. The roots shrink and rot because they are attacked by this fungus disease near the crown as the result of direct infection from the soil.

Control Measures. Never attempt to store any roots which have been "wounded" in any way during harvesting. Roots which show any indication of the disease before storage should be burnt together with any other infected material.

Good ventilation discourages the development of this fungus.

Other diseases that may attack carrots are Violet Root Rot, see Asparagus; Soft Rot, see Celery.

CAULIFLOWER

See Cabbage, page 58.

CELERY

LEAF SPOT (Septoria api).

Undoubtedly the most serious disease of celery—appears all over the country and has caused complete crop failure.

On the foliage discoloured areas will be found on which minute black fluted bodies will be seen. The spots will increase in size until the whole leaf is affected. It will then wither away and rot. Sometimes this disease appears as brown, dry patches, plus a few black specks.

Though the disease usually attacks the plants in the early stages, it is generally not obvious until July. The disease is carried on from year to year by infected seed.

Control Measures. Seed should be purchased from seedsmen who guarantee that the seed coats are free from the disease, or all celery seeds purchased should be soaked in a weak solution
of formaldehyde for 24 hours. Formula: 1 part of formalin to 300 parts of water. The seed should be dried slowly afterwards.

In the garden, the plants should be sprayed with Bordeaux mixture, making certain to give them a thorough covering, both the lower and upper surfaces of the leaves. In most years three applications are necessary to get complete control. In wet years more applications than this may be advisable. Formula: 1 1/2 lb. hydrated lime, 1 lb. copper sulphate to 12 1/2 gallons of water. Alternatively, a copper white oil emulsion spray may be used.

ROOT ROT (Phoma apiicola).

Attacked plants develop black or dark brown areas, both on the roots and on the stems just below soil level. In very bad cases the tops of the plants will break off. The trouble may occur both on the seedlings and on the adult plants. This disease is common all over the country. It is carried on from year to year on the seed coats.

Control Measures. It is possible now to obtain seed which is guaranteed to be free from this disease. Seedsmen should be asked about this.

Where infected seed is purchased this should be treated with formalin as advised for leaf spot.
SOFT ROT (*Bacterium carotovorum*).  
This rot usually attacks the hearts of celery plants, rendering them useless. The trouble generally occurs from December onwards, and will continue even though the adult celery plants are lifted to be stored under cover. The disease enters the plants through wounds made by insects, slugs and snails.  
**Control Measures.** All insects, slugs and snails should be kept down.  
Affected plants should be burnt and the ground concerned should not be used for growing celery for three years.  
Applying borax crystals along the rows before planting at \( \frac{1}{2} \) ounce to the yard run and raking lightly in has proved useful.

CUCUMBER

ANTHRACNOSE (*Colletotrichum lagenarium*).  
This disease is often called Leaf Spot because the foliage when attacked is covered by reddish or pale green spots. These enlarge and unite, and the leaves then wither and die. The stems and fruits may be attacked too.  
It is the most widespread serious leaf spot disease of cucumbers in the country.  
**Control Measures.** The fungus will live on new and rotten wood; on paper, straw, and even on strawy manure. The spores will be spread when watering and syringing and distributed on the clothes of workers.  
It is most important to inspect all sources of infection and to clean the glasshouses and frames in the winter thoroughly with emulsified cresylic acid. Excessive humidity in the glasshouse or frame should be avoided and so should wide variations of temperatures.  
Spray affected plants directly the disease is first seen with liver of sulphur. Formula: 1 ounce potassium sulphide to 2 gallons of water, stirring in a cupful of flour paste. Regular sprayings every week may be necessary.

BLOTCH (*Cercospora melonis*).  
A disease which was very prevalent in the country but which has almost disappeared now since the introduction of the variety Butcher's Disease Resister.  
Pale green, water-soaked spots appear on the leaves. These
turn brown and soon the leaves wither completely. Can soon ruin a whole plant.

Control Measures. The variety Butcher's Disease Resisting should be grown. The soil should always be sterilised (see Chapter XIV). Cucumbers should not be grown with too much humidity or in too high temperatures.

CANKER (*Bacterium carotovorum*).

A brown soft rot or canker occurs just below or just above soil level. Sometimes the disease attacks young plants but generally it doesn't show itself till the plants are fruiting.

The trouble is usually caused by wet conditions of the soil where the base of the plants join the soil.

Control Measures. Keep the base of the plant as dry as possible. Never allow any water to be poured directly on the stems.

Dust the parts affected with a mixture consisting of hydrated lime, 10 parts, finely divided copper sulphate, 3 parts, and flowers of sulphur, 3 parts.

FUSARIUM WILT (*Fusarium sp.*).

Attacks cucumbers, causing wilting, yellowing, and desiccation of the leaves. Usually starts from the base and works upwards, causing the death of the plant. Develops most rapidly with high soil temperatures.

Control Measures. Sterilise all soil before using. (See page 205).

Remove infected plants, together with the soil around their roots. The holes thus made may be filled in with a mixture of 8 parts soil and 1 part lime. This should then be watered with a Cheshunt Compound solution and replanted with a young cucumber plant.

GREY MOULD (*Botrytis cinerea*).

Grey velvety fungus growth will appear over the leaves and even over the stems. May also damage the young fruits.

Control Measures. As the trouble is only severe under very humid conditions it is necessary to pay adequate attention to ventilation and to general plant hygiene.

GUMMOSIS (*Cladosporium cucumerinum*)

Attacks the fruits only, causing small sunken spots to appear.
These soon enlarge and exude a gummy liquid. An olive-green dark, velvety growth then covers the affected parts. Cracks may appear and the white flesh below may be exposed.

In very bad cases the fungus will attack the leaves, causing small, light brown spots to appear.

**Control Measures.** Remove all diseased fruits and leaves immediately they are seen, and burn them.

As the disease is most destructive under humid conditions, give more air by attending to ventilation.

Spray with liver of sulphur. Formula: 1 ounce of potassium sulphide to 5 gallons of water, stirring in a cupful of flour paste.

**MOSAIC.**

There are various viruses which attack cucumbers known as Mosaic. The commonest, often called Green Mottle, causes the leaves to be mottled, wrinkled and puckered. The plants are dwarfed also. Another, known as yellow mosaic, causes yellow mottling of the leaves, plus silver-coloured or yellow streaks and spots on the fruit. The plants also are stunted.

**Control Measures.** Purchase virus-free seed. Insect pests should be kept down at all costs because these transmit the virus. The virus may be carried on the fingers or knives of the gardeners.

**VERTICILLIUM WILT** (*Verticillium albo-atrum*).

Will attack tomatoes as well as cucumbers. The damage is chiefly done early in the spring and late in the autumn when the temperature is low.

The symptoms produced are similar to those of Fusarium Wilt (see page 63) and, on cutting open diseased stems, the wood will be found to be of yellowish brown colour.

**Control Measures.** Raise the temperature of the house to 77 deg. F.

Avoid any heavy watering.

**LEEK**

**RUST** (*Puccinia porri*).

This disease is common in most parts of England and Wales but is particularly bad in the North.

Yellowish spots, scattered or arranged more or less in rows, will be found on the foliage. These gradually turn yellowish-red.
Control Measures. Do not plant leeks on the same ground for four or five years.

Remove affected leaves and burn them or, in bad cases, whole plants.

Spraying with colloidal copper (Bouisol) is a possible cure.

**WHITE TIP** (*Phytophthora porri*).

This disease is bad in market-gardens around Edinburgh and in the Evesham valley. It is known, however, to attack plants all over the country.

The ends of the leaves first die back and then turn white. Sometimes the parts attacked are limp and, on other occasions, they remain crisp and stiff. Sometimes the margins of the leaves are damaged and then they become twisted. Water-soaked areas may develop towards the middle or base of the plant. Diseased plants are always badly checked in growth.

Control Measures. Dust the plants with a good copper-lime dust at the rate of 2 ounces to the square yard. Continue dusting at intervals of four weeks, from October till early spring.

Cut off infected tips and burn.

**LETTUCE**

**DOWNY MILDEW** (*Bremia lactucae*).

Affects outdoor plants in damp climates. Often attacks lettuces under glass. The leaves become yellowish and sometimes brown. In bad cases the whole of the plant will be yellow and dwarfed. The mildewy appearance of the leaves will be noted.

Control Measures. Humidity in glasshouses should be avoided. Resistant varieties under glass seem to be Loos Tennis Ball and Cheshunt 5B, and the French variety, Laitue du Saint Elan.

**GREY MOULD** (*Botrytis cinerea*).

A very common disease of seedlings in the frame. Also causes the rotting of plants in the field, especially in wet seasons.

The plants become covered with a grey mould and as a result they wilt.

Control Measures. It is of the greatest importance to see that the plants are put in "level," neither too deep nor too shallow, either in the seed box or out of doors. The plants
should, as it were, just sit on the soil. Outside the plants should never be put in with a dibble hole left at the side. All the leaves showing any brown spot should be cut off with a sharp knife.

Diseased plants and decaying rubbish should be removed and burnt.

RING SPOT (*Marssonina panattoniana*).

This causes more losses than any other lettuce disease. It is very prevalent in cold wet weather.

Infection starts in the outer leaves and soon spreads towards the heart and may easily kill a plant. Brown spots appear on the leaves. These soon turn white, the dead portions then dropping out, leaving holes with white margins. Infection usually occurs on the underside of the mid-ribs where rusty brown blotches appear.

**Control Measures.** Avoid using any manure containing lettuce refuse. Carry out some system of rotation which prevents lettuces being grown on the same ground year after year. Use an artificial manure rich in potash.

Under glass admit more air and reduce the moisture content in the house. Keep up a buoyant atmosphere.

MARROW

MILDEW (*Erysiphe eichoracearum*).

The leaves and younger portions of the plant will be covered with a white powdery growth. The plants then wither and the fruiting period is curtailed.

**Control Measures.** The plants should be dusted as soon as the disease appears with a good sulphur dust. Another method is to spray the plants with a solution of liver of sulphur, using 1 ounce to 3 gallons of soft water.

All badly affected plants should be uprooted and burnt.

MINT

RUST (*Puccinia menthae*).

This disease occurs wherever mint is grown. The plants attacked can be noticed in the spring and summer because the
shoots are distorted and abnormally thick. Before long yellowish orange cushions appear on the stems and leaves. These produce innumerable spores which are distributed to other plants which they infect. Rust spreads like an epidemic in the summer.

In the winter dark brown, or almost black, spores are formed. **Control Measures.** Burn off the mint tops in late September or early October. Use dry straw for this purpose and produce a rapid fire so as to burn the stems and the leaves.

Another method and a very successful one, too, is to cut the tops down in October, remove and burn them, and then water the beds with a 5% solution of a good neutral high boiling tar oil wash.

Roots that are lifted for forcing should be washed thoroughly in two changes of water. This removes most of the infected material. It is well worth while also washing roots in this way that are to be replanted outdoors. An even more effective method is to subject the roots to hot water treatment. They should be immersed in a bath of water maintained at a temperature of 112 deg. F. for 10 minutes.

**ONION**

**DOWNY MILDEW** (*Peronospora destructor*).

A very serious onion disease which occurs most seasons but, in wet years, is particularly bad. The trouble will attack shallots, but seldom leeks. The crop weight is reduced, the keeping quality of the bulbs impaired and, with young plants, many deaths occur. The leaves turn yellow and soon afterwards collapse. The mildew itself is of a whitish-grey colour and looks like felt. The bulb, though it may be overrun with the "roots" or mycelium of the fungus, seldom shows any external sign.

**Control Measures.** Never grow onions on low-lying land or any ground that is poorly drained. Never plant out soft onion sets as these may contain the mycelium of the disease. Sow the spring sown crop as far away from the autumn sown crop as possible.

Spray with a Bordeaux mixture (see Chapter XV for formula). This prevents the spread of this disease from plant to plant. Dust, if preferred, with copper lime dust.

**SMUT** (*Urocystis cepulae)*.

A very serious disease of onions which is scheduled under the
Destructive Insects and Pests Act and therefore its presence on any plants must be notified at once to the Ministry of Agriculture. Plays havoc, particularly with young plants and seedlings.

It may be distinguished by the dark opaque spots and streaks which are seen on the leaves and scales of the plants. Soon afterwards the skin covering these spots will split and a black powdery mass will exude. Most plants die but those which survive develop more leaves on which more blisters occur. The soil will thus become contaminated and may remain so for many years.

**Control Measures.** Do not grow onions on the same piece of ground for five years. Pull up the plants and burn them directly the trouble is seen so as to prevent the spores from infecting the soil.

Water the seed drills with a diluted formalin solution. Formula: 1 part of formalin to 300 parts of water.

**WHITE ROT** (*Sclerotium cepivorum*).

A fungus disease which rots the bulbs of onions when they are quite small. The damage is done at the roots and no mould develops on the foliage. The disease may appear at the end of April, but is usually seen during the first hot spell in May or June. The infected plants wilt, and when pulled they come away easily from the soil, thus exposing a mass of white mould at the base of the plant.

It is this white mould that distinguishes the trouble from the Onion Fly Maggot attack. The disease may trouble seedlings, transplanted onions and bulb onions of any size, and it can cause severe losses in shallots. No one quite knows how the disease spreads, but the fungus can travel at least five yards through the soil in one year by its own efforts. It is normally carried from garden to garden and allotment to allotment on gardening tools and the dirty boots of workers.

**Control Measures.** A special Calomel powder known as Calotox should be applied before sowing or transplanting onions. It is no good making an application once the disease has appeared. One pound of the powder should be dusted along a drill 50 yards long and this equals about one heaped teaspoonful per yard run. Transplanted onion seedlings and shallots should be dipped in a stiff paste made up by stirring 3 pounds of Calotox powder in a pint of water. The shallots should be dipped half-way up and be planted immediately, and the onion seedlings may be dipped up to their first leaves.
PARSNIP

CANKER.

A very widespread disease. No one knows really whether it originates from any specific parasite or no. It is thought that the trouble originates from some injury. Anyway, the tissue cracks, turns rusty brown and eventually a brown rot may appear. Sometimes this is followed by a wet black rot.

**Control Measures.** The varieties Large Guernsey and Tender and True are said to be resistant.; No method of control is known.

PEA

MARSH SPOT.

An obscure trouble which is common all over the country. Difficult to see externally but, when the seeds are split open, a brown spot will be found in the centre of the seed leaves or cotyledons. The seedlings produced from such seeds are weak and often mutilated. They are frequently branched at, or below ground level.

**Control Measures.** As the cause of Marsh Spot is not known it is difficult to suggest control. It may be that the trouble can be prevented by applying manganese to the soil in the form of magnesium sulphate or borax, or even both. When using either of these, dissolve a teaspoonful in 2 gallons of water and apply this over 30 square yards.

MILDEW (*Erysiphe polygoni)*.

Both the leaves, stems and pods will be attacked and will be found covered with whitish powdery patches. The disease occurs every season, usually towards the end of the summer. It is particularly bad on late varieties.

**Control Measures.** Dust with a fine sulphur dust early in the morning immediately after the first symptoms have appeared. Dust again a week later, or sooner should it rain in between.

*Other diseases* which may attack peas are: Root Rot, Black Root Rot, and Leaf and Pod Spot.

POTATO

BLIGHT (*Phytophthora infestans*).

One of the commonest potato diseases. The leaves of the potato are attacked first, and irregular dark green spots or blotches
appear on them. These soon turn brown or black and become covered with a delicate white mould. In damp, muggy weather the disease spreads rapidly, and in a bad attack the whole of the tops may be killed. The spores fall to the ground and infect the tubers, which develop darker sunken areas on the skin, and the whole potato soon becomes rotten and useless.

**Control Measures.**

Bordeaux Mixture is the usual remedy for blight, though in smoky districts near towns it is advisable to use Burgundy mixture instead, as the acid smoke has an adverse reaction with Bordeaux Mixture. The formulae for both these fungicides will be found in Chapter XV. The plants should be sprayed thoroughly with the solution about the end of June, and further applications made at 2–3 week intervals. Alternatively, a copper-lime dust may be used. If a bad attack occurs, the haulms may be cut off when they die down, or even before. This will to some extent prevent the blight spores from falling onto the soil and being carried down to the tubers.

**COMMON SCAB** (*Actinomyces scabies*).

This disease causes the familiar brown, corky scabs to appear on the tubers, in consequence of which the potatoes have to be peeled more deeply and there is a lot of waste. The disease is usually more prevalent in districts where the soil is gravelly or
sandy, or where it is very alkaline owing to large applications of lime, or to the addition of ashes or unbalanced fertilisers.

**Control Measures.** Organic matter such as decayed leaves, spent hops or grass mowings should be dug in at the rate of one barrowload to 4 square yards. When planting, the trenches may be filled up with grass mowings if these are available. Lime, soot and ashes should not be normally applied to land intended for potatoes.

Sulphur may be applied along the rows at the rate of 1 oz. per square yard at planting time, or the tubers may be dipped in sulphur.

Any peelings from potatoes which have been attacked by scab should be burned and not put on the compost heap.

**WART DISEASE** (*Synchytrium endobioticum*).

Wart is a very serious disease, but very few attacks are experienced nowadays as immune varieties are available. If an outbreak does occur it is necessary to notify the Ministry of Agriculture. It first appears round the "eyes" of the tuber, where small wrinkles or warts appear. These gradually get larger, until the whole tuber may become a blackish-brown spongy mass.

**Control Measures.** The following is a list of some of the best known varieties which are immune to wart disease:

Arran Pilot, Home Guard, Ulster Chieftain, Arran Banner, Catriona, Gladstone, Redskin, Di Vernon, Olympic, Ben Lomond, Ulster Ensign, Dunbar Rover, Bally Doon, Duke of Kent, Dunbar Standard, Arran Peak, Arran Consul.

**RADISH**

**CLUB ROOT.**

See Cabbage, page 58.

**RHUBARB**

**ROT** (*Bacterium rhaponticum*).

The leaves gradually turn a purplish colour and the bases of the stems become distorted and swollen. The crown of the plant usually goes soft and rotten and the terminal bud may be destroyed. When the disease gets a firm hold only spindly, useless shoots appear.

**Control Measures.** When purchasing plants care should be
taken not to accept any which show any sign of rot at all, especially around the crown. All infected plants should be removed and burnt together with all refuse around.

SEAKALE

BLACK ROT (*Pseudomonas campestris*).

A common disease of seakale, particularly where the soil is badly drained or where the subsoil has not been disturbed. Black streaks appear first of all in the roots, and finally the whole plant turns black and rots away.

Control Measures. Never plant seakale on land that is not properly drained.

Never plant thongs that show any black streaks.

*Other diseases* which attack seakale are: Violet Root Rot and Club Root.

SPINACH

DOWNY MILDEW (*Peronospora effusa*).

A very common disease of spinach which sometimes causes serious damage. The leaves may be covered with yellow spots and a violet-grey or grey mould develops on the under-sides of the leaves as well as on the upper.

Control Measures. See that the land is properly drained, for moist conditions favour the disease. Give the plants a good dusting with a reliable sulphur dust or spray with a 1 in 100 solution of lime-sulphur. On the whole, dusting is preferable if well done.

TURNIP

CLUB ROOT AND BLACK LEG.

See page 34.

SOFT ROT.

See *Celery*, page 62.

*Other diseases* that may attack turnips are: Dry Rot, Mildew, Downy Mildew, Leaf Spot and White Blister.
LEAF MOULD (*Cladosporium fulvum*).

A very common disease of tomatoes, particularly under glass. Usually occurs in July and August.

The pale grey fungus appears as a mould first of all on the under-side of the leaves in large spots. This fungus changes to tawny-olive and finally to purple. The upper surfaces of the leaves turn pale yellow and then reddish-brown. The leaves next become brown and brittle and finally die. The fungus spreads most rapidly under humid conditions.

Control Measures. Spray directly the trouble is first seen with colloidal copper or salicylanilide, together with a good wetter or spreader. Colloidal copper may be bought as Bonisol and salicylanilide as Shirlan, a suitable spreader being called Agral. Copper white oil emulsion is also very effective.*

STREAK OR STRIPE.

The disease may be recognised by the long brown stripes which appear on the stems and by the mottling and final shrivelling of the leaves. Sunken irregularly-shaped brown blotches will appear also on the fruits.

This disease which should now be called streak, for the old term “stripe” has been reserved for the attack made by the *Bacillus lathyri*, is undoubtedly a virus. There are various types of viruses but at the present time little is known about them.

Control Measures. Affected leaves may be cut off with the blade of a knife that has been disinfected by dipping it in a 2% solution of formaldehyde. This will prevent the virus being transmitted to other plants.

Sulphate of potash should be applied to the ground before planting the tomatoes at 2 ounces to the square yard.

SLEEPY DISEASE OR WILT (*Fusarium* or *Verticillium*).

The sleepy disease of tomatoes may either be caused by a fusarium or a verticillium. The roots are invaded by the fungi and the plant wilts badly in consequence.

In the case of the fusarium, the trouble is largely due to high temperatures and consequently is seldom seen in this country. At any rate, it only occurs in the height of summer.

In the case of verticillium it usually appears about the middle

* Vetomould is said to be an immune variety.
THE ABC OF PESTS AND DISEASES

of April and goes on, generally with increasing intensity, until the second or third week of May. Then it will disappear, only to reappear again about the middle of September.

It is affected by the temperature of the soil and the air. In low temperatures, affected plants will wilt suddenly and die quickly. If the temperature is moderately high the foliage does not wilt, but yellow patches appear on the leaves which slowly shrivel from the base of the plant upwards.

Control Measures. In the case of the fusarium wilt, control can usually be secured if the temperature is reduced immediately.

In the case of the verticillium wilt the temperature in the greenhouse should be raised to 77 deg. F. A light dressing of whitening should be sprayed on the outside of the glass, and as little water as possible should be given to the roots. It is curious that watering should aggravate wilting, but it does. The plants, however, should be syringed overhead, as this helps them to recover.

It is a good plan, also, to earth up the soil to the plants and then they make fresh roots above the original diseased ones.

DAMPING-OFF OR FOOT ROT (Phytophthora cryptogea, parasitica, or Corticium solani, etc.).

Tomato seedlings are attacked, the stems rotting off at, or above, soil level. The plants then topple over. The trouble is commonly known as Damping-off.

Control Measures. Prevent excessive moisture in the seed boxes or pots. Keep the temperature as low as possible and avoid overcrowding.

Check the spread of the disease by watering with Cheshunt Compound. (For formula see Chapter XV.)

BLIGHT (Phytophthora infestans).

This is a common disease of tomatoes grown in the open, especially during the months of July and August if the season is wet. The foliage will become affected, and blackish purple spots edged with a white down will show itself. The fruits will be covered with sunken spots of dark brown or leaden colour. Later they may be involved in a wet or dry rot.

Control Measures. Spray with a Bordeaux mixture immediately the disease is detected as advised for Potato (see page
Any plants that are seriously attacked should be pulled up and burnt. Alternatively, a copper white oil emulsion spray may be used.

**BUCK-EYE ROT** (*Phytophthora parasitica*).

In the early part of the year coloured patches will appear on the fruits on the bottom trusses. These will vary from grey to brown and will usually take the form of concentric rings. The trouble starts at the blossom end of the fruit as a rule.

**Control Measures.** Everything must be done to prevent soil from being splashed on to the fruit during watering, so mulch the ground with straw or peat.

Spray the soil and lower parts of the plant with Cheshunt Compound; for formula see Chapter XV.

Remove all diseased fruits and burn them. Cut off the lower leaves and so help to keep the fruit dry and allow good circulation of air.

**BLOSSOM END ROT.**

No one quite knows what parasite, if any, causes this disease. Usually it appears as a patch of dark green colour near the exposed end of a fruit. This may look water-soaked to start with but eventually becomes black and leathery.

More prevalent where plants have been over-watered or where they have suddenly had a check in their water supply. The digging in of too much stable manure or using too much sulphate of ammonia usually favours the development of the trouble.

**Control Measures.** All watering done to tomatoes must be regular but never excessive. Drainage should be perfect.

Lime seems to have some affect in neutralising the effect of heavy watering. It may be applied in the form of hydrated lime at 4 or 5 ounces to the square yard.

**ROOT ROT** (*Colletotrichum atramentarium*).

Usually occurs in June and July when the temperature of the soil is high. As a rule, however, it is not seen till about the middle of August. The lower leaves turn yellow and wither, and death may follow. The trouble usually develops more quickly when the soil is rich in organic matter for the fungus thrives on such material.
Control Measures. Sterilise soil known to be contaminated with this fungus. (See Chapter XIV, page 205). Water the soil around the plants with a solution of Cheshunt Compound. (For formula, see Chapter XV, page 215).

Other diseases which may attack tomatoes are: Mosaic (see Viruses, Chapter IV, page 35), Spotted Wilt (see Chapter IV, page 35), and Grey Mould. page 63.
CHAPTER VII

THE PESTS OF FLOWERS

Flowers get pests too.
1. Cuckoo spit should be dealt with.
2. Caterpillars devour foliage.
3. Root aphides cause wilting.
4. Even Solomons Seal is attacked by a bluish caterpillar.

There are a number of pests which attack flowering plants as a whole, just in the same way that there are pests which attack plants generally as described in Chapter III.

Perhaps the six main general pests of garden plants are capsid bugs, tarnished plant bugs, cuckoo spit, angle shades moth caterpillars, swift moth caterpillars and tortrix moth caterpillars.

CAPSID BUG \((Lygus pabulinus)\).

This pest is fully described in Chapter IX. It has a wide range of plants on which it feeds, including shrubs, herbaceous plants, annuals and, of course, weeds. The bug is bright green and when an adult can fly.
Control Measures. The best method of control is to spray with nicotine and soft soap. (For formula, see page 212). Dusting with D.D.T. has proved effective.

TARNISHED PLANT BUG (*Lygus pratensis*). This is similar to the capsid bug already mentioned, only it is, as its name suggests, brownish-green mottled with reddish-brown. It is a very serious pest to chrysanthemums and other herbaceous plants, particularly zinnias, dahlias and delphiniums. It spoils the foliage, malforms and may ruin the flowers. The adult is \( \frac{1}{4} \) inch long and may fly from plant to plant. When young it moves about very quickly. In a bad attack the shoots will be malformed and stunted, and the buds go blind.

CUCKOO SPIT (*Philenus spumarius*) (Frog hopper). Most people recognise the spittle-like deposit on plants. Inside will be found a green bug, sucking the sap and causing the shoots to wilt. It is a particularly bad pest of lavender, coreopsis, geum, phlox, and solidago.

Control Measures. Spray with nicotine and soft soap (see page 212 for formula); with liquid derris or with a good pyrethrum extract such as Pysect.

ANGLE SHADES MOTH CATERPILLAR (*Phlogophora meticulosa*). This moth is rather interesting, for when it is resting on a tree trunk or on herbage it folds its wings into its body and looks like a crumpled decaying leaf.

The young caterpillars are olive green or brownish in colour and feed on the leaves of flower buds and on open blossoms. They are very fond of winter-flowering iris, gladioli, dahlias, hollyhocks, primulas, wallflowers, St. Brigid anemones, and many herbaceous plants. Under glass they attack chrysanthemums, geraniums, pelargoniums, and cinerarias, and may do untold damage to violets in frames.

Control Measures. Spray directly the caterpillars are seen, and even before, with liquid Derris I.T.P., giving the plants a thorough soaking. It is possible to use lead arsenate as a poison in cases where it doesn't matter spotting the leaves.
THE PESTS OF FLOWERS

SWIFT MOTH CATERPILLARS (*Hepialus* spp.).

The white active larva of the moths live in the soil and may feed on herbaceous plants, strawberries, vegetable crops, bulbs, corms, tubers and rhizomes. They are whitish with a reddish-brown head and a number of dark dots along the body. They may feed for two years.

They can do a tremendous amount of harm to delphiniums, lupins, rudbeckias, and to dahlias, gladioli and iris.

**Control Measures.** Hoe the ground regularly and fork in crude naphthalene at the rate of 3 ounces per square yard during soil preparation.

Water the soil thoroughly with a D.D.T. emulsion—usual formula.

TORTRIX MOTH CATERPILLARS (*Cephasia* spp.).

Various tortrix moth caterpillars are known as "leaf-tyers" and injure various herbaceous plants, especially phloxes, helianthems, *solidagons*, and *rudbeckias*. The little caterpillars draw together two or three leaves, fastening them with silken threads. They may be olive or greyish green and they usually appear in May or June. These caterpillars often feed on the flowers of members of the chrysanthemum family.

**Control Measures.** Spray liquid D.D.T. as an emulsion, usual strength. Treat in good time before the larva have had time to become inaccessible.

ALYSSUM

FLEA BEETLES.

A tiny little metallic-looking beetle which attacks the plants in the seedling stage. These are the same as the flea beetles which attack turnips, cabbages, etc. (see Chapter V).

**Control Measures.** Use D.D.T. dust along the rows of seedlings and dust again a week later in dry weather.

ANDROSACE

SPIDER MITES (*Bryobia pratiosa*).

During the late autumn and winter this mite appears, often in great numbers, and attacks many rock garden plants, but the
androsace is the chief plant to be damaged. The mites pierce the foliage and suck the sap.

**Control Measures.** Spray with nicotine and soft soap. (For formula, see Chapter XV.)

They love to winter in ivy-covered walls. Avoid making rock gardens, therefore, near ivy—or else destroy the ivy.

**ANTIRRHINUM**

**GREEN FLY OR APHIS.** See page 19.

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**GREEN FLY AND CUTWORMS.** See pages 19 and 29.

**AURICULA**

**ROOT APHIS** (*Pentaphis auricula*).

The foliage yellows and wilts and around the collar—that is, the part where the stem joins the root—the root aphides will be found. They are pale green or white, covered with white mealy threads.

**Control Measures.** Lift the plants, wash the roots in nicotine and soft soap (usual formula). Dip the whole plant in this solution for 2 minutes.

Remove soil from round about attacked plants and replace with sterilised compost.

If it is impossible to lift the plants, water the soil, giving it a thorough soaking with a solution of nicotine and water. Formula: 1 ounce nicotine and 5 gallons water.

**CARNATION**

**APHIS.** See page 19.

**RED SPIDER.** See page 39.

**SLUGS.** See page 26.

**CHRYSANTHEMUM**

**APHIDES, EARWIGS AND EELWORM.** See pages 19, 21 and 22.
THE PESTS OF FLOWERS  

CAPSID BUGS. See page 177.

MIDGE. See page 177.

LEAF MINER. See page 176.

Control Measures. Prick whizzed naphthalene into the soil at the rate of 2 ounces to the square yard.

CORNFLOWER

APHIDES. See Chapter III, page 19.

CYCLAMEN

VINE WEEVIL. See under Vine, page 188.
Dahlia

May be attacked by eel worms, earwigs, caterpillars and capsids. For control see Chapter III and beginning of this chapter.

Delphinium

May be attacked by eel worms, slugs and caterpillars.

Iris

The irises may be damaged by slugs, snails, eel worms and caterpillars.

Sawfly (Rhadinaequorea micans).

The little caterpillars of this sawfly eat large pieces out of the edges of the leaves in June and July.

Control Measures. Spray with an arsenical wash, adding 2 ounces of gelatine to every 10 gallons of mixed wash, to prevent it being washed off by rain.

This pest is also easily controlled with D.D.T. dusts or sprays.

Lupin

Weevil (Sitona lineata).

A grey weevil which eats crescent-shaped pieces out of the leaves.

Control Measures. Dust with derris at night time. Give young seedlings a dressing of nitrate of soda at 1 ounce to the square yard.

Narcissus

Narcissus Flies (Merodora equestris and Eumerus spp.).

The fly lays its eggs on the neck of the bulbs in May. Small maggots emerge and burrow down to the centre of the bulbs. The tips of the leaves turn yellow and cease to grow. When bulbs are cut open grubs will be found in the centre.

Control Measures. Sterilise bulbs in warm water as advised in Chapter XIV.

D.D.T. is particularly effective against this pest. A 5% dust should be applied as a deposit on the remains of the foliage and in
THE PESTS OF FLOWERS

the hole in the soil above the bulb. This should be done in May–June and if necessary repeated in July.

Spray on warm sunny days at 11 a.m. when flies are on the wing. Spray ground, banks, hedges, etc.

Never plant soft bulbs. Lift bulbs every two or three years.

PHLOX

EEL WORM.

Control Measures. Take root cuttings from washed roots only, as the eel worm lives in the stem and leaves.

PRIMULA

ROOT APHIS. See Auricula.

ROSE

APHIDES. See page 19.

RED BUD BORER.

Midge appears mid-July to mid-August and lays eggs in wounds made during budding.

Control Measures. Smear buds and raffia with vaseline directly after budding.

CATERPILLARS AND MAGGOTS.

The larvae of many moths attack the leaves and buds of roses.

Control Measures. Spray with nicotine and soft soap or liquid derris.

SAWFLIES.

Various sawflies attack rose leaves, some eating them and boring into the stems; some, like the slug worms, skeletonising the leaves and feeding on the under surface; and others by rolling up the leaves tightly.

Control Measures. Spray with arsenate of lead. (For formula see Chapter XV.) At the end of May.

Spray again with nicotine and soft soap in June.

Hand pick and burn all rolled leaves and cut off and burn tunnelled branches.
SCALE (*Diaspis rosæ*).

The stems of the bushes become covered with round, flat whitish scales.

**Control Measures.** D.D.T. spray is effective and is preferable to dust as the latter leaves a slight deposit on the foliage.

WEEVIL (*Otiorrhynchus singularis*).

A clay-coloured weevil which is particularly destructive to rambler roses in spring and early summer. It will eat the lower buds and girdle the stems.

**Control Measures.** Place a white cloth under the attacked bush after dark. Shake the bush and flash a bright light on to it. The weevils then fall off and can be collected and burnt.

Spray the lower part of the stems with lead arsenate. Formula: 1 ounce lead arsenate paste to \( \frac{1}{2} \) gallon of water.

RUSH—BULL AND FLOWERING

APHIDES (*Rhopalosiphum nymphaeae*).

Aphides or green flies appear in great numbers on the leaves, stems and flowers.

**Control Measures.** Spray forcibly with nicotine and soft soap.*

Never use derris for this is poisonous to fish.

SOLOMON’S SEAL

SAWFLY (*Phymatocera aterrima*).

A bluish-grey little caterpillar may completely defoliate the plants.

**Control Measures.** Spray with nicotine and soft soap or liquid derris directly the pest is seen.

D.D.T. dust may be used instead if preferred.

STOCK

SAWFLY (*Pteronidea spiræae*).

Yellowish green little caterpillars collect on the under sides of the leaves and devour them.

**Control Measures.** As for Solomon’s Seal.

* Or spreader (see page 216).
THE PESTS OF FLOWERS

SWEET PEA

APHIDES. See page 19.

TULIP

APHIDES. See page 19.

VIOLET

Treat very much in the same way as strawberries for both are attacked by aphides and eel worms.

RED SPIDER (Tetranychus telarius).

One of the worst diseases of violets.

There is one variety which seems to be resistant, that is Governor Herrick.

Control Measures. Keep the soil in the frames moist. Syringe the plants daily if enclosed. Dry conditions encourage red spiders. Spray with clean water using 100 lbs. pressure in cases of slight attacks, and in bad cases strip the whole of the infected plants.

Petroleum sprays have proved effective if a good sousing is given. A second spraying is, however, necessary in twelve days.

WATER LILY

CADDIS FLIES (Nalesus radiatus and Limnophilus marmoratus).

The worms of these flies are caterpillar-like creatures which eat the leaves, stalks and flowers of the water lily.

Control Measures. Keep goldfish or golden orfe in the pool as these eat the larvæ.

Remove all decaying vegetable matter from the tank. Hand pick the larvæ.

BROWN CHINA MARKS MOTH.

The caterpillar is greenish in colour with a dark line down its back. The leaves are eaten in a ragged way.

Control Measures. Hand pick; force under water, so that fish will eat the larvæ.
BEETLE (*Gateruella nymphae*).

The beetle and its larvæ feed on the leaves and flowers. The former is dark brown and the latter is brown above and yellow underneath. First of all they scale off the outer tissues of the leaf and then eat whole pieces out of it.

**Control Measures.** Syringe heavily so that beetles and larvæ are driven into the water where goldfish can eat them.

Give light spraying with nicotine and soft soap (for formula, see page 212), or other spreader (see page 216).

Some gardeners fasten leaves under water in loops for several days so that fish can clear the pests.
CHAPTER VIII
THE DISEASES OF FLOWERS

*Flowers may be spoilt by:* —
1. Mildew — plants look white and powdery.
2. Rust — rusty brown patches appear.
3. Leaf Spot — describes itself.
4. While a "rot" may ruin a bulb.

Unfortunately there are a large number of diseases which attack garden flowers, many of which, like Mildew, are quite common. It has not been possible to deal with every single fungus disease in detail, but all the more important "troubles" are dealt with.

In obvious cases where, for instance, the disease is not dealt with under the particular flower concerned, the gardener should adopt the method of digging up the plant and burning it in order to prevent the spread of the trouble. It must be remembered, too, that fungus diseases are usually controlled either by sulphur in some form, i.e., lime-sulphur, liver of sulphur, sulphur dust, or with copper in some form, usually Bordeaux mixture, Burgundy mixture, colloidal copper (Bouisol), and so on.

In order that the remedy may be applied immediately, the garden medicine chest should be kept stocked with the fungicides needed.

Colloidal copper and colloidal sulphur are very useful to have, for, on the whole, they are safer to use than any of the other fungicides mentioned. Further, they have an advantage with flower plants in that they don't "spot" the leaves.

**ANEMONE**

**STALK—BULB ROT.**

See page 98.

**STEM ROT** (*Sclerotinia tuberosa*).

This disease attacks the tuberous roots of the anemones causing
them to rot. They are waxy when cut. In the spring brown
cup-like fungi are produced.
  Control Measures. Dig up and burn.

CLUSTER CUPS (*Ecdidium Puccinia*).
This fungus attacks the leaves and stalks forming spots on them,
from which cup-like fruiting bodies are produced later. Plants
attacked are often taller than usual.
  Control Measures. Remove and burn.

ANTIRRHNINUM

LEAF SPOT (*Septoria antirrhinum*).
This fungus attacks the leaves and stems of the plants causing
pale brown or whitish spots.
  Control Measures. Spray with Potassium sulphide or
Bordeaux mixture.

RUST (*Puccinia antirrhinum*).
A prevalent disease of antirrhinum for the past ten years.
Recognised by rusty brown patches on the under sides of the
leaves. If severely attacked the plants wither and die. The
disease spreads rapidly from plant to plant.
  Control Measures. Avoid overcrowding the plants—give
ample room between them for the air and light to get in. Stag­
nant, water-laden air encourages the disease. See that the beds
are well drained, and if necessary to water, do this in the morning,
rather than in the evening, so that surplus water is not left lying
about overnight. Avoid watering the foliage.
  Dust with sulphur or spray with one of the sulphur sprays at
weekly intervals, to prevent and control the disease.

AQUILEGIA (COLUMBINE)

STALK AND BULB ROT (*Sclerotinia sclerotiorum*).
This disease which is found more often amongst bulbs and
roses does sometimes attack the columbine.
A water-soaked spot appears on the stems, and the leaves above
wither and the whole plant may die. The base of the stem is a
favourite place for the disease to start.
Control Measures. Remove and burn diseased plants; lime the soil heavily. Dig the bed deeply.

**LEAF SPOTS**  (*Ascochyta* sp., *Coleosporium* sp., *Marssonina*, *sp.*).

Sometimes the leaves of the aquilegia are attacked by a fungus causing bluish-black, yellow and ashen grey spots, but rarely is the disease severe enough to necessitate control measures. If, however, it is found to be bad, use a spray made of colloidal copper (Bouisol).

**ARABIS**

**WHITE RUST** (*Cystopus candidus*).

This appears on the leaf as shining raised white patches. Rarely severe enough to cause serious damage.

**Control Measures.** Dust with flowers of sulphur. If on small scale remove diseased flowers and leaves and burn.

**GREY MOULD** (*Peronospora parasitica*).

This disease appears in patches on the leaves. The spots are first pale in colour and then turn brown, having a greyish-white powdery fungus on them.

**Control Measures.** As for Rust. See above.

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**DAMPING-OFF DISEASE.** See page 74.

**MOULD** (*Coleosporium campanulae*).

On the under surface of the leaves yellowy red dusty looking cushions are found.

**Control Measures.** Spray with Bouisol.

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**WILT** (*Verticillium Vilmorinii*).

This disease enters through a damaged portion of the plant and shows as a yellow mottling of the lower leaves in the summer. This is followed by a complete browning of the leaves and towards the end of the summer the whole shoot will wilt.
The ABC of Pests and Diseases

Control Measures. Do not propagate by division of diseased plants—but select healthy shoots and take cuttings from them.

STEM ROT (Fusarium spp.).

The leaves and flowers hang down and become yellow-green and later brown, and die off. The stem will be black in colour.

Control Measures. Do not over manure the border and give occasional dressings of lime at 5–6 ounces per square yard. Remove and burn attacked plants. The variety American Beauty is resistant to this disease.

YELLOW VIRUS DISEASE.

See disorders caused by Viruses, Chapter IV, page 35.

CAMPANULA

STEM AND ROOT ROT (Sclerotinia sclerotiorum).

See Aquilegia, page 88, where it is called Stalk and Bulb Rot.

CARNATION

RUST (Uromyces dianthi).

This can be a serious disease of carnations, especially in a wet season. Yellowish brown cushions appear on the leaves and they may be killed.


LEAF SPOT (Septoria dianthi).

Leaf spots caused by various fungi are found on the leaves of the carnations. Some may have black centres.

Control Measures. Bouisol spray as recommended for Rust.

LEAF ROT (Heteropatella dianthi).

Border carnations are often attacked, the base of the leaves rotting and dying off.

Control Measures. Destroy all susceptible varieties.

DIE BACK AND WILT (Fusarium spp.).

This disease is more prevalent under glass than in the garden.
A CARNATION CUTTING SHOWING RUST ON THE LEAVES

Control Measures. Do not grow carnations in the same spot. Propagate from healthy plants.

CHRYSANTHEMUM

MILDEW \( (Oidium\ chrysanthemi) \).

White powdery patches may be seen towards the end of the season on the leaves, both upper and lower surfaces.

Control Measures. Spray with a colloidal sulphur wash, i.e. Sulsol or with Shirlan A.G. when the disease is first noticed.
RUST (*Puccinia chrysanthemi*).

Most varieties of chrysanthemum are attacked by this disease. Red rusty spots are seen on the under surfaces of the leaves. Usually worse in dry seasons and with excessively manured plants.

**Control Measures.** Watch out for the rusty patches and spray at once with Bouisol. All old plants and leaves which have been infected should be burnt.

LEAF SPOT (*Septoria chrysanthemi*).

Dark brown patches appear on the upper surfaces of the leaves. Burn severely attacked plants and spray others with Bordeaux mixture. For formula see page 214, or use a proprietary Bordeaux mixture, which merely has to be dissolved in water.

DAHLIA

WILT (*Verticillium dahliae*).

This disease causes the whole plant to wilt.

**Control Measures.** Badly affected plants should be dug up and burnt. If there are any affected raspberry canes in the garden they also should be dug up and burnt, as it is thought that the same fungus causes the Blue Stripe in raspberries.

CROWN GALL (*Bacterium tumefaciens*).

In the roots at the base of the stalk, large cauliflower-shaped growths appear.

**Control Measures.** Destroy affected plants. Sterilise the soil where possible. Plant clean stock in another part of the garden.

LEAF SPOT (*Entyloma dahliae*).

This disease usually appears late in the season. Light yellowish green spots appear which later turn greyish brown, starting from the middle. The dead tissue falls off. The disease lives through the winter in sticks or dead leaves which may be stored with the tubers.

**Control Measures.** Plant out early in open situation. Spray attacked plants with Bouisol. Remove and burn leaves in autumn. Plant least susceptible varieties.

MOSAIC.

See Virus Diseases, page 35.
THE DISEASES OF FLOWERS

DRY ROT.

Dry, unsuitable storage places seem to encourage this trouble.

Control Measures. Dig up tubers before the first frost. Stand upside down for several days to drain thoroughly. Protect from frost in airy cool storage place. Dust tubers with equal quantity of sulphur and lime when storing. Disinfect storage place with formaldehyde before the tubers go into position. Leave for two or three days afterwards to allow the fumes to disperse.

DELPHINIUM

BACTERIAL SPOT (Bacterium delphinii).

Deep, black, irregularly shaped spots appear on both sides of the leaves and may spread to the stalks and blossoms. Seeds may also be infected.

Control Measures. Collect and burn all diseased foliage. Spray repeatedly with Bouisol. In severe attacks cut down plants and burn.

MILDEW (Erysiphe polygoni).

A white flour-like dust is found on the leaves and stalks and blossoms. The leaves die off prematurely and the buds dry up. In severe attacks the whole plant is stunted.

Control Measures. Avoid over manuring with nitrogenous matter. Give plenty of space between the plants. Spray with Bouisol or Shirlan in warm sunny weather.

STALK AND BULB ROT (Sclerotinia sclerotiorum).

See Aquilegia, page 88.

DIANTHUS


ERICA (HEATH)

MILDEW (Oidium sp.).

The leaves and young shoots become covered with a white powdery mildew.

Control Measures. Dust with a fine sulphur dust.
STEM ROT (*Fusarium pelargonii*).

The attacked stem becomes black and decays. The leaves turn sickly yellow. Pale spots appear on diseased part of stem.

**Control Measures.** Destroy plants by burning.

**BACTERIAL LEAF SPOT** (*Bacterium pelargonii*).

First shows as a water-soaked dot. Later becomes well defined. Irregular in shape, sometimes round and brown in colour. Leaves turn first yellow, then brown and finally red.

**Control Measures.** Plant out plants in open airy situation, leaving plenty of space between them. Hand pick diseased leaves and flowers and burn them.

Spray stock and plants with a good Bordeaux mixture (see page 214) or colloidal copper (Bouisol).

**GREY MOULD** (*Botrytis cinerea Auct.*).

The flowers fade and die prematurely and a grey mould appears. The fungus spreads from the petals to the leaves.

**Control Measures.** As for Leaf Spot.

**LEAF SPOT** (*Cercospora Brunkii*).

Round spots light brown or brick red in colour are found on the leaves. These may be slightly raised and may join together till they cover most of the leaf surface.

**Control Measures.** As for Bacterial Leaf Spot. See above.

**BLACK LEG** (*Pythium spp.*).

A common disease of cuttings and young plants. Stem and leaf stalk become black and shrivelled. The rot starts at the base of the stem.

**Control Measures.** Be careful not to overwater. Shade if sun is very bright. Maintain even temperature with adequate ventilation.

Water with Cheshunt Compound. Formula, see page 215.

**GLADIOLUS**

**BASE DECAY** (*Bacterium marginatum*).

Reddish brown raised spots appear on the leaves towards the
base. These spots increase in size and may become black and pitted. A wet rot may develop inside and the bases of the leaves and stalks thus be destroyed.

**Control Measures.** Destroy all diseased leaves by burning. Do not plant corms in heavy wet soil. Only store healthy corms.

**Smut (Tubercinia gladioli).**

Black cushions appear on the corms, leaves and stalks. The corms become completely destroyed.

**Control Measures.** Remove and burn infected plants. Dig the ground deeply. Lime the soil heavily, say hydrated lime at \( \frac{1}{2} \) lb. to the square yard.

**Dry Rot (Sclerotium gladioli).**

When the corm is split dry sunken spots will be found, reddish brown in colour. As the plant grows in the spring the leaves become yellow and then turn brown. The stem will decay at soil level and the leaves fall earlier.

Infection invariably is caused through the soil.

**Control Measures.** Buy good clean corms. Remove scales so as to look for sunken spots.

**Hard Rot (Septoria gladioli).**

The leaves are attacked, yellow patches appearing which later turn brown. Hard dark spots are produced on the corms. The fungus may live in the soil for four years.

**Control Measures.** Do not plant in infected soil. Reject infected corms.

**Other diseases** which may attack gladioli are: Grey Bulb Rot (see Tulip, page 103), Penicillium Rot and Fusarium Bulb Rot.

**Helianthus (Sunflower)**

**Rust (Puccinia helianthi).**

Powdery brown mounds will be found on the leaves and stems. They are first chestnut-coloured, turning darker later. The leaves dry up, and the plant looks unsightly. The disease is carried from year to year on the seed.

**Control Measures.** Remove and burn attacked sunflowers in severe cases.
In mild cases spray with colloidal copper (Bouisol).
Save seed from healthy plants only.

**HELLEBORUS (CHRISTMAS ROSE)**

**MILDEW** (*Peronospora pulveracea*).

On the upper sides of the leaves pale patches appear, and on the under sides the white powdery mildew will be seen. The whole leaf will die eventually and in severe cases the whole plant will be killed.

**Control Measures.** Pick off and burn infected leaves directly disease is seen.
Spray with colloidal copper (Bouisol).

**LEAF SPOT** (*Coniothyrium hellebori*).

Black, irregular shaped spots are found on both surfaces of the leaves. These turn yellow and die and the plant is rendered useless.

**Control Measures.** As for Mildew, see above.

**HOLLYHOCK**

**RUST** (*Puccinia malvacearum*).

Discoloured small spots will be found on the upper surfaces of leaves. Reddish-brown rusty cushions will be seen on the lower surfaces. These become dark brown later.

**Control Measures.** It is important to raise new plants every year for young plants are seldom attacked.
Should seedlings be attacked, spray with colloidal copper (Bouisol).

**IRIS**

**RHIZOME ROT** (*Pseudomonas iridis*).

The rhizomous roots become soft, putrid smelling masses. The base of the leaves rot away.

**Control Measures.** Do not apply lime as an alkaline soil encourages the trouble. Take up all diseased portions and burn them. Cut out diseased portions from slightly attacked rhizomes
and wash thoroughly in a 2% solution of formaldehyde. Replant in new or sterilised soil.

Another method is to soak the roots in mercuric chloride—formula: 1 ounce to 10 gallons of water after cutting out any rotten portions there may be.

**IRIS SCORCH.**
The leaves look as if they had been on a bonfire. Is probably another form of rot and should be treated in similar manner.

**LEAF SPOT** *(Heterosporium gracile).*

Yellowish brown spots, stripes and marks appear on the leaves early in the autumn.

**Control Measures.** Spray the leaves with lime-sulphur, 1 pint to 100 pints water, three or four times during the summer.

Cut off infected portions of leaves when seen in the autumn, and burn them.

**LILY**

**LEAF SPOT** *(Botrytis cinerea).*

Reddish brown spots appear on the leaves. These may enlarge and cover the whole surface. The leaves will die, the stem may dry up and the flowers may be distorted. The trouble spreads rapidly.

Madonna lilies and its hybrids are the most susceptible.

**Control Measures.** Spray with colloidal sulphur two or three times at weekly intervals. Bordeaux mixture is effective but is inclined to mark the foliage.

In severe cases give the surface of the soil a good soaking with Bordeaux mixture, and spray the young growths when they first appear in the spring.

Plant bulbs in an open sunny position on well-drained soil. A stagnant atmosphere is conducive to the disease.

**MOSAIC.**
The leaves become mottled and distorted and the petals usually remain closed.

**Control Measures.** No known cure. Infected plants should be taken up and burnt. As Aphides are probably the carriers of this disease, see that they are kept down with nicotine and soft soap.
LILY OF THE VALLEY

BOTRYTIS (*Botrytis paeonia*).

The leaves of the Lily of the Valley wilt and turn brown. Fortunately the disease does not attack the rhizomes or fleshy stems below ground.

**Control Measures.** Do not grow lilies of the valley on infected soil. See that the disease is controlled on *paeonia* and then it seldom troubles lily of the valley.

LUPIN

ROOT ROT (*Thielaviopsis basicola*).

Attacks the roots of the plants turning them black. From these blackened portions a white fungus will be found growing.

**Control Measures.** Do not add lime to the soil as this seems to encourage the disease. Do not plant lupins on the same ground for four years.

MIGNONETTE

LEAF SPOT (*Cercospora resedae*).

Brown patches appear on the leaves, usually found on plants grown on damp soil deficient in lime.

**Control Measures.** Spray with liver of sulphur. For formula, see page 214. Give soil a dressing of lime.

NARCISSUS

GREY BULB ROT (*Sclerotium tuliparum*).

Gaps may be noticed, or only weak shoots appear. When bulbs are dug up they will be found to be rotten.

**Control Measures.** Burn diseased bulbs. Do not plant in the same spot for four years.

Water soil thoroughly with 2% solution of formaldehyde.

YELLOW STRIPE (*Ramularia narcissi*).

Yellowish light green streaks will be found on the leaves and flower stems and in bad cases even on the flowers themselves. The stripes vary according to the variety attacked. In the case
of King Alfred and Victoria, for instance, it is much more virulent than in the case of Sir Watkin and Golden Spur.

In bad cases the leaves become distorted and the bulbs blind.

**Control Measures.** Remove and burn diseased bulbs directly they are detected. A sharp look-out should be kept when they are six inches high.

**PÆONY**

**BOTRYTIS** (*Botrytis paoniae*).

The shoots are attacked above soil level. They wilt and turn brown. Later the fully developed leaves may be attacked. The roots will rot but rarely does the plant die.

**Control Measures.** Cut off affected leaves and burn them. Each winter cut down the foliage and burn.

Never plant on infected soil.

Dust with a good copper-lime dust immediately the trouble is seen.

**ROOT GALL.** See DAHLIA, Crown Gall, page 92.

**POLYANTHUS AND PRIMROSE**

**LEAF SPOT** (*Ramuliera primulae*).

Yellowish patches are seen on the upper and lower surfaces of the leaves.

**Control Measures.** Spray with Bordeaux mixture or with Colloidal Copper. (For formula, see Chapter XV, page 214).

**ROSE**

**BLACK SPOT** (*Diplocarpon rosae*).

Purplish black irregular shaped spots appear on the leaves and young stems. The whole bush may lose its leaves.

**Control Measures.** Spray with Bordeaux mixture or colloidal copper directly the spots are apparent. Repeat the spray in 14 days. Next season spray as soon as the young leaves are well developed. Mulch the beds with plenty of fresh lawn mowings all the summer. Pick off badly infected leaves and burn,
MILDEW (*Sphaerotheca pannosa*).

The white powdery mildew will be found on the leaves, stems and even on the thorns. The flower buds may be attacked and in bad cases the leaves will fall. The disease is always more acute in a dry summer. The two most susceptible varieties are Crimson Rambler and Dorothy Perkins.

**Control Measures.** Spray with colloidal sulphur (Sulsol), or copper white oil emulsion.

See that the soil gets a good dressing of potash either in the form of sulphate of potash or wood ashes.

RUST (*Phragmidium mucronatum*).

Orange spots appear on the under surface of the leaves. In severe attacks many of the leaves will fall. If the disease is allowed to establish itself, the bush usually dies.

**Control Measures.** Cut out diseased stems immediately they are seen.
THE DISEASES OF FLOWERS

Spray the leaves thoroughly with colloidal copper (Bouisol), directly the disease is seen, and again ten days later.

SAXIFRAGE

RUST (*Puccinia spp.*).

Chestnut brown rusty patches are found over the leaves; these eventually become yellow and brown. The fungus attacks Saxifrage longifolia and other allied species.

**Control Measures.** Spray with a solution of potassium permanganate strong enough to be rose red in colour.

SCILLA

RUST (*Uromyces scillarum*).

Red rust shows itself in scattered brown spots over the leaves.

**Control Measures.** Remove attacked leaves and burn them. Spray the plants with Bordeaux mixture (usual formula), or to prevent spotting of leaves use colloidal copper instead.

Smut (*Ustilago vaillantii*).

The plants are attacked in their seedling stages and never recover. The only thing to do is to destroy the plants.

SEMPERVIVUM (HOUSE LEEK)

RUST (*Endophyllum sempervivi*).

The leaves will be found to be covered with yellowish brown spots.

**Control Measures.** Dig up and burn.

SENECIO

RUST (*Coleosporium senecionis*).

Bright yellow waxy patches appear on the under surfaces of the leaves. It is very difficult to see the damage from above.

**Control Measures.** Never allow the weeds groundsel and ragwort to be present in the garden, as they are members of the same family and are usually carriers of this disease.
SNOWDROP

GREY MOULD (*Botrytis* galanthina).

The leaves and bulbs become covered with a grey mould. A rot sets in.

**Control Measures.** Dig up and burn affected bulbs, being careful to remove soil nearby also, as this will also be infected with the fungus.

SWEET PEA

STEM ROT (*Fusarium* spp.).

This disease is most severe in wet seasons. The lower part of the stem turns brown and rots at soil level. The leaves turn yellow and wilt and the whole plant flags.

**Control Measures.** Avoid planting on ground known to be infected with this disease. Take particular care in the wetter parts of England. Sterilise soil before planting by giving a thorough soaking with 2% solution of formaldehyde. Do not plant in the treated ground for three weeks.

STREAK.

It is sometimes said that this disorder is due to a virus and other times that it is due to *Bacillus lathyri*.

Long brown streaks will be found on the stem and the foliage will be discoloured also. The whole plant looks sickly, very few flowers being produced.

**Control Measures.** See that the soil is well fed with sulphate of potash. Work this in at 3 ounces to the square yard 10 days or so before planting. Where sulphate of potash is not obtainable, use finely divided wood ashes or better still, bracken ashes, at ½ lb. to the square yard.

SWEET WILLIAM

RUST (*Puccinia* lychnidearum).

Reddish-brown spots appear on the leaves, chiefly on the underside.

**Control Measures.** Spray with colloidal copper.

The dark red flowered varieties seem to be resistant.
THE DISEASES OF FLOWERS

TULIP

FIRE (*Botrytis tulipae*).

A common disease of tulips. Scorched spots will be seen, brownish grey in colour, on the leaves and stems, and pitted spots will appear on the flowers.

**Control Measures.** Sterilise affected bulbs with formaldehyde. Immerse for 15 minutes in a 0.5% solution, i.e., 1 pint in 25 gallons of water.

Dust the tulips immediately they come through the ground with copper-lime dust. Dust again 10 days later and if the weather should be wet, again 10 days after that.

SHANKING (*Phytophora cryptogea*).

The base of the stem is attacked, the plant wilts and falls over and the blossom buds die out in consequence.

**Control Measures.** Sterilise the soil (see Chapter XIV, page 204). Keep plants growing healthily by regular hoeing.

William Copeland is the most susceptible variety.

BREAKING.

The plant loses vigour and produces small blooms, if any. The foliage is usually mottled. The bloom will be streaked and speckled.

The trouble is undoubtedly caused by a virus, spread in all probability by aphides which live in the bulb and stem.

**Control Measures.** Keep down insect pests, particularly aphides, by spraying regularly with nicotine and soft soap or liquid derris.

GREY BULB ROT. See NARCISSUS, page 98.

VIOLA

RUST (*Puccinia violae*).

The disease first appears on the leaves and stems as yellow spots bearing cup-shaped receptacles full of spores. Later the brown rust spores appear.

**Control Measures.** Destroy badly diseased plants.

Spray when the trouble is first seen with colloidal copper (Bouisol).
VIOLET

May be attacked by Smut, Rust, Leaf Spot and White Spot, but none of these diseases is very serious on cultivated violets and the best control in each case is to pick off the affected leaves and burn them, and to spray with colloidal copper.

WALLFLOWER

CLUB ROOT. See page 34.

WATER LILY

HOLES (*Ramularia nymphaeae*).

The leaves will be found full of holes. These will be surrounded by decaying tissue.

Control Measures. Remove all diseased leaves and burn. Try and empty the pool and provide clean water, or allow fresh water to stream through the pool for some time.
TO GUIDE YOU WHEN SPRAYING

SEVEN STAGES OF DEVELOPMENT OF FRUIT
CHAPTER IX

THE PESTS OF FRUIT

If you want clean fruit, you must:—
1. Spray regularly.
2. Spray thoroughly.
3. Spray at the right time.
4. Use tar distillate every December.
5. Remember the grease bands!

Unfortunately there are a very large number of pests which attack fruit trees and bushes, and whole books have been written on the subject. It would be impossible in a manual of this kind to deal with every single insect pest which might damage the various fruits grown in this country, but in this chapter will be found those which are most common as well as those which do the greatest amount of harm.

TAR DISTILLATE WASHING

With fruit trees and bushes the grower has the opportunity of cleaning up the stems and branches in the winter and killing the eggs of a very large number of pests at the same time. It is necessary every year to spray trees with a tar distillate wash—which must be used exclusively during the dormant season.

It should be applied at a strength of 5%, i.e. 1 pint of tar oil in 20 pints of water. Though in cases where orchards have not been sprayed previously or where woolly aphis is known to be prevalent, it is better for the formula to be 1 pint to 10 pints of water. The winter washing should be done in December on a fine, dry day, though if this is impossible it may be carried out in January.

All fruits may be sprayed with this wash (I should like to have said must be sprayed with this wash) in December, with the exception of strawberries, nuts and filberts. If roses are sprayed at the same time the eggs of the green fly will be killed.

This tar distillate washing is, as it were, the basis for all future successful pest control during the summer. Omit the tar distil-
THE PESTS OF FRUIT

late washing one year, and the result is that pests abound and far more spring and summer spraying will be necessary.

D.N.C.—Another useful winter spray. See page 215.

APPLE

1. BEETLES

APPLE FRUIT RHYNCHITES (Rhynchites aquatus).

More common in the south of England than in the north. The weevil is brownish-red and \( \frac{1}{6} \) inch long. Attacks fruits fortnight after petal-fall and goes on doing so till July. Damage done is similar to that made by pushing the point of a lead pencil into the side of the fruit. Hundreds of holes may appear on one apple.

Control Measures. Dust with derris dust on the first warm, sunny day after petal-fall, to destroy the beetle.

APPLE TWIG CUTTER (Rhynchites caeruleus).

This weevil is of a beautiful blue colour and \( \frac{1}{6} \) inch long. It is more common in the south than in the north. It lays its eggs in the young shoots cutting them off just below where the eggs are deposited. The shoots then either fall off, or wither and die.

Control Measures. Dust the trees with derris dust about 10 days after petal-fall to destroy the beetle. Give a good application on a sunny, warm day.

APPLE BLOSSOM WEEVIL.

The blossoms when attacked by the weevils do not expand, and remain brown in colour. In this stage they are usually called Capped blossoms. If the brown cap formed by the dead petals is pulled off, a whitish grub or a pale yellow chrysalis will be found inside.

The weevil itself has a V-shaped white mark on its back and a grey background. It is not more than \( \frac{1}{6} \) of an inch in length. It deposits an egg in the flower truss before the blossom opens. The grubs soon hatch out and feed on the stamens. Hundreds of blossoms may be ruined in this way.

Control Measures. Use D.D.T. in the form of a wettable powder at the rate of one pound to 20 gallons of water, not later than at the green bud stage. If it is applied later it will kill 33 species of pollinating beetles which are of great importance.
2. CATERPILLAR PESTS

LEOPARD MOTH (*Zeuzera pyrina*).

The caterpillar of this moth bores into the limbs of apple trees, usually confining its activities to trees from 6-10 years of age. Its presence can usually be determined by sawdust and grass being seen on the ground below the place of entry of the caterpillar. When the attack first starts the caterpillar is very small, but when fully grown it is often 2 inches in length, yellowish white with a brown head, marked with black spots.

**Control Measures.** If a branch is attacked, saw it off, but if the main trunk is attacked it is possible to poke a piece of wire up the hole and hook the caterpillar out. When this is not possible, a small piece of sodium cyanide should be pushed into the burrow, the entrance hole being plugged up with clay or plasticine.

LACKEY MOTH (*Malacosoma neustria*).

This is a common pest in the south, but rare in the north. Some years it reaches epidemic proportions.

In the winter the egg bands of this moth will be found laid in a ring completely encircling a spur or twig. This ring consists of eggs stuck together. In the spring these eggs hatch out, and the little caterpillars make silk tents in the crutches of branches. These are very conspicuous early in June. The caterpillars are
blue grey in colour with white and reddish-yellow stripes on their backs and sides.

They soon defoliate a tree completely and then they move off to another tree. They are usually fully fed early in June and then they spin a silken cocoon either between leaves or attached to the bark. These have even been found in the grass under the tree.

**THE LACKEY MOTH AND CATERPILLAR (much enlarged)**

**Control Measures.** The tar distillate winter washes do not kill the eggs in the winter, but dinitro-ortho-cresol at 7½% usually does—if used in addition to tar oil about mid-March. The egg-bands, however, may be cut off during pruning and be burnt.

When the nests are seen in May and June, these should be removed while the caterpillars are small. When they get beyond this stage they may be killed by arsenical sprays. (For formula, see Chapter XV, page 211).

**VAPOURER MOTH (Orgyia antiqua).**

The eggs are found in the winter in a mass consisting of about 200 eggs attached to an empty cocoon. They are usually yellowish-brown or reddish-grey in colour. The caterpillars hatch out in May and June and feed on the leaves. They are very pretty and have four large yellow tufts of hairs on their backs.

**Control Measures.** Collect the egg masses in the winter during pruning.
Spray with a tar distillate wash in the winter, using a 10% solution.

When caterpillars are present, spray with an arsenical wash. (For formula, see Chapter XV, page 211).

![Vapourer moth and caterpillar](image)

D.D.T. dust or D.D.T. emulsion dissolved at the right strength will control these pests and can be applied at any time except at blossoming.

**WINTER MOTH** (*Operophtera brumata*).

**MARCH MOTH** (*Erannis ascularia*).

**MOTTLED UMBER MOTH** (*Hybernia defoliaria*).

These three moths have been classified together because the damage they do is so similar. The control measures are the same in each case.

The caterpillars of this group are leaf-eating and fruit-eating and are known commonly as loopers, because when they move from place to place they form a half loop in doing so, having only legs in the forefront of their body and in the rear.

The female winter moth is wingless and has to crawl up the trunk of the tree to lay her eggs which she does on the spurs and in wounds and cracks in the stems. The caterpillars hatch out in March and April and start feeding on the buds directly they open. They will often defoliate a whole tree. The caterpillar, when mature, is green, with palish lines along its body. By the second week in June it is fully fed, and then falls to the ground, turning into a chrysalis four inches below the surface of the soil.
Control Measures. Bands of special tree-banding grease may be put straight on to the tree trunks, 3 to 4 inches wide. They should be placed as high as possible up the stems of bush trees. The application should be made before the end of October, and from time to time the grease should be "combed" to remove any leaves or other matter which may have stuck to it.

Spray the trees with a 10% solution of a high boiling neutral tar oil wash in the winter, applying this wash with as much force as possible.

Should the caterpillars appear in the spring, because grease-banding and tar oil washing have been neglected, they may be killed by spraying with lead arsenate. This may be added to the lime-sulphur wash if necessary. (For formula, see Chapter XV).

CODLING MOTH (Cydia pomonella).

The Codling moth is an important pest. It causes the maggot or worm which ruins the young fruits. Sometimes it attacks pears, as well as plums, damsons and walnuts.

If an attacked apple is cut open and a pale pinkish caterpillar with a brown head, covered with a few scattered hairs is found inside, this is the maggot of the codling moth. It is usually not more than $\frac{1}{2}$ inch long.

Do not mistake these grubs for the maggots of the apple sawfly (see page 114). The sawfly maggots emit a very repugnant odour, whereas the codling moth maggots do not. The sawfly cater-
pillars, too, have usually left the fruit before a codling attack starts. The grubs of the codling are usually to be found in July and August.

Sometimes a second brood occurs, but this is not common in this country.

**Control Measures.** As the caterpillar hibernates under loose bark a good tar distillate washing is essential in the winter. In very old trees it is worth while scraping the trunks with a horse curry comb, before starting to spray.

The first summer spray must be applied by the end of the second week of May. The formula being 1 lb. of lead arsenate paste to 25 gallons of water. Direct the spray on to the developing fruitlets. If some of the maggots have already penetrated the surface of the apple, add 2 ounces of nicotine to the spray mixture already advised, plus a spreader like Estol H.* Give a second lead-arsenate spraying at the beginning of June and a third before the 1st week in July. Arsenate of lead is very poisonous, and D.D.T. or derris may be used as an alternative.

If the trees are banded in July with sacking, or with corrugated cardboard strips—with the corrugation downwards—the caterpillars will prepare to hibernate in these bands, which may then be removed in October and the pests destroyed. It is possible to purchase special bands for this purpose from horticultural sundriesmen.

**TORTRIX MOTHS.**

There are a large number of Tortrix Moths whose caterpillars damage leaves and fruits. The rough and ready way of knowing which are tortrix caterpillars is to touch them on the head to see if they wriggle backwards quickly. This test isn't infallible but it usually works.

**Fruit-surface Eating** (*Caoxcia podana*).

The caterpillars are pale yellow and usually appear in July and August when they are about \( \frac{1}{2} \) inch long. They generally get hold of a leaf and fasten it to an apple by means of a silken web. They then feed on the surface of the apple, often remaining on the fruits in this manner until they are gathered. Sometimes they just feed on the under sides of leaves and then, after the first moult, feed on the fruit.

**Control Measures.** Unfortunately, it is very difficult to control this pest. A tar distillate washing should, of course, be carried out with force in the winter, and the use of arsenate of

* Now called Shellestol.
THE PESTS OF FRUIT

lead (for formula, see Chapter XV, page 211) in July has proved effective.

Bud Moth (Spilonata ocellana).

This form of tortrix known as the bud moth is a small, reddish-brown caterpillar with a black head. It enters the buds just before they start to grow in the spring and quickly ruins them. When the blossoms are opening, it migrates and feeds on the foliage, making for itself a little home with silken hairs in between several leaves. Sometimes it feeds on the fruits in August and September.

Control Measures. As for Fruit-surface Eating Tortrix.

ERMINE MOTH (Hyponomeuta malinella).

Once this pest has been seen it is never forgotten. The small, spotted caterpillars live in conspicuous white nests of "spider's web" like material which they build in the crutches of apple trees. They make their nests in May and continue to live in them till the end of June. The caterpillars defoliate the trees.

Control Measures. Spray the trees with a 10% tar distillate winter wash in December or January.

Remove all tents of caterpillars seen in May and June.

Spray the trees with arsenate of lead (for formula, see page 211) at the end of April and the beginning of May.

PITH MOTH (Blastodacna atra).

The caterpillar appears in May and June and attacks the shoots, burrowing inside them and inside the stems of flower trusses also. It is particularly bad in the case of young trees. As the result of the attack, the spur or shoot wilts and dies, and then the caterpillar may leave the twig and bore into another. It is brownish-pink in colour, $\frac{1}{4}$ inch long when fully grown and has a dark brown head.

Control Measures. When regular spraying with a 10% solution of a tar distillate wash is carried out the pith moth seldom appears. This spraying should be done during the month of December.

All infected shoots should be hand picked and burnt.

CASE BEARERS (Eupista spp. and Solenobia inconspicuella).

The caterpillars of the case bearers live in a little shell or case, something like that of the snail, only it is cigar-like in shape. It
feeds on the leaves, feeding first of all on the surface and then on the tissue inside. It produces irregular-shaped bare patches by cutting out circular holes in the tissue.

There is another type of case bearer which has a pistol-shaped case, while the Solenobia has a greenish-grey case, three sided and straight.

**Control Measures.** Directly case bearers are seen damaging the leaves, spray with arsenate of lead, being sure to incorporate a spreader.

### 3. FLIES

**SAWFLY** (*Hoplocampa testudinea*).

One of the most serious pests of apples. It has been known for one hundred years. It must not be confused with the codling moth.

The sawfly lays its eggs just below the calyx of the flower. The caterpillar, which soon hatches out, bores into the side of the young fruit, leaving a sticky mess where it enters in. It often has more than one attempt at entering, forming a ribbon-like scar in this way.

The caterpillar is dirty white, with a brown head and has a very
objectionable odour. It may leave one fruit and enter another. When matured late in June or early July it drops to the ground and spends the winter as a cocoon in the soil.

**Control Measures.** The tree should be sprayed with nicotine and soft soap immediately after 80% of the petals have fallen (for formula, see Chapter XV, page 212). The spray should be put on with as much force as possible, and directed into the flower trusses, where the insects will be laying their eggs.

Should this spraying have been omitted, and the caterpillars be noticed later; then a good dusting with derris should be given about 16 days after petal-fall. D.D.T. dusts are equally effective.

All infested fruits should be picked off and burnt should either of the measures mentioned above not have been adopted.

**WASPS.**

Will not only attack plums and pears but will actually bite pieces out of a ripe apple, either dessert or culinary.

The best method of controlling them is to find their nests and to place a tablespoonful of fresh derris powder on a dry day over the hole. The wasps when returning send up a cloud of dust by fanning their wings, and so take the derris into the nest. All the grubs may not, however, be killed and so it is a good plan to dig out the nest the following day. Where this is impossible, a second or third application of derris dust near the hole will be effective.

A handful of 5% D.D.T. dust may be dropped into the entrance of each nest. If the nest is in the roof, it should be tackled at night time. D.D.T. is very effective.

4. **APHIDES, CAPSIDS, SCALES, etc.**

**APPLE CAPSID** (*Plesiocoris rugicollis*).

The capsid bug is a comparatively new pest of apples. There are several different kinds but the one mentioned here is the most important. It is found wherever fruit is grown in this country.

A small yellowish bug hatches out in April and May and may be seen running rapidly on the leaves and stems of apple trees on sunny days. It feeds on the under surface of leaves and on the tips of shoots. Little brown marks will be seen—as if puncture holes. These marks turn black later. If a leaf is removed and held up to the light the punctures show up clearly.

When the blossom has fallen the capsid starts to attack the fruits, puncturing the skin and causing rough corky patches to
appear. The cork scars thus made can ruin fruits and make them look very unsightly.

When young, early in May, the bug is only $\frac{1}{16}$ inch long and yellowish-green in colour. It molts five times, however, getting larger each time and gradually producing wings. When fully grown it is $\frac{3}{4}$ inch in length and green in colour.

**Control Measures.** The ordinary tar distillate wash does not kill the eggs of the capsid bug, for this is laid in the young shoots or in the trunk just below the bark.

A D.N.C. petroleum winter wash should be used instead and should be applied at a strength of $7\frac{1}{2}$% in early March.

Better results are, however, achieved by those who apply the ordinary tar distillate wash in December, followed by a D.N.C. wash at $7\frac{1}{2}$% about the third week of March.

Where winter washes have been omitted, spraying with nicotine and soft soap or a spreader (for formula; see Chapter XV, page 212) should be done with as great a pressure as possible a week before the petals open.

A ring of grease-banding material should be placed around the trunks of the trees at the same time in order to prevent any bugs which fall to the ground from climbing up into the branches again.

**APHIDES (Aphis spp.).**

Eight different kinds of aphides or green fly feed on apple trees, but the eggs of all of them may be killed by the tar distillate washes applied in December and January. Such washes must be applied efficiently for if any part of the tree is missed, some aphid eggs will hatch out in the spring.

If tar oil is not used as a winter wash, a D.N.C. wash may be applied early in March.

It is not proposed to describe the various aphides, some of which are green, others of which are black, or of a plum colour.

When for some reason or another the tar distillate washing in the winter has been omitted, a nicotine spray (for formula; see Chapter XV, page 212) should be applied in the spring directly the aphides are noticed.

**WOOLLY APHIS (Eriosoma lanigerum).**

The woolly aphid or American Blight is very well known. It attacks the trunks of trees and young wood, producing a white cotton-wool-like substance which makes its attack very con-
spicuous. This wool-like substance may be present all the year round but the pest is usually at its worst in the beginning of June till the end of October. It is important to keep it down because it may be the cause of transmitting the disease known as canker. (See page 136).

Control Measures. The trees should be fully covered with a good tar distillate wash in December or January, applying the spray with as much force as possible and directing it into all the nooks and crannies—especially of old trees. A 10% solution should be used.

This should be followed by spraying early in March with a good D.N.C. wash, using a 7½% solution.

In the spring, spraying should be done with nicotine and a spreader (formula 1 ounce nicotine, 1 ounce Shellestol, to 10 gallons of water). Those who do not wish to have the bother of making up such a wash may use a proprietary nicotine insecticide.
As nicotine is a poison, many prefer to use the non-poisonous liquid derris, which has given good results against this pest in Kent. In small gardens it is possible to hand paint with liquid derris, using it almost neat. This is far better than painting with methylated spirit.

APPLE SUCKER (*Psylla mali*).

In years gone by the apple sucker was a very serious pest, but since the advent of the tar distillate washes it has almost disappeared. The young suckers attack the opening flowers and quickly destroy them. This trouble is often erroneously described as frost damage. Trees that have refused to bear for fourteen years cropped the following year when sprayed by the writer with a tar distillate wash in the winter!

**Control Measures.** Spray all trees as a routine measure with a tar distillate wash in December or January, using a 5% solution. Be sure to cover the tree thoroughly.

Where the tar distillate wash has been omitted in the winter, spraying with nicotine and soft soap (for formula, see Chapter XV, page 212) should be carried out just before the blossoms open.

MUSSEL SCALE (*Lepidosaphes ulmi*).

Little mussel-shell shaped scales will be found on the bark of trees. They are about ¼ inch in length, have a hard shell, being swollen and rounded at one end. They lie flat on the bark.

**Control Measures.** Spray the trees with a 10% solution of a good tar distillate wash in December or January.

MITES AND SPIDERS.

The red spider or red mite which attacks apples and many other types of fruit trees are not controlled by tar distillate washes in the winter, though most of the insects that feed on them are. The result is that this pest has been increasing during the past few years. The benefits, however, of the tar oil wash far outweigh the damage done by red spiders.

Minute red bead-like eggs will be found on the under sides of spurs, in cracks in the trunk, and on the shoots. They are usually to be found in large masses and because they are bright red, can be seen from some distance away.

The mites hatch out towards the end of April or early in May and are yellowish or lightish red in colour. They feed on the under surface of the leaves, several broods developing in the
summer. The leaves turn yellow or brown and assume the autumn tints long before the end of the summer.

**Control Measures.** Lime-sulphur gives an excellent control of red spider and so when trees are sprayed with this wash in order to control scab and mildew (see page 139) the spiders are kept down automatically.

Apply a 4% dinitro-ortho-cresol wash in late February or early March and spray with a good liquid derris containing at least 0.004% Rotenone in early June and repeat it in 2–3 weeks' time.

No D.D.T. spraying should ever be carried out after the green cluster stage, for the insects that eat red spiders will be killed.

**HARES AND RABBITS.**

Few people realise the damage that hares and rabbits can do in a night. They bark the trees—often ringing them completely, and they may even climb up into the crutch of bush trees, gnawing the branches for three feet above ground level.

**Control Measures.** See that the trees are wired round with narrow mesh wire or wire the whole orchard round carefully.

Heat tree banding grease until it runs freely, paint the stems of trees as far as rabbits and hares can reach with such material in September. Use a smear such as "Trepar."

### CHERRY

#### 1. CATERPILLARS

**CHERRY FRUIT MoTH** (*Argyresthia nitidella*).

This pest must not be confused with the cherry fruit fly—an insect which damages the crop in France. The caterpillar of the moth is transparent green with a brown head. It enters the flower buds in the spring and by the time the blossoms open, it is feeding on the petals and stamens. Later it feeds on the young fruitlets. It can do a tremendous amount of damage and ruin the whole crop.

**Control Measures.** Spray with a 10% tar distillate wash in December. See that the trees are fully covered, using as much pressure as possible.

Most of the caterpillars which attack apples, attack cherries also. The control measures are similar in each case.

Spray with a D.D.T. emulsion or dust with a 5% D.D.T. dust as soon as the pest is seen.
2. FLIES

SAWFLIES.

The two sawflies that attack cherries also attack pears. Please see under PEAR, page 127.

3. APHIDES, CAPSIDS AND SCALES

CHERRY BLACK-FLY (*Myzus cerasi*).

This black-fly infests the tips of branches, causing the leaves to curl and stunting the shoots. It is usually very conspicuous in May and June and then departs to another host in July. It is very difficult to get at the insects in the summer under the curled leaves, especially as the fruit is usually ripening at the time and it is obviously not desired to damage the crop.

**Control Measures.** Spray the trees with a 5% solution of a tar distillate wash in December. To get good results it is necessary to have a perfect covering.

It is possible to spray with a 7½% D.N.C. solution in early March and thus kill the eggs.

Where, for some reason or another, tar distillate or D.N.C. washing was omitted, the trees should be sprayed about the middle of April with nicotine and Shellestol, formula: ¾ ounce nicotine, 1 ounce Shellestol to 10 gallons of water.

Cherries may also be attacked by Capsids (for information, see under CURRANTS) and by Mussel Scale (for control, see APPLE).

CURI'ANTS, BLACK, RED AND WHITE

1. CATERPILLARS

CURRANT CLEARWING (*Conopia tipuliformis*).

Mainly attacks the black currant but also damages the red currants and gooseberries. The caterpillar bores in the stems, the leaves wilt on the shoot and the fruit trusses do not mature. It is fully grown by April and is then white in colour with a brown head.

**Control Measures.** Go over the bushes in the winter, bending over the end growths or tips. Those that are weak because of the tunnelling will snap off. When this happens the remainder of the shoot should be cut back to sound wood and the infected material burnt.
THE PESTS OF FRUIT

SHOOT-BORER (*Lampronia capitella*).

The caterpillars bore into the stems and buds in the spring. The leaves wilt and the shoot eventually dies. Later it may attack the fruits, the baby caterpillar being found inside feeding on the seed. The caterpillars are bright red first of all but turn greenish white as they reach maturity.

**Control Measures.** Infested shoots should be removed in April when they are seen.

The bushes should be sprayed with a 10% tar distillate wash in December, the wash being put on with considerable force, so as to get at the cocoons which are hiding in cracks and under the rind.

2. FLIES

GOOSEBERRY SAWFLY.

A small caterpillar which eats the leaves and may defoliate the bush. For control, see under GOOSEBERRY.

3. APHIDES, CAPSIDS AND MITES

CAPSID BUG (*Lygus fabulinus*).

This capsid is very similar in appearance to the apple capsid bug.

It may attack gooseberries, blackberries, cherries, raspberries, strawberries, pears and peaches, as well as currants. It hatches out in April, attacking the young leaves and causing minute brown spots and holes to form in them. When the terminal bud is attacked, large numbers of side shoots develop.

In the case of gooseberries the fruit will be badly marked by brownish-yellowish patches and the skin may crack. In the case of pears, brownish-black spots appear on the leaves, and on the fruits irregular pitted, corky tissue will develop. On plums the foliage will be spotted and pitted. On strawberries similar damage is done; on blackberries the damage is often severe and the holes that develop after attack are often very large and conspicuous.
The eggs are laid just under the bark of one- or two-year old shoots. The bugs hatch out in April and feed on the young foliage. Like the apple capsids they moult several times, and during part of their life may feed on weeds and other plants. When fully grown they fly about readily. On first hatching out the bug is semi-transparent, small and shiny, and of a pale yellowish-green colour, but fully grown it is of a very green colour.

Control Measures. Following the winter washing with a good tar distillate wash, a spraying should be given with a D.N.C. petroleum wash at $\frac{7}{8} \%$ early in March.

Spraying may also be done with nicotine late in April, and again about mid-May (for formula, see Chapter XV, page 212).

When the bugs feel a jar on the tree, caused by the spray or the operator, they drop to the ground where they live on weeds if the land is not kept clean. Some consider it worth while, therefore, to spray the ground as well as the trees.

**APHIDES.**

Various types of aphides or green fly attack currants, sucking the underneath side of the leaves and causing the foliage to curl up and turn red in colour. The new wood growth may be deformed and the fruit may be covered with the secretion of the aphides and not develop to its proper size.

Control Measures. Spray the bushes with an efficient solution of a tar distillate wash in December or January.

Or spray with a $\frac{7}{8} \%$ D.N.C. wash in early March. Soak the bushes thoroughly.

Where this has been omitted for some reason or another, spray in the spring with nicotine and soft soap (for formula, see Chapter XV) before the leaves begin to curl. Usually towards the end of April. Spraying is useless once the leaves have curled, and then the only thing to do is to mix up a nicotine and soft soap wash and go round the bushes, dipping the tips of the leaf curled shoots under the solution.

**BIG BUD (Eriophyes ribis).**

The big bud mite or black currant gall mite does more damage to black currant bushes than any other pest known. In black currants the big buds produced make the attack very obvious. When, however, the mite attacks red, white currants, or gooseberries, the buds merely die and go brown.

The mite itself is microscopical, being only $\frac{1}{200}$ of an inch in
length. It is *not visible to the naked eye*, being white and semi-transparent. It lives on the leaves from March to the end of June, and in June or early July works its way into the bud of the current year's growth where it lays its eggs. There may easily be, at the end of the winter, 10,000 mites and more in one bud. In the spring, usually the end of March, and early in April, when the new leaves are unfolding, they escape from the buds in order to move on to new homes.

**Control Measures.** The bushes should be sprayed with lime-sulphur about the end of March or the first week of April, just after the flower racemes appear but before the blossom opens. This is usually when the leaves are about the size of a two shilling piece. The formula is: 1 pint of lime-sulphur to 20 pints of water, except in the case of Goliath, Davison's 8 and Wellington XXX, when the concentration should be 1 pint of lime-sulphur to 50 pints of water, because these varieties may be damaged by the stronger solution.

The big bud mite is considered to be the carrier of the virus disease, Reversion, and it is, therefore, most important to prevent mite attacks from spreading. Lime-sulphur spraying should, therefore, be done every year as an insurance.

*Other pests* that may attack currants are Weevils, Winter Moths, Mottled Umber Caterpillar, Mussel Scale and Red Spider (see under *Apple*).

**GOOSEBERRY**

**GOOSEBERRY SAWFLY** (*Nematus spp.* and *Pristiphora pallipes*).

There are various sawfly caterpillars which attack gooseberries.
Some are green, spotted with black dots, some are pale green and have a black head, while others are dark green with a lighter coloured head. The caterpillars feed very rapidly and bushes can often be completely denuded of foliage before the gardener is aware of their presence.

They first appear in April and May, there is usually a second generation in June, and a third about mid-August. With the *Pristophora* there are four broods in a season.

**Control Measures.** As the sawflies lay their eggs on the leaves in the centre of the bushes near the ground, quite good control may be achieved by spraying the centre of the bushes at the end of April with a lead arsenate spray. Dust or spray with D.D.T. as soon as sawfly damage is noticed, before the little caterpillars have worked their way all over the bushes and so become almost inaccessible to control.

Where the pests have been overlooked until the fruit is almost ready for picking, spraying with liquid derris should be done instead.

**APHIDES** (*Aphis grossulariae* and *Eriosoma ulmi*).  
There are two kinds of aphides or green fly found on gooseberries, the one attacks the shoots and the other the roots.

The aphid that attacks the shoots is dark green, and plump. It feeds on the tips in the spring, crumpling the leaves and deforming the shoots. The whole bush may be stunted thereby. Ants love this particular species and are always in attendance. They usually are the first to indicate the presence of the trouble.

The aphides that attack the roots (also attacking the roots of red and black currants) produce a white woolly-like substance below ground level, and check the bushes severely. It is seldom that the damage is realised till the bushes are dug out.

**Control Measures.** Spray the bushes in December with a tar oil wash, using a 5% solution, or spray with D.N.C., using a 7½% solution, in February. Spray the bushes in May with a nicotine wash so as to give the shoots a thorough soaking.

In the case of the root form, dip the roots of young trees in nicotine and soft soap (for formula, see Chapter XV) before planting them in their permanent positions.

**RED SPIDER** (*Bryobia pratiosa*).

A very serious disease of gooseberries. Can cause a tremendous amount of damage in a week or two. The leaves go pale yellow
and look as if they have been fired. Usually they drop off. The whole plant will look sickly, the fruit being under-sized.

The mites, which are usually greenish, greyish or rusty red, will be found underneath the leaves, sucking the sap. They feed only on warm sunny days. On cold days they retire to the lower leaves and rest. They usually leave the gooseberry bushes in June and do not return again till the following spring.

Control Measures. Spray the bushes with a 4% solution of D.N.C. wash in December. As the mites usually migrate to the bushes, however, in the spring, this is not always successful.

Spray with a 2% lime-sulphur solution directly after the flowering period, taking care to wet the under surfaces of the leaves, and giving the centre of the bushes special treatment.

With varieties that are sulphur shy, like Leveller, Gunner and Keen's Seedling, spray with a 2% solution of a white oil emulsion instead.

Other pests which may attack gooseberries are Currant Clear-wing (see CURRANTS), Winter Moth Caterpillars (see APPLE), Capsids (see APPLE and CURRANTS), Mussel Scale (see APPLE), and Gall Mites (see Big Bud in BLACK CURRANTS).

LOGANBERRY, BLACKBERRY, PHENOMENAL BERRY, etc.

RASPBERRY BEETLE (Bylurus tomentosus).

The raspberry beetle is often wrongly called the Raspberry Weevil. It is perhaps a more serious pest of loganberries than of raspberries and blackberries. The beetle appears in May and may be seen on the canes when the flower buds open. It is brownish-yellow at first, turning to greyish-brown, and about \( \frac{1}{4} \) inch in length. It lays its eggs in the blossoms during June or July,
white grubs hatch out and these feed on the forming fruits and tunnel into the "plugs."

**Control Measures.** Spray with liquid derris ten days after flowering begins, to destroy the beetles. Give a second application, if necessary, ten days later. The first spraying usually has to be done about the middle of June and the second spraying about the end of June. With blackberries, the application should be made the first week of July and again the third week of July.

A fine spray should be used and all parts of the flowers and fruits should be wetted.

Derris dust may be used, if necessary, instead of liquid sprays, but these are never as effective. As an alternative to derris, D.D.T. may be used.

**BLACKBERRY MITE** (*Eriophyes essigi*).  
Minute microscopic mites attack the fruits, malforming them, and causing uneven ripening. The berries often have an abnormal red appearance which has caused American workers to call this trouble the Red-Berry Disease.

The translucent mites hibernate until the end of February under the bud scales or in the dried-up fruits. By flowering time they have bred and migrate to the blossoms.

**Control Measures.** Spray with lime-sulphur when the new growths are about 5 inches long. *Formula*: 1 pint lime-sulphur to 12 pints of water.

Remove and burn old canes as soon as possible after fruiting.

**BRAMBLE SHOOT WEBBER** (*Notocelia uddermanniana*).  
This is one of the tortrix caterpillars, dusky brownish-red in colour with a black head, though the newly-hatched caterpillar is whitish.

It feeds on the leaves in May and June, particularly at the tips, and may nibble the terminal growth, thus causing laterals to develop. It usually draws the leaves together and feeds in the centre of the young growths. Eventually the terminal bud is completely destroyed and the surrounding leaves webbed together.

**Control Measures.** Cut off the webbed leaves, as these contain the caterpillars, and burn them. Do this in May.

Spray in April with a lead arsenate wash (for formula; see page 211).

*Other pests* that attack these cane fruits are Capsids (see **CURRANTS**, page 121), and Aphides (see **RASPBERRY**, page 133).
THE PESTS OF FRUIT

PEACH, NECTARINE AND APRICOT

APHIDES (*Myzus persicae*, *Anuraphis schwartzi*), etc.

A large number of species of aphides or green fly attack apricots, nectarines and peaches. The two principal ones, however, are the Almond Aphis and Peach Aphis. The latter is greenish-yellow, or brownish-pink, and feeds on the young leaves, causing conspicuous leaf-curl.

Sometimes the blossoms will be infested and deformed. The former is yellowish-green, amber, yellow, or reddish, though some colonies may be black. The aphides attack the leaves, curling the foliage, and in bad cases the trees will be left almost bare because of leaf fall.

Control Measures. Spray the trees with a 5% solution of a tar distillate wash in December. Do not delay till January, or there will be a danger of the wash injuring the buds.

Other pests which may attack apricots, nectarines and peaches, are Winter Moth Caterpillars (see Apple), Tortrix Caterpillars (see Apple), Wasps (see Apple), Mussel Scale (see Apple), Red Spider (see Apple), and Capsids (see Currants), Mealy Aphis (see Plum).

PEAR

SLUG WORMS (*Caliroa limacina*).

This pest feeds on the foliage of both pears and cherries and sometimes attacks apples and plums. The caterpillar looks like a dark green or blackish slug and feeds entirely on the upper surface of the leaves, making them patchy and blotchy. The trouble is usually at its worst from the middle of June until leaf-fall.

Control Measures. Spray with arsenate of lead the moment slug worms are seen, or spray with nicotine or liquid derris. Dust may be used instead of sprays. Be sure to apply the wash directly the slug worms are first seen.

PEAR SAWFLY (*Social Sawfly*) (*Neurotoma flaviventris*).

The true pear sawfly is very rare. The social pear sawfly is sometimes quite common. It may feed on plums and cherries as well as pears. The caterpillars are orange yellow and have pale brown stripes down each side of their bodies. Their heads are
black and shiny. They live in white tents which they make on the leaves and shoots, varying from three inches to twelve inches in length. These are usually to be found from the beginning of July till the end of August. The caterpillars are very clumsy when they move and they wriggle violently when disturbed. When frightened they exude a clear blood-red fluid from behind their head.

**Control Measures.** Remove the tents in July immediately they are seen, thus destroying the caterpillars.

**PEAR MIDGE (Contarinia pyrivora).**

One of the most important pests of pears. Seems more partial to Fertility and Williams while Conference often escapes. The maggots infest the young fruits which grow rapidly as compared with the others. They soon, however, become deformed and when they are cut open, a black cavity will be found inside filled with little white maggots. The damage is usually noticed from the middle of May to the second week of June.

**Control Measures.** Spray the ground around the infected trees with a tar oil or with dinitro-ortho-cresol petroleum oil wash, using at least a quarter of a gallon of the diluted wash per square yard. Do not spray the trees themselves, or the foliage will be injured, for this spraying must be done between the bud burst and white bud stages. Don't spray with very high pressure so as to avoid the spray drifting on to the trees.

Cultivate the ground thoroughly from the second week of June till the second week of July; regular hoeings have to be done each week. This method destroys the maggot as it goes to hibernate for the winter.

**APHIDES.**

The aphides or green fly which attack pears are not at all important. It is seldom that they give much trouble.

**Control Measures.** As for Apple; see page 116.
PEAR LEAF BLISTER MOTH (*Eriophyes piri*).

This mite is microscopical like the big bud mite. It attacks the upper surface of leaves thus causing them to become dotted with greenish yellow or yellowish-red blisters. The old blisters turn brown and finally black. Fruits may be attacked too, reddish or brown pustules of irregular shape being formed.

**Control Measures.** The trees should be sprayed with a 5% solution of a lime-sulphur wash during the first or second week of March. All the buds should be wetted thoroughly since at that time the mites will be found there.

Other pests that may be found on pears include Leopard Moth Caterpillar (see Apple, page 108), Vapourer Moth Caterpillar (see Apple, page 109), Codling Moth Caterpillar (see Apple, page 111), Tortrix Moth Caterpillar (see Apple, page 112), Wasps (see Apple, page 115), Twig Cutters (see Apple, page 107), Shot-hole Borers (see Plum, below).

PLUM AND DAMSON

SHOT-HOLE BORER BEETLE (*Anisandrus dispar*).

These tiny black beetles attack plums, damson, apples, pears, cherries and other fruit trees. They are particularly bad where plums are attacked by bacterial canker. There are various species, all of which tunnel into the bark and trunks of fruit trees. There they bore galleries and lay eggs, two broods often appearing in a year.

Trees that are attacked by these little beetles usually have a most peculiar smell.

**Control Measures.** Remove dead and dying branches that are attacked by these boring beetles. In bad cases it may be necessary to remove whole trees and burn them.

Where only the lower portion of a tree is attacked, spray this in April with a tar distillate wash, directing the spray into the holes. Care should be taken not to allow the young shoots or foliage to be touched with the spray at this time of the year.

Paint the trunks of attacked trees with a paraffin wax in March or April with the object of stopping up the holes.

RED PLUM MAGGOT (*Cydia funebrana*).

This maggot, which infests plums, damsons and peaches, is unfortunately very common. The caterpillar is bright red, and feeds on the fruits from the middle of June onwards. It makes
a hole near the base and bores into the fruit, the caterpillar tunnelling into the flesh near the stone.

When fully grown at the end of August or early in September it comes out of the fruit, and hides under bark or in cracks and crevices where it spins a cocoon.

**Control Measures.** Spray with a good tar distillate wash in September. Give a good drenching so as to make certain to get into the cracks and crevices.

Spray in the summer with liquid derris, about the middle of June, just at the time when the caterpillars are hatching. This kills the maggots before they enter the fruits.

**PLUM SAWFLY** *(Hoplocampa Flora).*

A very common pest. Its favourite varieties are Victoria, Czar and Belle de Louvaine. Pond's Seedling and Monarch seem to be resistant.

The eggs are laid in the flowers and the little caterpillars that hatch out enter the fruits. The trouble can usually be detected by the sticky substance and black frass that exude from the hole. When fully grown the caterpillar is \( \frac{3}{4} \) inch long, and has a creamy white body and yellowish-brown head. It has ten pairs of legs.

**Control Measures.** Spray the tree with liquid derris, giving a good drench just after all the blossoms have fallen. Spray again a week later.

Those who like D.D.T. may use this either as a dust or spray before and after blossoming time.

If it is necessary to dust, dusting should not be done until 14 days after petal-fall, using derris dust.

**APHIDES** *(Anuraphis padi and Hyalopterus arundinis).*

*Anuraphis* is the leaf-curling kind and *Hyalopterus* the mealy aphid. Neither of them is very important these days since the advent of the tar distillate wash.

In neglected orchards or where trees are never sprayed with tar oil in the winter these two aphides do a tremendous amount of harm, for they not only damage the leaves by sucking them, but
THE PESTS OF FRUIT

they reduce the vigour of the trees so much that they fail to crop the following season also. In many districts damsons never crop year after year, entirely owing to aphid attacks.

Control Measures. Spray with a 5% solution of a tar distillate wash in December or early in January, or if preferred use a D.N.C. wash in early March. It is important to spray as early as this for the buds of some plum varieties like Belle de Louvain are damaged if the spray is applied later than the middle of January. The Myrobalan plum is very subject to bud injury.

Those that miss spraying plums in the winter with tar distillate should spray in the spring with nicotine and soft soap (for formula, see Chapter XV, page 212), before leaf-curling takes place. In the case of the mealy plum aphid a miscible white oil should be used instead of the nicotine spray for these aphides have a waxy covering.

MITES AND SPIDERS.

On plums and damsons it is quite a good plan to spray the trees using a 2% solution ten days after petal fall. A second spraying may be necessary in bad cases ten days later.

Other pests that may attack plums and damsons are Leopard Moth (see APPLE, page 108), Lackey Moth (see APPLE, page 108), Winter Moth Caterpillar (see APPLE, page 110), Tortrix Caterpillar (see APPLE, page 112), Wasps (see APPLE, page 115), Red Spider (see APPLE, page 118), Red-legged Weevil (see RASPBERRY, below), (Capsid (see CURRANTS, page 121).

RASPBERRY

RED-LEGGED WEEVIL (Otiorrhynchus clavipes).

This weevil attacks the blossoms, minute fruitlets and unopened buds. It may gnaw at shoots and cause them to break. It may feed on the foliage, making little round holes in the leaves. It may bore into the young canes near the base and check the growth. The weevil mainly feeds at night and is difficult to find during the day as it hides under stones, rubbish, clods of earth, etc.

The weevil is black and has red legs. It appears late in April and early in May.

Control Measures. It is very difficult to control, but it is worth while tapping the canes at night time, holding out boards covered with banding grease. This work has to be done without
the aid of a light because these pests fall to the ground directly
they see any light or hear movement.

Another method is to make up a bait consisting of 1 lb. apple
pulp, 1 lb. bran or wheat chaff, and \( \frac{1}{10} \) lb. of sodium fluosilicate.
These three should be mixed together and sprinkled along the
rows. The mixture acts as a poison bait.

**CLAY-COLOURED WEEVIL** (*Otiorrhynchus singularis*).

This clay-coloured weevil does similar damage to the red-legged
weevil, but it usually starts its attack at the end of March and
early in April, when it feeds on the leaf stalks, causing them to
wilt.

**Control Measures.** As for Red-Legged Weevil, see previous
page.

**RASPBERRY MOTH** (*Lampronia rubiella*).

A very important pest. The canes when attacked will be found
at the end of April or early in May to have withered shoots on

![Raspberry Moth](image)

them, the insides of which are tunnelled. The grub that does this
feeds on the pith, and is red in colour, though the chrysalis that it
forms later is brown. It must not be confused with the grub of
the Bramble-shoot Webber (see under LOGANBERRY, page 126).

In addition to the damage it does in April to the cane, the
grub feeds on the plug of the fruit about June, though its damage
is often unnoticed. It hibernates at the base of the canes in the
rubbish or on the stakes at the ends of the rows.

**Control Measures.** The canes should be sprayed with an
8% solution of a tar distillate wash in December or January.
This will destroy the hibernating grubs and as a matter of fact,
any aphis eggs there may be on the canes as well.
APHIDES.
There are several species of aphides which attack raspberries, some of them curl the leaves and some of them just suck the sap. None of them does a great deal of damage.

Control Measures. Should it be necessary to control the aphides, spray the canes in the winter with a 5% solution of a tar distillate wash. The eggs will thus be smothered.

Other pests that may attack raspberries are Raspberry Beetle (see LOGANBERRY, page 125), Vapourer Moth Caterpillar (see APPLE, page 109), Tortrix Moth Caterpillar (see APPLE, page 112), Bud Moth Maggot (see APPLE, page 113).

STRAWBERRY

GROUND BEETLES.
There are six different kinds of beetles which attack strawberries, four of which damage the ripening fruits. They usually do more damage on warm nights.

Control Measures. It isn’t easy to check these beetles. Dressings of naphthalene at 2 ounces to the square yard seem to drive them away without doing harm to the plants.

It is most important to keep the rows hoed regularly in order to move the hiding places and expose the pests.

STRAWBERRY BLOSSOM WEEVIL (Anthonomus rubi).
This in strawberry circles, is often known as the Elephant Beetle. It lives not only on the strawberry but on the raspberry and blackberry as well. The variety Royal Sovereign is particularly susceptible to attack.

The weevil itself is black. It appears in April and May and lays its eggs in the unopened flowers. It makes a puncture hole with its long snout in order to do this. It then either partially or completely cuts through the stalk of the bud and prevents it developing further. Most of the damage is seen in June.

Control Measures. Dust with a 5% D.D.T. dust as soon as the first trace of the trouble is noticed. Give a second application a week or ten days later.

STRAWBERRY MOTH (Peronea conariana).
This is sometimes called the Leaf Button Moth. The caterpillar appears in late April or early May and feeds on the unopened
leaves and on the blossom buds as they develop. It often joins several leaves together by means of silken threads and it may make a web on the under side of the foliage inside which it may feed. When disturbed it is active and wriggles about freely. It is greenish—the back being darker than the head, which is shiny yellow. It is fully grown by September.

**Control Measures.** Spray with arsenate of lead at the end of April, usual formula—see Chapter XV, page 211.

In May or early June spray with liquid derris for it is dangerous as late as this to spray with arsenate.

In very bad cases the tops of the plants should be cut off in September down to the crown, the tops being removed and burnt.

**APHIDES.**

There are many species of aphides or green fly that attack strawberries, perhaps the most important of which has the Latin name of *Capitophorus fragaefolii*. This is the aphis which carries virus disease from diseased to healthy plants, any time between March and September. It is lighter in colour than the normal green fly, being almost yellow. It lives on the strawberry plants from the latter part of August till the following July and doesn't seem to be worried by frost, snow or cold winds.

**Control Measures.** As aphides are the carriers of the virus diseases, it is most important to try and control them. The only method which we have found really satisfactory is to spray with nicotine and soft soap. 1 ounce of nicotine, 1 lb. soft soap, and 10 gallons of water. The plants should be given a thorough soaking in April, and again in May.

Immediately after picking the straw, which has been put down to keep the fruit clean alongside the rows, should be set alight. In this way large numbers of the leaves are burnt off and the aphides thus destroyed. In addition, red spiders and other pests will be killed. The plants will scarcely be harmed thereby and many growers affirm that they are much stronger the following year as the result.

**TARSONEMID MITE (Tarsonemus pallidus).**

This mite occurs all over the country. It is very troublesome, not only because it injures the plant directly, but also because it so disfigures the leaves that it makes it difficult to be certain whether a plant is attacked by the Yellow Edge virus or not.

It feeds in the folds of small, unexpanded leaves, from the
middle of May until well on in November. As a result, the older leaves become puckered and crinkled, the young leaves may be killed, and the plant loses its fresh green colour. In bad cases, multiple crowns are formed and runners are killed. It is not known how the mites pass from plant to plant or from garden to garden.

**Control Measures.** Spray with a 3% solution of lime-sulphur, plus a spreader, during the third week of March, giving the plants a thorough soaking.

Immerse all strawberries before planting in water, kept at a temperature of exactly 110 deg. F. for 20 minutes. This kills all the mites present and, of course, other pests too. Cool the plants off immediately after this treatment by plunging them into cold water. Plant immediately afterwards.

This warm-water treatment is the only satisfactory way of controlling the Tarsonemid Mite.

**STRAWBERRY RHYNCHITES (Rhynchites germanicus and R. minutus).**

This is a stem-cutting weevil which not only cuts the stems of the leaves but of the fruits also, and may work systematically over the plants, crippling them. The damage is notable in May and continues right through the month of June. The stems are often cut half-way through only, but even in this case the leaves will flag and die.

**Control Measures.** Dust with a 5% D.D.T. dust directly the first sign of damage is noticed. Repeat the dusting a week or ten days later if the infestation persists.

Sometimes this pest will spread to the blackberry and loganberry, but can be controlled here with D.D.T. also.

**Other pests** that attack strawberries are: Chafer beetles (see Chapter III, page 20), Wire Worm (see Chapter III, page 31), Leather Jackets (see Chapter III, page 24), Slugs (see Chapter III, page 26), Eelworms (see Chapter III, page 22, and Chapter XIV, page 209), and Red Spider (see above).
CHAPTER X

THE DISEASES OF FRUIT

Keep disease down by:—
1. Spraying and pruning regularly.
2. Cutting out unhealthy wood.
3. Burning all diseased material.
4. Read—Recognise and root out.

A DISEASE WHICH MAY ATTACK ANY FRUIT TREES

ARMILLARIA ROOT ROT (Armillaria mellea).

This disease, sometimes called the Honey Fungus, and sometimes the Bootlace Fungus; is really one of the common toadstools. It lives on the roots of trees, producing black strands which look like black string, hence the name bootlace. Trees attacked soon die, and then the toadstools are seen above ground. Their stalks are often seven or eight inches long, yellow brown and dark brown at the base. The cap is honey coloured above and bears brown scales, the toadstools are usually in dense clusters. They are found from July to December, but are most prolific about October.

Control Measures. Every diseased tree must be removed as soon as possible. When woodlands are being planted up with fruit trees, care must be taken to remove all the roots and stumps, even gate posts and fencing poles may be attacked. Experiments in America seem to show that the disease can be killed with carbon bi-sulphide which should be injected into the ground to a depth of 8 or 9 inches. There are injectors specially made for the purpose. This chemical should be injected every 18 inches all over the infected ground and 30 to 60 days are required before the fungus is completely killed.

APPLE

APPLE CANKER (Nectria galligena).

A most serious disease which, if neglected, will cause the death of the tree. It can be recognised in the early stages by a sunken
area of bark round a bud or open wound. These areas tend to spread lengthwise along the branch or stem in raised rings, making them look rather like oyster shells.

The tissues around the canker increase and the branch becomes swollen and distorted. The bark is killed and the dead portions discoloured.

The spores of the fungus enter the tree through wounds left when pruning or by cracks due to Scab, or even through the leaf scars when the leaves fall in the autumn.

Some varieties are more susceptible than others, these being: Cox's Orange Pippin, Lord Suffield, Warner's King, James Grieve, and Worcester Pearmain. Bramley's Seedling, Lane's Prince Albert and Newton Wonder are most resistant.

Root stock also has an influence on the degree of resistance of a variety, Worcester Pearmain being most resistant on root stocks Nos. I and V and far less resistant on Nos. IV and VII.

In areas that have been infected for a long time the centres become ridged and cracks appear. In these cracks bright red egg-like bodies are observable — only just visible to the naked eye (but easily seen with a hand lens). By these the disease is increased, the rain washing them on to the other parts of the tree, and even the fruit is attacked and becomes another source of infection.

**Control Measures.** If trees are very badly attacked dig them up and burn them. If a branch is badly attacked, cut back well below the canker. If the canker is on the surface, remove all infected bark and wood. All cut surfaces must be painted with a thick coating of white lead paint. All mum-mified fruits must be burnt.

Routine spraying with Bordeaux mixture helps to control the disease, as it reduces Scab infection on the young twigs and, therefore, less infection via Scab wounds.
Woolly Aphids must also be kept in control, see page 116, as the disease enters through the injuries caused by this pest.

Low-lying, badly drained soil with a heavy sub-soil is conducive to canker and care should be taken not to plant susceptible varieties on such a site. Avoid heavy dressings of nitrogenous manure.

APPLE MILDEW (*Podosphaera leucotricha*).

A common disease attacking young shoots and foliage or flower buds. This fungus can live through the winter in buds which have become infected the previous season, and shows itself when the tree first comes into leaf. Those leaves that are attacked are narrow and curled, and covered with mealy powder—the shoots becoming distorted and stunted in growth. The flower buds attacked produce smaller and paler flowers than usual and these do not set fruit.

The spores from this first attack are blown by the wind and further infection occurs on shoots and leaves and fruit, though the latter is not seriously attacked as a rule.

The most susceptible varieties are: Lane's Prince Albert, Cox's Orange Pippin, Bismarck, Bramley's Seedling; Worcester Permain is one of the more resistant varieties.

**Control Measures.** Spraying and pruning out infected shoots are the two main methods of control. In winter infected shoots are pale grey in colour and should be cut out before the spring. In the spring when the leaves come out, it is possible to cut out those shoots showing mildew.

Mildew may be controlled by application of sulphur in powder form—either flowers of sulphur, a ground sulphur, or in the form of liquid lime-sulphur, or colloidal sulphur.

Some varieties such as Stirling Castle and Lane's Prince Albert are "sulphur-shy" and for these varieties the pruning out of infected shoots should be done as thoroughly as possible, or a soda and soap spray may be used.

BLOSSOM WILT (*Sclerotinia laxa*).

A common disease in the South of England and often occurring in other parts. Chiefly attacks the flowers. Recognised by the wilting of the blossom trusses about a fortnight after they have come into flower. The spurs are killed with their flowers and leaves and sometimes the fungus extends into the branch for a foot or so, following a canker.

Very susceptible varieties are Lord Derby, Cox's Orange Pippin,
James Grieve, Rival, and Ecklinville Seedling. Many others are also attacked. Bramley’s Seedlings are rarely attacked by Blossom Wilt.

**Control Measures.** Winter and summer pruning out of all infected spurs and cankerous wood. Wilting spurs should be removed at once so that the fungus has no chance to spread into the branch. Spraying with tar oil in the winter and lime-sulphur in the spring helps to control this disease.

**APPLE SCAB** (*Venturia inaequalis*).

The most troublesome of all apple diseases. It attacks young shoots making wounds by which canker spores can enter; infects the foliage and, most serious of all, the fruit, making it unsightly and unsaleable when severely attacked. If attacked in the early stages the fruit becomes misshapen and cracked and may often fall early. If infected later they develop normally with large scabby spots on the skin.

The disease is first seen as dark spots; later the spots become
greenish and corky. The spots developing when the apples are in store are nearly round in shape, and are sunken and pitch black.

Cox’s Orange Pippin, Worcester Pearmain and Laxton’s Superb are some of the most susceptible varieties.

King Edward VII is one of the most resistant varieties. Bramley’s Seedling, thought to be resistant, is now considered doubtful, as some serious attacks on this variety have been recorded recently.

Control Measures. It is necessary to cut out all shoots with scab wounds on them as it is in these scabs that the spores are produced and cause new infection in spring. The prunings must be burnt and, if feasible, any old leaves from the infected trees.

It is essential to carry out a spraying programme if this disease is to be satisfactorily controlled. Two applications at least should be given, but four are advisable. Where only two are given these should be B and C.

(A) In the “green bud” stage—when the flower bud is still enclosed by a rosette of leaves.

(B) In the “pink bud” stage—when the petals are clearly showing, but the flower is quite short.

(C) In the petal-fall stage—directly the petals have fallen.

(D) Two or three weeks after.

If pre-blossom spraying were not thorough, or if the season is wet and specially conducive to scab infection, later sprayings may be necessary to control a late infection, storage scab, and infection of leaves and twigs where the fungus lives during the winter.

Usually the infection is not bad in small gardens and in this case it is only necessary to spray in the pink bud and post-blossom stages. The washes used are Bordeaux mixture, lime-sulphur, colloidal sulphur, and colloidal copper. The colloidal mixtures are recommended for the late spraying only as they are more expensive but not most effective, but they do not leave a deposit on the fruit.

Bordeaux mixture is generally safe to use on Bramley’s Seedling, Newton Wonder, Allington Pippin, and Worcester Pearmain, but not on Cox’s Orange Pippin. Beauty of Bath and Lord Derby are also particularly susceptible to copper sprays, so a weak solution of lime-sulphur should be used.

Other varieties such as Lane’s Prince Albert and Stirling Castle are what is known as “sulphur-shy” and suffer from leaf scorch and defoliation if sprayed with sulphur sprays.

Choice of spray is influenced by the variety of the apple and also
THE DISEASES OF FRUIT

if the control of red spider is to be considered—if so, lime-sulphur will help in this case, but not the copper preparation.

The following spray programme is to be recommended:

(1) Green Bud. Lime-sulphur spray 2½% in strength except 1% for Lane’s Prince Albert and not to be used at all for Stirling Castle.

(2) Pink Bud. Lime-sulphur as for Green Bud stage. Lead arsenate at the rate of 1 lb. of lead arsenate paste or ½ lb. powder to 25 gallons of water may be added to the spray in both cases if attack by caterpillar is severe. Nicotine at the rate of 2 fluid ounces per 25 gallons of wash may be added to Pink Bud spray to control Capsid Bug.

(3) Petal Fall. Lime-sulphur 1% and Nicotine at 2 fluid ounces per 25 gallons.

Beauty of Bath, Duchess, Favourite, Lane’s Prince Albert and Stirling Castle should be omitted from this application as they are sulphur-shy and also fairly Scab-resistant.

Charles Ross, Grenadier, Early Victoria, King Edward VII, Lord Derby, Mr. Gladstone, are also generally resistant to Scab and should only be sprayed at this stage to control Red Spider.

(4) Two or three weeks after, repeat as for petal-fall stage, omitting nicotine unless aphid is present, then use at the rate of 1 ounce per 20 gallons.

As mentioned, in small gardens it is usually only necessary to spray at the pink bud and after petal-fall stages.

SOOTY BLOTCH (Glæodes pomigena).

This disease attacks the growing fruit and continues to develop during storage. The fruit attacked looks as if someone with sooty fingers had handled it, leaving smoky, smudgy marks. The marks are about ¼ inch in size, spreading into each other, they sometimes cover a large portion of the fruit with brownish green blotches.

This disease is affected by the weather and is most prevalent in cold wet summers, and the infection is heaviest on the shadiest parts of the tree and on branches in the middle or on the north side of the tree.
Most varieties are susceptible to Sooty Blotch, especially Bramley's Seedling, and sometimes Cox's Orange Pippin is badly attacked.

**Control Measures.** Careful pruning of the trees to prevent overgrowing of branches and to let in light and air. Ordinary spray programme with Bordeaux or lime-sulphur will help to check the disease. If, however, the control is not sufficient, it is necessary to treat the infected fruit before it is stored. This is done by mixing ½ lb. of chloride of lime (bleaching powder) in a gallon of water, stirring well. Next morning pour off the clear liquid, immerse the fruit in this liquid for 1 minute, expose to the air for 10 minutes, then wash under tap water and leave in the air to dry. For large quantities the fruit should be put in a tray and left there throughout the process until the fruit is dry.

**BROWN ROT (Sclerotinia fructigena).**

This disease attacks fruit soon after it has set till it is ripe, and may even continue to develop in the store.

It is recognised by rings of yellowish cushion-like growths. It does not cause the flesh to rot, but the whole fruit gradually becomes mummified. Sometimes the apples fall to the ground where they gradually rot and are eaten by birds and slugs, or they remain on the tree during the winter.

Infection may be started at wounds made in various ways either by the weather, nail bruises, splits due to wet weather, etc., by pests such as wasps, and the larvae (small caterpillar-like insects) of Codling Moth and Apple Sawfly.

Careless handling at the time of picking or storing causes bruises,
and punctures in the skin help to spread the disease. In store sometimes the apples turn quite black—and if kept too moist the fungus appears as a white fluff and spreads the disease to the surrounding fruits.

**Control Measures.** Spraying with fungicides against this disease has not been found to give good results. The following instructions with regard to hygiene and the like should be followed:

1. **Wasps’ nests in the neighbourhood should be destroyed.**

2. **All overwintering sources of infection should be destroyed by early spring.** See that all mummified fruits are removed and destroyed or buried very deeply in the ground, and cut off or burn all infected branches and spurs.

3. **A constant watch should be kept on the crop, and all infected fruits thrown into the alleyways (not under the trees) so that they can be rendered harmless.** At the time of picking rotten fruit should be taken off the trees and it can then be dug into the ground during the winter.

4. **Some method of bird scaring should be adopted.**

5. **Apple Scab, Codling Moth and Sawfly should be controlled by their respective methods.**

6. **Do not store fruit picked without stalks or bruised or injured in any form;** they may be carrying some infection which would spread amongst the other fruit.

7. **Similar methods apply to plum trees.** This is most important, as after a bumper crop plum trees carry lots of mummified fruit.

8. **Do not neglect anything,** and gardeners are asked to help one another as far as possible for the Brown Rot spores can be carried in the air by the wind, and can be spread rapidly from garden to garden.

**PHYSIOLOGICAL DISEASES**

**BITTER PIT.**

The exact cause of this disorder is not known. It may develop whilst the fruit is still on the tree, showing as dark spots underneath the skin. Later, usually in the store, the spots become sunken pits and are also scattered through the flesh.
Bitter Pit is influenced by climatic and cultural conditions which encourage vigorous growth. It is induced by heavy pruning and is found to be most prevalent on young, vigorous trees. Where there are extreme periods of heat and cold, of draught and rainfall during the season, Bitter Pit is noticeably much more prevalent.

Control Measures. Heavy pruning should be avoided and any excess applications of nitrogenous manures, as these are a stimulant to vigorous growth. Do not pick the fruit before it is ripe.

**RUBBERY WOOD.**

A disease known as Rubbery Wood has been noticed on many apple trees, particularly Lord Lambourne, James Grieve, Millers' Seedling and the Dartmouth Crab. The branches become flexible so that they can be bent with ease, hence the term, rubbery wood. The boughs always bend downwards with the slightest crop of fruit and very often the apples produced are very small.

The cause of this disease is not known, but it is probably a virus disease and is infectious. Graft wood should never be taken from a tree showing this trouble.

**WATER CORE. Also called GLASSINESS.**

In the early stages this may be seen only when the apple is cut open and the flesh around the core has a water-soaked appearance. Later on this extends outwards to the surface, appearing as glassy areas on the skin. Water or cell sap collects between the cells of the flesh, giving this watery, glassy effect.

Young trees just coming into bearing are most subject to this disorder especially if given a lot of nitrogenous manure. Again, extremes of much or little rainfall seem to bring on this glassiness, and also a high temperature, the side of the fruit in the shade being less susceptible than that in the sun.

The variety Rival is particularly prone to this disorder.

Control Measures. No really satisfactory method has been found for dealing with water core. Heavy manuring with nitrogenous manures should be avoided unless the first two or three crops are to be sacrificed to build up the framework of the tree.

If the disease is observed when the fruit is on the tree, pick at once and put into store. Often the glassiness will disappear if the store is cool and well ventilated.
CHAT FRUIT.

This disease is sometimes associated with Rubbery Wood, but sometimes the trouble may be on its own. The fruits remain generally about 1.5 inches in diameter, and they ripen and fall early.

The trouble is suspected as being due to virus infection and no cure is at present known.

BLACKBERRY

BLACKBERRY DWARF or REVERSION.

This is suspected to be a virus disease and is serious in cultivated blackberries. The chief symptom is that numerous stunted shoots are produced giving a witches' broom effect. The leaves are often distorted and covered with mosaic mottling. The Cut Leaf and Himalayan Giant seem to be the most susceptible varieties. It has been known to attack the Lowberry, Phenomenal Berry and Youngberry.

Control Measures. Dig up and burn diseased shoots at once as they are useless and a source of infection to other shoots.

CHERRY

BACTERIAL CANKER (Pseudomonas mors-prunorum and P. prunicola).

When twigs and branches "die-back" in cherry trees, the cause may usually be attributed to attacks by the bacteria mentioned above, the former being the most commonly found. The symptoms are very similar to those found on a plum tree.

The attack may be very serious on young trees, the whole stem being girdled by the canker and so destroyed, but in cherries it is separate branches which are usually attacked, and buds and twigs are often killed.

Infection takes place during the autumn, the organism entering the tree by any wound on the stem or branches. It destroys the bark and wood and so upsets the food conductive system of the tree, the leaves of the infected branch being yellow, and unhealthy looking, and often curling upwards. Later they become withered and brown. The cankers are sunken, cracked areas on the bark, from which a great deal of gum exudes.
Amber, Bigarreau, Bigarreau de Schrecken, Bradbourne Black, Emperor Francis, Napoleon and Waterloo are among the more susceptible varieties.

Early Rivers, Frogmore, Grosvenor Wood and Round Heart are some of the most resistant.

**Control Measures.** Any pruning or cutting back of the trees should be done by the end of August or not till the following April, as any wounds or injuries to the tree during the autumn should be avoided as it is then that infection most readily takes place.

Spray with Bordeaux mixture, formula 1 lb. of copper sulphate, 1½ lbs. hydrated lime to 17 gallons of water, just before the blossoms open, and give a further spraying with Bordeaux mixture at petal fall, this time the formula being 1 lb. of copper sulphate to 1½ lbs. of quicklime to 25 gallons of water. Spray thoroughly also just before leaf fall, using a stronger Bordeaux mixture, i.e. 1 lb. of copper sulphate, 1½ lbs. of quicklime to 10 gallons of water.

There is evidence to show that the disease is introduced into orchards on nursery trees, and nurserymen must realise the importance of sending out young trees free from the trouble.

**SILVER LEAF** (*Stereum purpureum*).

This disease attacks both the sweet and acid cherries, Napoleon and Turkey Heart being the most susceptible of the sweet cherries and Morello of the acid cherries.

The cherry is not as badly attacked, however, by this disease as the plum. Full directions for recognising and controlling silver leaf will be found on page 160.

**CHERRY LEAF SCORCH** (*Gnomonia erythrostoma*).

This disease occurs on the leaves of the cherry and nature has cleverly arranged that the fungus attacks the tissue at the base of the leaf stalks which should separate it from the strig at leaf-fall time, thus preventing this happening and so the withered leaves stay on the tree bearing the spores of the fungus which immediately infect the young leaves when they appear in spring.

The “scorch” starts as yellow patches on the leaves, turning brown later; as the leaves of the tree die its vigour is greatly reduced. The fruit is also attacked sometimes, and hard black spots appear in the flesh.

Two very resistant varieties are Napoleon and Turkey Heart. Some of the least resistant are: Early Amber, Frogmore,
Bigarreau and Waterloo. Wild cherry trees are often attacked and serve as a source of infection.

**Control Measures.** Gather all withered leaves from the trees and burn them. This is most necessary when young trees have been attacked, but impracticable on large standard trees, so spray these with Bordeaux mixture 6-6-100* just as the leaves are unfolding and again when the petals have fallen.

Sometimes in addition to the leaf scorch there is intervenal yellowing of the leaves. The cure here is to spray the trees with 4% manganese solution of manganese sulphate in February, or to inject into the trunks of the trees solid manganese sulphate in the form of tablets especially made for the purpose, which can now be purchased from some chemists.

**BLOSSOM WILT (Sclerotinia laxa).**

Both sweet and acid cherries may be seriously damaged by this disease. In the sweet cherry, where the flowers are borne on short spurs along the branch, all the flowers and leaves may die without actually showing canker or die back of the branch. In the Morello cherry, where the flowers grow directly off the slender twigs, the fungus penetrates into these causing them to die back and so the whole twigs are destroyed.

It is the most serious disease of Morello cherries and if the infection is very bad the whole tree looks as if it has been caught in a flame and burned.

The flowers may be infected before they are opened, and wither in the bud. These damaged flower buds are very conspicuous when the trees are in full flower. Infection takes place also when the flower is open and this is followed by a dying-back of the shoots bearing these infected flowers.

**Control Measures.** The chief method of control is to remove all the parts which have been infected as soon as they are apparent. This should be strictly done on a Morello which is usually grown as a bush tree, but the sweet cherries which are so often grown as standards, should be sprayed with Bordeaux mixture 6-6-100,* or lime-sulphur at 1 in 30 to 1 in 50.

The Morello cherry is very susceptible to damage caused by the lime-sulphur, so always use Bordeaux mixture on this variety.

**BROWN ROT (Sclerotinia fructigena and S. laxa).**

The relation of this disease to Blossom Wilt has already been

6-6-100 means 6 lbs. quicklime 6 lbs. copper sulphate to 100 gallons of water.
pointed out in the section on Plum Rot. The same fungus which causes Wilt spreads to the fruit and causes it to rot. In the case of the cherry, S. fructigena also causes considerable damage later in the season, especially if the fruit is cracked and the weather wet. Both these conditions aid easy infection.

**Control Measures.** See instructions for Blossom Wilt, above. Winter spray with tar oil.

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**CURRANTS**

**REVERSION.**

Reversion is classified as a "virus" disease which is caused neither by bacteria nor fungi, and about which little is known as has been pointed out in the section on Plum Rot. The disease can be transmitted when a healthy bush is grafted with a shoot from an infected bush, and also a "mite," *Eriophyes ribis*, which causes Big Bud, carries this disease from bush to bush.

As the name suggests, the bushes attacked seem to revert to a wild state, the leaves becoming smaller and darker green than in
normal bushes, and the fruit-bearing capacity of the bush is impaired.

True Reversion can be seen if leaves growing from the middle portion of a vigorous shoot are examined, and it is found there are less than five side veins coming from the big mid-vein. A normal leaf has five main veins going to each five points. They are seen more easily on the under side of the leaf during the month of June.

It is important to examine leaves from a vigorous shoot, as sometimes lower branches which have been damaged or cut back hard produce leaves with fewer veins. This is known as False Reversion and such bushes later produce normal leaves, whilst those attacked by the true Reversion produce more and more abnormal leaves.

The flowers of a reverted bush are darker in colour.

**Control Measures.** Dig up and burn all bushes showing signs of Reversion in the winter. Never take cuttings from a bush showing any Reversion at all, even though the young shoots are normal.

Keep Big Bud mite controlled by spraying with lime-sulphur, 1 in 20, just before the flowers open. If the attack is only slight 1 in 50 will be strong enough.

**CORAL SPOT (Nectria cinnabarina).**

During the summer the wood of currant bushes may be studded with pinkish spots, hence the name "Coral Spot." These are signs that the bush has been attacked by the fungus *Nectria cinnabarina* which permeates the conductive tissue in the bark and wood, and causes the bush to show signs of wilting and the leaves fall from the branches so infected. The fungus lives in dead wood first of all, usually old pruning stumps, and afterwards spreads to the living branch.

**Control Measures.** Cut out all dead and dying branches, if possible, before the Coral Spots appear, as from these come the spores by which the disease is spread farther.

**LEAF SPOT (Pseudopeziza and Gläsporium ribis).**

Small dark brown irregular shaped spots may be seen on both black and red currant leaves, usually about the middle of June. From these spots small cushions arise, bearing spores which become shining and sticky in wet weather, and these are splashed by the rain or carried by insects to other leaves and so the disease
spreads. Severe leaf fall may occur at the end of June or the beginning of July and this causes the fruit to shrivel before it is ripe, but should this not occur, the early leaf-fall seriously affects the next year’s crop. This stage of the disease is known as Gla\_s\_por\_ium Ribis; a further stage caused by Pseudopeziza Ribis develops in the fallen leaves and bears spores which are dispersed into the air and are a source of infection of the new young leaves in the spring.

Of the black currants, Baldwin, Boskoop Giant, and Seabrook’s Black are the most susceptible varieties and those not so susceptible are Edina, Goliath, September Black, and Victoria.

Of the red currants, Fay’s Prolific and Fertility are very susceptible and may suffer a great loss of vigour owing to early leaf-fall. Earliest of Four Lands and La Constante are two of the least susceptible.

**Control Measures.** The most effective control is to spray with Bordeaux mixture at 8–8–100* in May and June, but as the deposit left on the fruit makes it unsaleable, this is only to be recommended for young stock in nursery beds. Bushes sprayed directly after the fruit is picked will have leaf fall checked and the disease will be prevented from spreading.

In gardens and small plots, the fallen leaves should be collected and burnt. In large plantations the soil should be cultivated so that the old leaves are well buried before the young leaves open the next spring.

Bushes which are lightly manured have shown themselves to be more susceptible to this disease, so a good dressing of manure is recommended to assist resistance.

**CURRANT RUST** (*Cronartium ribicola*).

On the undersides of the currant leaves small yellowish cushions may be seen early in the year. Later, usually after the fruit is picked, the leaves become brown and withered, turning almost black in wet weather, and the under side of the leaf is covered with coarse woolly hairs which are the second type of spore produced from the fungus which attacks, not the currant, but “five needled pines,” the fungus developing on these and producing other spores which again attack the currants. The disease is spread during the summer on the currants by spores from the yellowish cushions, or “rust” spots.

* *8 lbs copper sulphate; 8 lbs. quicklime to 100 gallons water and pro rata.*
THE DISEASES OF FRUIT

Control Measures. Avoid planting currants near Weymouth Pines, and other live-needled pines. Spray with Bordeaux mixture as recommended for Leaf-spot.

EUROPEAN MILDEW (*Microsphera grossulariae*).

This disease has been found on both black and red currants, and in the latter case has been severe enough to cause early leaf-fall, but it is more commonly found on gooseberries. The leaves show white powdery patches.

Control Measures. Full details for the control of this disease are given for Gooseberry Mildew and the same methods are recommended for currants.

AMERICAN MILDEW (*Sphaerotheca mors-uvae*).

Red, white and black currants are attacked by this disease, though it is found to be most destructive on gooseberries.

White powdery patches are seen on the underside of the leaves which are distorted and curl upwards. The mildew patches spread to the fruit, the black spots seen in these patches are the spore-bearing structures of the fungus.

Control Measures. As for American Gooseberry Mildew, page 152.

CLUSTER CUPS (*Puccinia Pringsheimiana*).

These bright red or orange "cups" are tiny round blotches which may be found on the fruit and leaves and sometimes young shoots of currant bushes, but it is not a common disease.

Control Measures. See Cluster Cup Rust of Gooseberries, page 154.

RUNNING OFF.

When the young berries, especially those towards the top of the bunch, fall off at the end of May or the beginning of June, this is called "Running Off." It can be serious enough to cause the loss of half the crop. This falling off of the young berries is due to poor pollination, caused by adverse weather conditions such as frost. If odd bushes among many fruitful bushes show this disorder it is likely they are not the true variety, or "rogues" as they are called, or even reverted specimens.

Control Measures. Plant the bushes in sunny sheltered positions which encourages good pollination. A beehive placed in the vicinity will also help.
AMERICAN GOOSEBERRY MILDEW (*Sphaerotheca morio*).

This disease is the most serious one attacking gooseberries and, as the name suggests, was imported from America and first seen over here at the beginning of the century. It has been known to cause great loss in gooseberry plantations but recently the attacks have not been so severe, owing to the precautionary measures taken to prevent the spreading of the fungus. The disease also attacks currants but is rarely very serious in its effects on these fruits.

The disease is first seen as powdery white patches on the young leaves spreading later to the fruit, these patches producing spores which spread the disease rapidly, whole shoots being stunted and deformed. Later a dark felt layer is seen on the fruits and shoots and in this black dots, by which means the fungus passes the winter, these spore cases bursting in the spring and shooting up the spores to attack the young leaves and shoots. Those branches nearest to the ground often show the disease first in the spring as the spore cases fall to the ground in the autumn as well as some remaining on the twigs.
Control Measures. Attention must be paid to methods of cultivation as this disease is usually found to be worse on bushes grown on moist porous soils, which have been heavily manured.

Give plenty of space for free circulation of air round the bushes. Prune to keep the centres of the bushes open and the shoots evenly spaced. Do not give heavy dressings of nitrogenous manures such as stable manure and pig manure as they encourage soft, sappy growth, which is far more liable to become mildewed. When nitrogenous manures are given they should be applied with basic slag or superphosphate of lime and potash to counteract the tendency to form soft and sappy growth.

Any mildewed shoot tips should be cut out towards the end of August or in September before the black spore cases have fallen to the ground but, if done earlier, late sappy growth may give rise to shoots liable to be attacked by the disease.

The other method of control is by spraying with lime-sulphur, except on sulphur-shy varieties such as Yellow Rough and Leveller. On these a washing soda and soap spray should be used.

Spray with lime-sulphur, 1 gallon in 20 gallons of water, before the bushes flower; again soon after the fruit has set, and again about three weeks after. Colloidal sulphur can be used for the last spraying as there is no deposit left on the fruit.

If the varieties are known to be sulphur-shy, use 1 gallon in 60 gallons of water, or even 1 in 100.

A spray made up of 2 lb. of washing soda and 1 lb. of soft soap to 10 gallons of water may be used on all varieties, but must be used more frequently than lime-sulphur as it is more easily washed off by rain. The first spraying should be after the fruit has set, then at fortnightly intervals. Always spray in dull cloudy weather if possible, as on hot sunny days more damage is likely to be caused.

The varieties known to suffer little or no damage from sulphur sprays are Gunner's Seedling, Howard's Lancer, May Duke, and Whinham's Industry.

EUROPEAN GOOSEBERRY MILDEW (*Microsphaera grossulariae*).

This disease is not nearly so serious as the American Gooseberry Mildew with which it is confused but from which it is really easily distinguishable. It occurs as powdery patches on the upper surfaces of the leaves which are not as white as in the case of
American Gooseberry Mildew and rarely on the under-surface of the leaves and more rarely still on the fruit.

The means of spreading the fungi is by spores from the white patches of mildew and by overwintering in the black spore cases, which fall to the ground and cause infection in the spring.

**Control Measures.** Prune the bushes to let in light and air. Shade and stagnant air are conducive to the disease. If the attack is severe and threatens to cause considerable leaf fall, dust with flowers of sulphur, or spray with lime-sulphur as directed for American Gooseberry Mildew.

**GOOSEBERRY LEAF SPOT** (Pseudopeziza ribis).

The chief damage caused by this disease is the premature leaf fall resulting from an attack, but the fungus has been found on the fruit stalks and the fruits themselves.

First of all dark spots are seen on the leaves, then they turn yellow and the leaves drop off. The vigour of the tree is severely reduced if the attack is heavy.

**Control Measures.** Employ measures similar to those recommended for Black Currant Leaf Spot, page 149.

**CLUSTER CUP RUST** (Puccinia Pringsheimiana).

This fungus chiefly attacks the fruit and may be seen as bright red or orange blotches on the berries. It may also be found on the leaves, and occasionally on the shoots. The cups produce yellow spores which do not infect the gooseberries further, but attack sedges and cause a "rust" on them, which in turn produce more spores which attack the young gooseberry fruit and leaves in the spring.

**Control Measures.** Root up all the sedges near the bushes. Good drainage and clean cultivation should keep them out of the plantation itself.

The bushes may be sprayed with Bordeaux mixture or colloidal copper (Bouisol), a fortnight before the flowers open.

**LOGANBERRY**

**CANE SPOT or ANTHRACNOSE** (Elsinoë veneta).

This disease is caused by the same fungus as that which attacks the raspberry. The symptoms are the same—purple spots with
white centres appearing on stems and leaves and flower stalks. The fruit is small and unevenly developed as in the raspberry. The spots on the canes turn into sunken cankers and some of the buds on these canes do not develop. A number of the flowers do not set fruit and the development of the fruit is poor and so is the plant; the crop is adversely affected. It is perhaps the most serious disease of the loganberry.

Control Measures. By training the young canes above the fruiting-canes risk of infection by the rain splashing spores from the old canes on to the young canes is lessened.

Spray with Bordeaux mixture 2–2–50* before the flowers open and again after the blossoms fall at the end of June. Colloidal copper may be used for the later spray as it leaves no deposit on the fruits, and derris may be added to control the Loganberry Beetle, using ½ lb. derris, ½ pint colloidal copper, ¾ lb. soap and 25 gallons of water.

PEACH AND NECTARINE

PEACH LEAF CURL \textit{(Taphrina deformans)}.

Peach, Nectarine and Almond trees grown in the open are most susceptible to this disease. Those grown under glass are less frequently attacked.

The symptoms are outstanding—the leaves being curled up and turning pinky red in the later stages, and finally falling to the ground and causing defoliation and a severe reduction in vigour. Sometimes new leaves develop towards the end of the season, but the quantity and quality of the fruit are very much affected.

It is thought that the spores of the fungus winter in the bud scales and not in the young shoots, and these spores attack the young leaves directly they open, causing them to become smaller and curled, and generally distorted, being a pale greenish yellow at first, then more swollen and turning a reddish colour. The infection spreads from the leaves to the young shoots, which also become distorted, and the disease may spread to the flowers and fruit.

Control Measures. Cut out infected shoots and remove and burn infected leaves as soon as they are apparent.

To ensure a good control, spray the tree just before the buds

* 2 lbs. copper sulphate, 2 lbs. quicklime per 50 gallons water and pro rata.
begin to swell, towards the end of February, using either 1 pint of lime-sulphur solution in 29 pints of water (1 in 30) or Bordeaux mixture at 4:4:50, which is mixed as follows: 11 gallons of water, 1 lb. quicklime, 1/2 lb. copper sulphate. The Royal Horticultural Society recommends spraying with Burgundy mixture made as follows: 93/4 ounces copper sulphate, 11 ounces sodium carbonate in 3 gallons of water.

If the attack is very severe an autumn application of wash after the leaves have fallen is found to be helpful.

**MILDEW (Sphaerotheca pannosa).**

Powdery patches on the leaves and young shoots are a sign that the tree is suffering from mildew. The growth of the shoot becomes stunted and the leaves narrow and deformed. The white powdery appearance of the infected parts is due to the spores formed by the fungus. These spread the disease to other leaves and shoots, but the fungi live through the winter in the form of mycelium composed of thin, thread-like structures in the younger shoots.

**Control Measures.** Cut out all infected shoots. Spray with lime-sulphur at the rate of 1 in 120 (1 pint of lime-sulphur in 15 gallons of water).

**SHOT-HOLE (Clasterosporium carpophilum).**

The shot-hole effect found on peach leaves first starts as brown spots on the leaves, the centre of which fall out having been killed by the fungus. Not only are the leaves attacked, but the fruits and young twigs may become infected, scabs and gum being produced on them. This disease can cause serious damage in an orchard.

**Control Measures.** Just as the buds begin to swell, spray with Bordeaux mixture, 1 lb. quicklime, 1 lb. copper sulphate to 11 gallons of water, or 1 pint of lime-sulphur in 3 1/2 gallons of water.

Spray again with lime-sulphur at the rate of 1 pint to 6 1/2 gallons when the flower buds show pink, and again after petals have fallen, with 1 pint lime-sulphur in 18 1/2 gallons of water. Only if the attack was severe the previous season are these last two applications necessary.

Occasionally a leaf spot occurs which is followed by "shot-hole" and this is thought to be due to unfavourable soil cultural conditions, and care should be taken to keep the trees growing
healthily by seeing that they have enough water, but are never water-logged, and also by manuring them well.

CHLOROSIS.

This disease is a discoloration of the foliage, the leaves being a pale, yellowish green, caused by a lack of iron in the tree. There may be no iron shortage in the soil, but an excess of other substances which prevents the roots from absorbing the iron.

To find out if the discoloration of the leaves is due to chlorosis, cut off the tip of a leaf on a shoot bearing these pale leaves and bend the shoot over so that the cut surface of the leaf is immersed in a receptacle. This should contain a 0.1% solution of iron citrate. Leave the shoot there for 18 hours, and after that time should the leaf become the usual green colour, it shows that the discoloration is due to lack of iron.

It is important that leaves should be a good green colour, as this shows that the tissues are able to carry out their function of manufacturing the food required by the plant.

Control Measures. Excess of lime in the soil is conducive to chlorosis, so heavy dressings of lime and phosphates should be avoided but dressings of well-rotted farmyard manure, or any organic manures are recommended. A green crop, such as mustard or rape, can be grown and dug in. Fertilisers such as sulphate of ammonia or nitrate of soda may be dug in at the rate of 1 ounce per square yard.

Other methods such as spraying the tree with a weak solution of iron salts or smearing stronger solutions on the bark have been tried, but are not found to be so reliable.

Pills containing exactly the right proportions of iron to correct the deficiency may be pushed into the trunks of trees. Holes are made with brace and bit and the pills are pushed in with a pill pusher. Pills are obtainable from Messrs. Boots, together with instructions as to their use.

SPLIT STONE.

When peaches are cracked towards the stalk end, if the fruit is cut open it is found that the stone is split and the kernel rotting. Sometimes earwigs or other insects have got in, and the brownish substance "frass" is seen.

The splitting may be due to inefficient pollination, but more likely to a deficiency of lime in the soil, so a dressing of lime is to be recommended.
PEAR CANKER (*Nectria galligena*).

Some varieties of pears are most susceptible to this disease as in the case of apples, the same fungus being the cause of the trouble. It is most serious if not controlled. The symptoms are the same as in apple canker, the fungus entering by scab wounds in the same way and producing the same swollen distorted conditions—attacking both twigs and branches, and if left uncontrolled will spread and eventually kill the tree.

In summer white "strings" appear in the canker, giving rise to spores and so spreading the disease, and on the older cankers, dark red egg-like growths are seen which again help to spread the disease. Most susceptible varieties are Fertility and Marie Louise.

**Control Measures.** Cut back any badly infected branch to well below the canker and any wood that is discoloured. Cut out all infected shoots. Burn all prunings and paint all cut surfaces with white lead paint. Grow trees as bushes rather than as standards so that spraying against Scab and the pruning out of diseased portions can be done easily and thoroughly.

PEAR SCAB (*Venturia pirina*).

The fungus causing pear scab is a different species from that causing apple scab, but they are very much alike to look at and in their ways of attacking and spreading over a tree, young shoots, leaves and fruit. The fungus winters in cracks on the shoots and on dead fallen leaves. In spring spores are produced, and the young leaves and flowers become immediately infected and the scabs caused on these in time produce more spores and so further infection is caused.

Some of the most susceptible varieties are: Beurre Bosc, Beurre Clairgeau, Beurre d'Amanlis, Clapp's Favourite, Doyenné du Comice, Marie Louise and Williams, Bon Chrétien. Conference and Dr. Jules Guyot are also susceptible varieties.

**Control Measures.** Prune out all scabbed twigs before the spring and burn them. Rake together all old leaves and burn them. Spray as in the case of apples—at green bud, pink bud, petal-fall, and two or three weeks after.

As a rule Bordeaux mixture is preferred and not lime-sulphur, and can generally be used without harm on pears.

Bordeaux mixture used at the strength of 8–8–100 is made as follows:
THE DISEASES OF FRUIT

8 lbs. copper sulphate.
8 lbs. quicklime to 100 gallons of water, and pro rata.

If this strength causes too much russetting on the fruit, reduce to $\frac{6}{6}-6-100$ or $4-4-100$.

If using lime-sulphur, do so at $2\frac{1}{3}\%$ for pre-blossom spraying but only at $1\%$ post-blossom—but at this dilution it is not as effective as Bordeaux mixture.

STONY PIT or DIMPLED PEAES.
The fruits are curiously distorted and dimpled, they may be covered with deep irregularly shaped pits, at the base of which are quite hard cells. The bases of the pits are usually dark green and the more raised portions paler. The size of the pears is less than normal and the fruit may fall prematurely. The trees become useless and the fruit is unfit for sale or for home consumption. The following varieties are very subject to this trouble: Doyenne du Comice, Pitmaston Duchess and Durondeau, Beurre Bedford and Laxton's Superb.

The trees with this disease are unlikely to recover, and so they should be removed and burned. Graft wood should never be taken from such trees.

PLUM

BACTERIAL CANKER (Pseudomonas mors-prunorum).

This can be a serious disease of plums, causing up to 20% loss of trees in a young orchard.

The symptoms of the disease are stunted shoots, and yellowing leaves which wither later in the season. The disease enters the stem and branches through some wound on the surface, kills the bark and young wood, and produces the effects described above. If the canker girdles the whole branch it dies. The organisms which spread the disease usually die early in the summer and if the branches are not girdled completely, the canker heals, and the branches eventually recover. The disease also attacks the leaves, forming small round spots which turn brown, and the centre falls out causing a "shot-like" effect.

Control Measures. Avoid injuring stems and branches and causing wounds by which the bacteria can enter. As the infection occurs most readily in October, November and December, all

* 6 lbs. copper sulphate; 6 lbs. quicklime.
pruning and cutting out of branches should be done by the end of August or left until the following April.

Spray with a Bordeaux mixture using 1 lb. of copper sulphate, $\frac{1}{2}$ lbs. of quicklime to 25 gallons of water. It is said the inclusion of a little cotton seed oil in the wash diminishes the chance of spray injury. Do this three weeks after petal fall, and two weeks later spray with a colloidal copper preparation, using a strong solution.

The most susceptible varieties are: Victoria, Czar, Giant Prune, Prince of Wales, and Bradley's King Damson.

**BRANCH DIE BACK** (*Diaporthe perniciosa* and *Dermatema prunastri*).

This disease attacks plum and greengage trees which are made unhealthy either by growing on unsuitable soil or having been previously attacked by bacteria. The fungus can be seen in two stages—on dead and dying branches of a tree, or in bacterial cankers—(1) As tiny stiff hairs, and (2) later as tiny button-shaped bodies which are soft and jelly-like in wet weather but hard and leathery in dry weather.

**Control Measures.** The trees should be kept as healthy as it is possible to make them by suitable manuring and cultural operations. All cankered branches should be cut out and burnt.

**SILVER LEAF** (*Stereum purpureum*).

The Ministry of Agriculture found it necessary to issue an order in 1923 compelling people to cut out branches infected by this fungus as the disease was becoming so serious.

It is easily recognised by the silvery appearance of the leaves, due to a layer of air just below the skin. The wood of the infected branch is stained brown, and this symptom distinguishes the disease from a silverying of the leaves due to purely physical conditions.

The varieties Victoria and Czar are most susceptible to the disease, whilst Pershore Yellow Egg is most resistant and shows the highest proportion of recoveries.

**Control Measures.** Affected branches should be cut away only when wilting occurs (as the silvery leaves themselves are not infectious) and before the branch dies as it is then that the fungus comes to the surface and forms purple bracket fungi on the dead wood, which spread the disease to other trees. The wilting branches must be cut out by July 15th according to law.
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Do not prune the trees in autumn, winter or early spring, as the spores can enter through the open surfaces. If, however, it is found necessary to do so during these periods, cover the cuts with white lead paint.

Be sure to cut infected branches well down into the healthy wood as the brown stain shows where the fungus is present. Applications of sulphate of potash at the rate of 1 ounce per square yard and superphosphate at 2 ounces per square yard are found to be helpful in keeping the tree healthy and vigorous and therefore give it a better chance to recover from the attack.

SHOT-HOLE and LEAF SPOT (*Pseudomonas mors-prunorum*).

This has already been mentioned in the note on bacterial canker and though the Leaf Spot is not a serious disease in itself, it must be remembered that it is the same fungus which causes the canker which can girdle the stem and so kill the tree. These "shot-holes" are most noticeable in wet summers as the moisture helps to spread the disease.

**Control Measures.** Spray foliage in spring and summer with Bordeaux mixture 6-6-100*. It will be necessary to spray more frequently during a wet season if the disease is very prevalent.

BLOSSOM WILT (*Sclerotinia laxa*).

The whole blossom on neglected trees may be destroyed by this disease especially if the weather is wet at the time the trees are in flower.

The fungus attacks the young shoots, causing Twig Blight, Wither Tip and Blossom Wilt and also Brown Rot of the fruit, these various names describing the effects the same fungus has on the various parts of the shoot it attacks and it is important to realise these stages are all related in producing the Brown Rot of the fruit.

**Control Measures.** Withered tips, blighted twigs, spurs with cankers on, and mummified fruits should all be removed from the tree and burnt. This will help to prevent further infection.

Spray with Bordeaux mixture 8-8-100 or lime-sulphur 1 in 30 just as the flowers are opening.

BROWN ROT (*Sclerotinia fructigena* and *S. laxa*).

Brown Rot is caused by attacks of one or the other of the fungi named above. Sometimes both are found on the same tree.

* 6 lbs. copper sulphate; 6 lbs. quicklime to 100 gallons of water.
Infection is spread from one plum to another through any puncture caused either by bruising or insects.

*S. fructigena* has been found to be the cause of most Brown Rot in storage, whilst *S. luxa*, as already mentioned, is responsible for Blossom Wilt.

**Control Measures.** Remove all mummified fruits from tree and burn. Take great care in picking the fruit which is to be placed in a cold store. It is a good thing to pick the larger fruit with the stalks on, as the disease can enter through stalk scars.

The spray programme advised under Blossom Wilt will help to control the Brown Rot of the fruit.

**SOOTY BLOTCH** (*Glécodes pomigena*).

During a wet summer an attack of Sooty Blotch can be quite serious. The Blotch caused is similar to that on apples, appearing as circular brownish areas on the skin, especially on those varieties with light skins such as Warwickshire Drooper; and Pershore Egg, Victoria, Pond’s Seedling, Giant Prune and Cambridge Gage are other varieties on which the disease has been found.

**Control Measures.** Avoid planting trees on a heavy, badly drained soil, and planting too thickly. Allow the trees as much light and air as possible. A post-blossom spray of 1% lime-sulphur or colloidal sulphur at ½ lb. to 10 gallons of water will help to check the disease.

**FRUIT GUMMING.**

When fruit is needed for canning or bottling it is a drawback to find the fruit swelling and cracking during the proceedings and exuding a gelatinous gum-like substance. It is present in the fruit before picking and sometimes a few drops appear as the fruit is ripening.

No direct cause which produces this gumming has yet been found. Apparently it is due to some physical disorder.

**Control Measures.** Thorough cultivation of the soil is very important, especially in dry weather, to encourage fruit to develop regularly when growing. On heavy soil, cultivate to encourage drainage and avoid water-logging.

**RASPBERRY**

**BLUE STRIPE WILT.**

This disease derives its name from the blue discoloration of the cane which takes place, usually starting at the base and developing
upwards along one side of the cane, the leaves on the discoloured side withering and dying. When the discoloration encircles the cane all the leaves die.

The first symptoms are seen on the leaves about the end of June. There are yellowish blotches, usually in the strips between the main veins. These strips gradually turn brown, whilst those near the vein remain green, giving the leaf a striped appearance. The lower leaves are affected first. They wither and curl inwards, exposing the white under surface. Then they fall off, often leaving a tuft of healthy leaves at the top, or only one side of the cane may be infected and healthy leaves are left along the side which is free from infection.

No fungus is visible unless the cane is cut through the discoloured portion and examined under a microscope, and then minute black bodies are found which fall to the ground with the dead leaves and canes and attack other canes. As the infection comes mostly from the soil, the roots and underground portions of the stem are usually attacked first.

**Control Measures.** By good cultivation and manuring, improve the health of the canes and encourage them to grow away from the disease. If a shoot is badly infected it should be dug up completely and burnt. Cut out any dead or dying canes, collect old leaves and burn them. Never propagate from an infected shoot, as the fungus may be transferred to a clean plantation by the woody tissue of the cane itself in to the soil about its roots.

**CANE BLIGHT** (*Leptosphaeria Coniothyrium*). This disease can cause serious damage in a raspberry plantation if it is not recognised at an early stage and dealt with. It is identified by the wilting and withering of the leaves; the canes become very brittle and snap off very easily just above soil level, and at the base of these canes there is an area of discoloured bark—this cracks, and shows more or less round black fruiting bodies of the fungus.

**Control Measures.** Cut right back to the base all diseased canes. Breaking out is no use as the infected parts are still left on the shoot, causing further infection. Do not use the same knife for thinning out strong healthy shoots, until it has been well disinfected.

Do not transplant the "spawn" (the young rooted shoots) from a plantation where the disease has been observed, but if this
has to be done, sacrifice the first year's crop by cutting off all the old canes to below the soil level so that the new canes may grow up without a chance of infection from the old.

**SPUR BLIGHT** (*Didymella applanata*).

In this disease the canes do not die but the buds are killed which should have developed and produced fruit, so the crop is curtailed. Dark purplish patches appear on the canes, usually at the bases of the leaves. They may be two to six inches long, and the leaves growing on such canes are often blotched with large spots, dark brown in colour and irregular in shape.

The purplish blotches on the canes gradually lose their colour, becoming a greyish white, full of black dots which contain the spores, which are shot out when moistened by rain or dew and attack the young canes and so the disease is carried on. Wet conditions in spring and crowded plantations encourage the disease.

**Control Measures.** Thin the canes to avoid overcrowding. Cut out and burn all badly infected canes. If these measures do not check the disease, spray with Bordeaux as recommended for Cane Spot.

**CANE SPOT or ANTHRACNOSE** (*Elsinoë veneta*).

At the end of May or the beginning of June, small round spots on the base of the young canes may be seen. As the canes grow, so the spots become larger and more elongated in shape. The centre of the spot turns white with a purple edge; later the spot becomes sunken into small pits or cankers.

Canes may be infected from May to October, but the spots from the later infections do not become sunken pits, but develop into greyish-white and develop small black dots, easily seen with a hand lens. They are the fruiting bodies of the fungus.

The leaf stalks and leaves are also attacked, showing the same purple spots with white centre as are found on the canes. If the attack is severe the edges of the leaves curl downwards and may fall to the ground. The fungus may spread to the fruit and directly affect the quantity and quality of the crop, the fruits attacked being misshapen and one-sided, the druplets on the side attacked remaining small and green.

Blackberries and loganberries are also attacked by the same fungus.

The varieties of raspberry most immune are Bath's Perfection
and Pyne's Royal, those most susceptible being Baumforth Seedling B, Semper Fidelis A, Reader's Perfection, Devon, Red Antwerp C, Lloyd George and Baumforth A.

**Control Measures.** Badly spotted and cankered canes must be cut out and burnt. Then spray with either Bordeaux at 12–12–100 or lime-sulphur 1 in 15 when the buds on the cane are not more than half an inch out. Spray again when the flower buds are just showing white tips, with Bordeaux at 6–6–100 or lime-sulphur 1 in 40.

If propagating has to be done from infected shoots, the same procedure as advised for Cane Blight is recommended. Cut the canes back to below the ground and sacrifice the crop so that the new canes come up clean.

**RASPBERRY MILDEW** (*Sphaerotheca humili*).

Crowded canes and a shady situation encourage mildew. It attacks the leaves, making large white powdery patches. It is seldom serious, but does weaken the plant. When it starts to spread to the fruit it must be dealt with.

**Control Measures.** Dust with a fine sulphur dust. If the disease appears year after year the site where the canes are growing should be changed and a more open and sunny situation found.

**RASPBERRY MOSAIC.**

This disorder is caused by a virus which is characterised by the mottling of the leaves, producing the same effect as mosaic.

There are three types of mottling—one which covers the surface of the leaves, being only slightly sunken—if at all—and having no curling or distortion of the leaves.

Another type shows yellowish patches near the edges of the leaves and between the main veins. These patches are slightly sunken and the edges of the leaves curl downwards.

The third type has sharply defined yellow patches scattered over the leaf surface, these patches being deeply sunken and the whole leaf curled and distorted.

The virus penetrates the whole plant, so spawn taken from an infected stool takes the virus with it and is diseased from the first.

Stools which are infected with mosaic gradually become worse until they are dwarfed and unfruitful and a source of infection to others.
It is believed that the disease may be transmitted from infected to clean stock by the aphis *Amphorophora rubi*.

**Control Measures.** When planting new bushes be sure they are mosaic free—obtained from a reliable nursery which specialises in producing disease-free canes.

If the disease appears amongst bushes already planted, dig up and burn any stools showing bad mosaic. A new plantation should be planted not nearer than 50 feet to the diseased one, which should be dug up and burnt.

**STRAWBERRY**

**RED CORE DISEASE** (*Phytophthora fragariae* (Hickmay)).

This disease is sometimes known as "Lanarkshire Disease", as it first appeared there in 1921 but now it is found in most districts of Scotland and has spread to England as far as Devon and Cornwall.

In May and June patches of small unhealthy plants are seen. The plants may seem to recover during the summer but in the autumn they will be obvious again. The plants in the patches are small, the leaves reddish, and the outside ones may be dead.

If the plants are pulled up the roots will be found to be dead, or nearly so, there will be no fibrous roots at all, and in the centre of the blackened dead roots will be found a red portion from which the name Red Core is derived.

**Control Measures.** Unfortunately no control measures have proved of any use. The only known control is, therefore, to dig up the affected plants and burn them.

Several immune or resistant types have now been raised, the most successful being the Auchincruive* varieties. There is no doubt that the disease is carried about from place to place by infected runners, and it is most important, therefore, to obtain plants from districts where the disease is absent.

**LEAF SPOT** (*Mycosphaerella fragariae*).

Small circular spots appear on the leaves, some distance apart from each other. At first they are red, then grey and then they may be almost white with a dark red edge to them. In very severe attacks the leaves are killed.

**Control Measures.** After picking, set alight to the straw and let it burn through the rows.

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If the disease seems serious in the early part of the season, spray with Colloidal Copper.
Pick off diseased leaves and burn them. Select runners from plants free from leaf spot.

**STRAWBERRY MILDEW (Sphaerotheca humuli).**
Black blotches appear on the upper surfaces of the leaves, the under surface being a greyish colour. The leaves later curl up.
The most susceptible varieties are Sir Joseph Paxton and British Queen. Royal Sovereign seems to be fairly resistant.
**Control Measures.** Dust with a good sulphur dust from the end of April once every ten days until the fruit starts to grow.
After the fruit is picked, spray with lime-sulphur, formula: 1 pint to 100 pints of water.
If straw is used along the rows to keep the berries clean, set light to it after the fruit is picked and so burn off a great number of old leaves.

**YELLOW EDGE.**
This disorder is caused by a virus carried from plant to plant by aphides (green fly). Unfortunately, symptoms do not show at once and so apparently healthy plants may produce diseased runners.
The first symptoms, however, are shown on the younger leaves which are undersized and discoloured. Gradually all the leaves are small and have yellow edges. They curl upwards, giving a cup-shaped effect and the stalks are short and stout.
**Control Measures.** Destroy all the plants in the garden and buy in guaranteed virus-free plants.
Any plants showing Yellow Edge subsequently as a result of yellow edge infection should be dug up and burnt at once.
Give all young plants warm-water treatment (see Chapter XIV, page 209) before planting.
Control aphides by spraying with nicotine and soft soap (for formula, see Chapter XV, page 212). For further details, see PESTS OF FRUIT.

**CRINKLE.**
A similar virus disease to Yellow Edge but, in this case, yellow spots appear all over the leaf and the foliage looks crinkled rather than curled up. In mild cases the tiny yellowish spots will later turn reddish purple. In severe cases the spots are more numerous
and later they will become brown with a yellow margin. The older leaves will be smaller than usual and the younger leaves paler in colour.

**Control Measures.** See **Yellow Edge**.

**GREY MOULD ROT** (*Botrytis cinerea*).

Only serious in wet weather. A grey mould-like fungus appears on the berries and the grey tufts which appear velvety ruin the fruits.

**Control Measures.** See that all fruits rest on the straw and not on the ground.

Let in as much light as possible by holding the leaves together off the ground with a rubber band around them. These should be released after the fruit has been picked.

**STRAWBERRY LEAF BLOTCH** (*Gnomonia sp.*).

This disease was first recorded in 1941. It causes blotches on the leaves brown with a purplish border, and outside this a yellowish zone. On dead leaf stalks another fungal form has been found as Black Spheroids.

Shady moist conditions favour the spread of this disease, and it is never advisable, therefore, to plant strawberries under such conditions. Care should be taken never to propagate infected plants.

**VINE, GRAPE**

**POWDERY MILDEW** (*Uncinula necator*).

One of the commonest diseases of grapes. The leaves, young shoots, flowers and fruit may be attacked both under glass and in the open. White powdery patches appear on the leaves, and these will spread to the fruit, causing it to crack and fall.

**Control Measures.** See that the growths are thinned out well to prevent overcrowding.

Under glass give plenty of good ventilation, plus heat, so as to ensure a buoyant atmosphere.

Paint the vine stems with a mixture of sulphur and soft soap during the winter.

Dust with sulphur dust directly the powdery patches are seen.

**RIPE ROT** (*Glomereilla cingulata*).

Swollen oblong patches appear on the fruit where later little
cushions are produced. From these come a sticky substance. The whole vine may be quickly infected from one or two diseased berries. The infected berries turn purple and become shrunken.

**Control Measures.** Cease syringing the vines directly the trouble is seen.

- Give adequate ventilation. Reduce the moisture.
- Pick off all infected berries and burn them.

**SUN SCALD.**

A trouble merely caused by variation in temperature, thus causing condensation in the house. The berries become covered with moisture and, if the hot sun strikes these drops of water the tissue below becomes scalded and dead discoloured sunken patches appear.

**Control Measures.** Never allow the atmosphere to be too moist.

- Ventilate by day and by night.
- Maintain on a little heat in the pipes to keep the atmosphere buoyant and prevent the temperature from falling too low early in the morning.

**SHANKING.**

A dark spot appears on the stalk of the berry. This spot increases till it encircles the stalk. The berry does not ripen. Black varieties turn red, and white varieties remain green. Both are sour.

**Control Measures.** Give adequate manuring to keep the vines growing. Avoid waterlogging at all costs.

- Do not allow the rods to overcrop or shanking may appear the next season.
- Remove all infected berries and burn them.
- Do not allow overcrowding. On the other hand do not over-prune in summer.

**WALNUT**

**LEAF BLOTCH (Gnomonia leptostyla).**

Blotches appear on the leaves; first yellowish-brown in colour and greyish on the under side. Later these turn dark brown. Similar blotches may also appear on the "shuck" which holds the young nut.
In bad attacks all the leaves may be infected, causing early leaf fall. The vigour of the tree is thus reduced.

**Control Measures.** Collect all fallen leaves and burn immediately.

**BACTERIAL BLIGHT.**

Spots appear on the leaves and blotches on the fruit and young shoots. The spots may join together, forming large withered patches. The small size of each individual spot is the feature which distinguishes this disease from Leaf Blotch.

**Control Measures.** Spray the foliage at intervals during the growing season with Bordeaux mixture. For formula, see page 214.

Cut off all shoots well below the infected part. Sterilise pruning knife by wiping on cloth dipped in formalin.
CHAPTER XI

THE PESTS OF GLASSHOUSE CROPS

Try—
1. The new D.D.T. "Smokes".
2. Azobenzene for red spider.
3. The Chalcid wasp for white fly.
4. Warm-water treatment for mites.
5. D-D for root knot eel worm.

AZALEA

LEAF MINER (Gracillaria azaleella).

When leaf miners attack azaleas, the leaves go brown and look as if they are scorched. Some will fall to the ground. The browning is due to blisters containing the larvae. The young ones make oval burrowings, usually near the mid-rib, the older ones seem to burrow to the tips of the leaves. Young leaves are often distorted and when folded a cocoon may be found within. The maggots will leave their first homes to attack other leaves. Most of the damage is done in the winter from November onwards.

Control Measures. Fumigate the house with calcium cyanide, using ½ ounce per 1,000 cubic feet. (For further information; see Chapter XV).

The temperature of the house should be between 50-70 deg. during the night and the plants should have a complete overnight’s exposure to the gas from this dust. It will be necessary to give a further fumigation 14 days later and yet another 14 days after that in order to be sure of killing the overlapping generations.

In mixed houses where fumigation is not easy to carry out, azalea plants may be dusted with D.D.T. dust as soon as the pest appears and repeat as necessary. D.D.T. smokes also give good results.

WHITE FLY (Trialeurodes vaporariorum).

Few people fail to recognise the white fly pest. Unfortunately, however, they do not "bother" much with it in most cases until its attack has assumed very serious proportions.
In the case of the azalea, the leaves when attacked go pale yellow and greenish flattened scales may be found on them. The white flies, of course, will be found even on the tiny bushes. A sooty fungus may develop and a black felt spread itself over the leaves.

Though the fly itself is well known, the scaley-like nymph is not recognised as a rule. It attaches itself to a leaf and begins feeding immediately. It produces larger scales every time it moults and these increase in thickness each time also. The large scales are oval, tough and covered with wax.

**Control Measures.** It has been found that a small Chalcid wasp (*Encarsia formosa*) destroys white flies by parasitising them. In normal times it is possible to obtain these wasps from the Royal Horticultural Society or from the Cheshunt Research Station. The parasites spread rapidly in a greenhouse, controlling the white flies.

Fumigation with calcium cyanide is a simple method of destroying the adults, but does not, of course, kill the eggs. \( \frac{1}{3} \) ounce of this chemical per 1,000 cubic feet should be sprinkled on the ground in the evening before closing up the greenhouse. The house should be opened very early in the morning, before the rays of the sun reach the glass. In the case of young plants it may be necessary to use \( \frac{1}{2} \) of an ounce of calcium cyanide instead.

D.D.T. smokes give good results; they should be used twice at 14-day intervals. They kill the adults but not the eggs.

**THRIPS.**

For general information on this pest, see page 29.

The thrip that damages azaleas is the *Heliothrips hamorrhoidalis*. The leaves when attacked have pale, yellowish areas produced on them or they may go brownish or bleached looking. If the leaves are turned up, on the under side will be found little black or dark brown specks.

**Control Measures.** See that the plants are supplied with sufficient water. Give special attention to those near the hot-water pipes where the soil dries out quickly.

Naphthalene may be used as a fumigant, broadcast in the greenhouse at the rate of 10 ounces per 1,000 cubic feet of space. It is sometimes difficult to use this fumigant in a mixed house, because the most delicate plants may be injured.

In such a house it is sometimes necessary to use only 5 ounces
of naphthalene per 1,000 cubic feet of space plus \( \frac{1}{2} \) ounce of nicotine. The two fumigants should be sprinkled on the floor late in the afternoon, the greenhouse being closed tight until morning.

D.D.T. "smokes" are, however, the most modern way of controlling this pest.

A THRIP (tremendously enlarged)

French beans and runner beans are common crops of the greenhouse. The principal pests that attack them are:

**WIRE WORMS**, see page 31.

**RED SPIDERS** (*Tetranychus telarius*).

When the foliage is found to be covered with yellow bleached areas, when the leaves go a pale colour and when the plants make little growth, the presence of red spiders may be suspected.

**Control Measures.** Fumigate the greenhouse in the evening, after a good damping over, with flaked naphthalene at the rate of 1 lb. per 30 square feet of house. It is then best to close the house for two nights and a day, except for a short time each morning and evening, so as to allow watering to be done. During the whole period the temperature of the house should be about 70 deg. F.

**BEAN**
It is seldom, however, that an attack of spider warrants such drastic treatment except in the case of cucumbers.

Keeping the plants syringed over regularly with clean water always helps to keep down this pest.

The use of Azobenzene "smokes" is also effective.

CARNATION

CARNATION TORTRIX MOTH (*Tortrix pronubana*).

This pest not only damages carnations but may attack other flowering plants in the greenhouse as well. The attack will be noticed by leaves being spun together at the tips of the shoots and by other rolled leaves. As a rule the caterpillars concentrate on the growing points of the plants, and thus not only damage the shoots but check growth by reducing the leaf surface. The caterpillars may penetrate the flower buds and eat the interior.

They are pale yellowish-green in colour, having a dark brown or black head. They often suspend themselves by long silken threads when disturbed. When fully grown they are ½ inch in length and olive green in colour, having a yellowish brown head with darker markings. There are usually two generations in the greenhouse during the year.

Control Measures. The most satisfactory way is to hand pick all the caterpillars and larvae, especially those in the spun-up leaves.

Spraying with nicotine and soft soap has proved successful if carried out two or three times during the season.

Spraying with a D.D.T. wash gives good control.

RED SPIDER (*Tetranychus telarius*).

The leaves of the carnation lose their lovely bluey-green colour and go pale yellow and brown. They are usually covered, too, with a little white or grey dust. The plants look sickly and if leaves are examined the mites will be found on the underneath side, of a straw-coloured or greenish appearance.

Control Measures. The most satisfactory method of control is to use a lamp that will vaporise naphthalene rapidly. A good dose consists of 10 ounces of naphthalene per 1,000 cubic feet. The temperature, however, must be kept above 70 deg. F. throughout the night and the house must be really humid. Where this is impossible, the dose should be reduced to 5 ounces per 1,000 cubic feet.
There are special naphthalene fumigating lamps on the market, but it is possible to place the naphthalene on an enamel plate held over an ordinary paraffin lamp by some method.

Azobenzene "smokes" give very good results in controlling the pest.

**APHIDES** (*Myzus persicae*).

Green flies will attack carnations and as a result the leaves appear mottled green and yellow.

**Control Measures.** Plants should be sprayed immediately with a solution consisting of \( \frac{1}{8} \) ounce nicotine in a 2½ gallon can of water, plus \( \frac{1}{3} \) lb. soft soap, or a little spreader. The plants should be given a good drenching.

Another method is to fumigate the house with nicotine and to do this it should be mixed with an equal quantity of methylated spirit. \( \frac{1}{8} \) ounce of the mixture is sufficient for 1,000 cubic feet of glasshouse space.

Calcium cyanide also controls aphides, \( \frac{1}{8} \) ounce being sufficient for 1,000 cubic feet. This should be sprinkled along the path of the house, making certain beforehand that all the leaves are quite dry. The house should be kept at a temperature of 60 deg. F. during the night. If there should be any very tender plants in the house, the quantity of calcium cyanide should be reduced to \( \frac{1}{16} \) ounce per 1,000 cubic feet.

**THRIPS** (*Thrips tabaci*).

Thrips produce little black specks all over the foliage. They prevent the formation of new green growth and the leaves seem to turn a palish yellow colour. When the flowers unfold, the petals will be found to be discoloured, bleached or speckled. If the stems of a plant are jarred quickly over a clean white handkerchief, little orange or black insects will be seen on the linen.

**Control Measures.** Spray the plants regularly with clean water with plenty of force so as to wash the insects off from the under sides of the leaves. By repeating such treatment regularly, most of the young ones will be eliminated.

Fumigate the house with naphthalene (for further details; see **THRIPS ON AZALEAS**, page 172).

Spray the plants with nicotine and soft soap or, instead of soft soap, use a wetting agent such as Shellestol. Use the formula advised in Chapter XV, page 212.

Spray with a 5% D.D.T. wash or use the D.D.T. "smokes."
ROOT MAGGOT (*Psila nigricornis*).

Small white maggots feed on the root tissue and tunnel into the root stock. The result is, few side shoots develop and the vigour of the plants is greatly reduced.

**Control Measures.** Dust with whizzed naphthalene along the rows of chrysanthemums, hoeing this lightly into the soil.

Water attacked plants with mercuric chloride, formula: 1 ounce to 10 gallons of water. Mercuric chloride is poisonous and corrosive, so use with care.

CATERPILLARS.

Various caterpillars attack chrysanthemums, including those of the Angle Shades Moth (*Phlogophora meticulosa*), Gothic Moth (*Phalana typica*), Cabbage Moth (*Mamestra brassicae*), and Turnip Moth (*Agrotis segetum*).

The caterpillars of the angle shades moth when fully grown are two inches in length, greenish or brownish in colour, dotted with tiny white dots. It is particularly fond of white blooms and damages yellow flowers also. It seldom attacks the mauves and bronzes. The caterpillar also eats the young chrysanthemum plants and the leaves of the older plants.

The caterpillars of the gothic moth are greenish-grey or brownish-grey in colour and when “grown up” they are 1½ inches long. The cabbage moth caterpillars are greenish or brownish dotted with greyish-white, while the caterpillars of the turnip moth feed in the surface of the soil where they eat the roots ravenously and sever plants near the soil level.

**Control Measures.** Kill the turnip moth caterpillars with the bran and Paris Green bait described in Chapter XV, page 216.

Hand pick the other caterpillars or spray the plants regularly with good liquid derris. The plants should be given a thorough soaking, another spraying being given ten days later.

Dusting with 5% D.D.T. dust gives good control.

LEAF MINER (*Phytomyza atricornis*).

The mining and tunnelling done in the leaves of chrysanthemums by this little pest is very common indeed. The burrowings may be seen as yellow, white or brownish markings, and these may cross and re-cross. Badly attacked leaves often wither and die and when all the leaves of a plant are infected it may die.
The larvae that do this work are about $\frac{1}{2}$ inch long when fully grown, greenish-white, legless and pointed towards the head.

Control Measures. The plants should be sprayed with nicotine and soft soap (for formula, see Chapter XV, page 212) immediately the pest is seen. When such sprayings are persisted in, say once a fortnight, there is no difficulty in eradicating this pest.

Dusting with 5% D.D.T. dust at 10-day intervals not only prevents but kills.

MIDGE (Diarthronomyia chrysanthemi).

Not a common pest in this country, though very common in America. Because, however, it is so serious, it is one of the notifiable pests under the Ministry of Agriculture's Order. The midges produce galls on the leaves, stems and bracts. These are conical, $\frac{1}{4}$ inch long, and stand out plainly from the leaf surface. The larvae feed inside the galls.

Control Measures. Spray with nicotine and soft soap (see Chapter XV, page 212) when the midges are emerging from the galls. Spray again a week later and again a week after that.

Dust or spray the adult flies with D.D.T. to prevent egg-laying. This should be done to propagating stools and cuttings, and again in the autumn when the plants are brought in.

Notify the Ministry of Agriculture immediately the presence of this pest is suspected.

CAPSID BUGS (Lygus pratensis and Lygus pabulinus).

Lygus pratensis, commonly called the Bishop Bug or Fly or Tarnished Plant Bug, may cause very serious injury to chrysanthemums. It is a pest which feeds on the tips of the shoots, causing them to become blind, or stunted and twisted. The flowers produced will be small and imperfect. The stems may become disfigured with brown galls. The leaves will become puckered and imperfectly shaped.

The bug is $\frac{1}{4}$ inch long, being greyish-green or yellowish-green in colour, mottled with reddish-brown.

In their young stage they are very active, running about all over the plants. First of all they are wingless, and as they pass through five stages the wings finally develop. They are fully grown from June onwards.

The common green capsid (Lygus pabulinus) will be found described in Chapter IX, page 121, for it normally attacks black currants.
Control Measures. Spray regularly with nicotine and soft soap, giving the plants a thorough drenching. Direct the fluid into the "hearts" of the plants and see that both the upper and lower sides of the leaves are covered. Where it is impossible to use a nicotine wash, a nicotine dust may be used instead.

D.D.T. either as a dust or spray is effective against Capsid, and is as good as nicotine. The D.D.T. "smokes" also give good results.

APHIDES.

The main aphis that attacks chrysanthemums is known as the black fly (Macrosiphoniella sanborni). The insects are shining black or blackish-red and they attack the shoots, stems and flowers causing much damage and distortion.

Leaf-curling plum aphis and other aphis may infect chrysanthemums.

Control Measures. Spray with nicotine and soft soap (usual formula), giving the plants a thorough soaking. Spraying with a good liquid derris is also effective.

If desired, fumigation may be done with equal quantities of methylated spirit and nicotine, mixed together and used at the rate of \( \frac{1}{2} \) ounce of the mixture to 1,000 cubic feet; vapourise this over a lamp.

Other pests that may attack chrysanthemums are: Leather Jackets (see Chapter III, page 24), Cutworms (see Chapter III, page 29), Frog Hoppers (see Chapter VII, page 78), Eelworms (see Chapter III, page 22), and Earwigs (see Chapter III, page 21).

CINERARIA

LEAF MINER (Phytomyza atricornis):

See Chrysanthemum, page 176.

CUCUMBER

MILLIPEDES (for general remarks, see Chapter III, page 25).


Under glasshouse conditions nicotine fumigation does help to control millipedes. It is a good plan also to soak infested ground
with a solution of nicotine in water; formula: 1 fluid ounce of nicotine to 20 gallons of water.

Human beings may be poisoned by nicotine, so beware!

Another method is to sprinkle whizzed naphthalene over the ground at 4 ounces to the square yard in the case of light land, and 8 ounces to the square yard in the case of heavy land, and well water the naphthalene in.

**FUNGUS GNATS.**

These gnats not only attack cucumbers but mushrooms as well. White, legless maggots attack the roots of the plants, causing the plant to flag. They are usually ½ inch long when fully grown.

**Control Measures.** It is seldom that these maggots attack cucumbers unless the beds have become dry. If an attack is seen, a really good watering should be given. Where cucumbers are growing in pots, the maggots can be eliminated if the pots are stood in water for 8 hours.

Dust the beds with D.D.T. at 5% strength.

*Other pests* that may attack cucumbers are Woodlice (see page 32), Thrips (see page 29, and Bean, Red Spider, see page 173).

**CYCLAMEN**

**VINE WEEVIL** (*Otiorrhynchus sulcatus*).

The grubs of this weevil attack cyclamen and other pot plants such as primulas, geraniums and ferns. The grubs feed on the roots of the plants, eating into the corms and crowns. The plants droop and finally die. The larvae are white, wrinkled and legless, and usually lie in a semi-curled position. They have brown heads and strong biting jaws.

The weevil of which this is the larva is dull black in colour and ½ inch long.

**Control Measures.** The plants should be repotted in fresh soil after washing the roots. Dry arsenate of lead (very poisonous), say 10–12 ounces per bushel of soil, may be mixed with the potting compost.

**MEALY BUG** (*Pseudococcus citri*).

This mealy bug attacks all kinds of ferns including the asparagus
species. It does much harm also to palms and gardenias. The pest is covered with a white mealy wax and measures $\frac{1}{8}$ inch in length. It may lay several hundreds of eggs which are white and woolly. The greatest congregations are found at the bases of the leaves and at the crutches of the stems and stalks. It is a pest that may occur all the year round.

**Control Measures.** D.D.T. is a good control and should be applied as a spray as it leaves less deposit than a dust.

It may be necessary to spray 10 days later with a similar wash. If sprays are carried out in this way as a matter of routine, the pest can easily be kept under.

**THRIPS.**

Bleached areas will be found on the fronds. These are usually speckled with black. The insects may be yellowish or nearly black, and are narrow and tiny.

**Control Measures.** For control see Bean, page 173

**FERN MITE (Tarsenemus tepidariorum).**

This mite causes serious damage to the fern *Asplenium bulbiferum*. It pierces the tissue, sucking the plant sap, causing minute brown areas on the leaves and ruining the badly attacked fronds. Distortion and malformation is also common after a severe attack, plus swellings and galls in the tips. Large quantities of mites may gather together in the uncurled fronds and within the tips. They will also be found in the scales at the base of the plant. They are yellowish-brown in colour but when fully fed appear darker. Throughout the summer they are very numerous.

**Control Measures.** Fumigate with flaked naphthalene as advised for red spider. See Carnation, page 174.

Sterilise young plants by immersing them in water at a temperature of 110 deg. F. for 20 minutes and pot up in sterilised soil, see Chapter XIV.

**EEL WORM.**

When ferns are attacked by eel worm, black areas will be seen in the fronds or sharply defined brownish spots. Not only are
ferns attacked, but begonias, salvias, coleus, gloxinias and orchids also.

The eel worms are minute and live in the plant tissue. They are similar to those of the chrysanthemum eel worm.

Spray the ferns regularly with nicotine and soft soap.

Immerse young ferns in water at a temperature of exactly 110 deg. F. for 20 minutes, re-potting afterwards in a sterilised compost.

**GERANIUM**

**APHIS ( Macrosiphum solani ).**

This aphis or green fly not only attacks geraniums but arums, tomatoes, carnations, calceolarias, etc., as well. In the winter it will injure lettuce. The aphis is green, or yellowish-green.

**Control Measures.** Spray with nicotine and soft soap (usual formula) or spray with liquid derris. Fumigation, if desired, may be done with calcium cyanide.

**LEAF HOPPER ( Erythronoeura pallidifrons ).**

The leaf hopper will attack the leaves, producing bleached areas. The insects are very active indeed, as their name suggests. They are about ½ inch in length, being pale yellow, almost white in colour. In addition to feeding on geraniums they will attack primulas, salvias, calceolarias, fuschias, verbenas, etc.

**Control Measures.** Spray with nicotine and soft soap (usual formula) or dust with nicotine dust.

Fumigation may be done with nicotine at the rate of ¼ ounce per 1,000 cubic feet. Calcium cyanide may be used instead at ½ ounce per 1,000 cubic feet. Care has to be taken in the latter case in mixed houses as damage may be done to the more delicate plants.

Spraying with D.D.T. has proved effective, as also have the D.D.T. "smokes."

**LETTUCE**

**ROOT MAGGOT.**

For details see Chrysanthemum, page 176.

The plants will be found wilted, and when pulled up small white grubs will be found at the roots.

**Control Measures.** As for Chrysanthemum (see page 176).
SYMPHYLIDS (Scutigerella immaculata).

This pest is sometimes called a glasshouse centipede or white insect. Not only does it attack lettuces, but tomatoes, beans and cucumbers also. Lettuces are usually attacked in November when the trouble continues until March.

The roots are bitten off or are damaged by holes being made in them, the pests may gnaw into the plant at the surface of the soil, corky growths may develop which give a gnarled appearance. The lettuces may die and at any rate make little growth. As the result of an attack, root rot fungi usually enter the wounds. The damage will never be found evenly distributed throughout the greenhouse. The patches will appear near the hot-water pipes, near the walls, and around the paths.

The Symphyllids measure $\frac{1}{4}$ inch in length, being white and slender. They are very quick moving and usually disappear as soon as the ground is moved. They live in the soil all the time. The trouble is usually worse when the organic content of soil is high.

**Control Measures.** The soil should be sterilised if possible, either by steam or heat.

If this is impossible, a good watering may be given instead with cresylic acid at the strength of 2 pints to 10 gallons of water. This is sufficient for soaking 2$\frac{3}{4}$ square yards of greenhouse soil. Having soaked the surface with this chemical, the top 2 inches should then be dug in 1 ft. down, so as to cause the acid to volatilise and fumigate the soil.

If these pests are not noticed until after plants have been put out it is possible to water with an emulsion consisting of equal parts of sulphonated castor oil and carbon bisulphide. Two pints of this should be dissolved in 30 gallons of water, $\frac{1}{3}$ pint of the diluted insecticide being used per plant. A hole should be made 2 inches away from the plant with a trowel or crowbar, and the liquid poured in. The symphyllids which are feeding at the roots will thus be destroyed.

Yet another method is to water the ground with a solution of mercuric chloride, formula: 1 ounce of mercuric chloride to 10 gallons of water.

Carbon bisulphide is inflammable and mercuric chloride is corrosive and poisonous.

APHIDES (Macrosiphum solani).

When the plants are found not to be hearting up, and are
THE PESTS OF GLASSHOUSE CROPS

growing loose and open, aphids must be suspected. By careful examination they will be found somewhere on the under surface of the leaves.

Control Measures. As for Geranium (see page 181).

ROOT KNOT EEL WORM (Heterodera marioni).

Not only attacks lettuces but is a very bad pest also of tomatoes, cucumbers and beans. When the roots are infested with this pest they become swollen and covered with galls. These galls may be as small as a bead or as large as a walnut. Sometimes they grow together and the whole root system is distorted, having few fibrous roots. It is interesting that on tomatoes the galls are compact and hard while on cucumbers they are open and spongy.

When these eel worms attack lettuces the plants immediately start to wilt and on being pulled up the galls, or cysts, will be found on the roots. The eel worms are minute and transparent. They are usually at their worst when the soil is light and warm.

Control Measures. All soil known to be infected with this eel worm should be sterilised before being used. Common weeds should be kept down at all costs as the eel worms can live on these. All plants affected by this pest should be burnt, care being taken to dig up all the galled tissue below ground.

It is difficult to destroy this eel worm with chemicals, perhaps the most satisfactory method being to dig in calcium cyanamide at the rate of 1 lb. per 5 square yards to a depth of 1 foot in the spring. The new D-D soil fumigant is also very effective. For details see Chapter III.

Other pests that may attack lettuces are Wire Worms (see Chapter III, page 31).

MELON

APHIDES.

When plants are attacked the foliage goes yellowish and the plants look "poorly." If they are examined the aphides will be found both on the shoots and leaves.

Control Measures. As for Carnation (see page 175).

THRIPS.

The leaves look as if small areas have been bleached. Tiny yellowish elongated insects will be found under the leaves where a black speckly appearance will be evident also.

Control Measures. As for Carnation (see page 175).
LEAF HOPPERS.
Parts of the leaves will appear bleached and on the under sides will appear the pale yellow pests, plus some white cast skins. These insects are very active.

Control Measures. As for GERANIUM (see page 181).
Spraying with D.D.T. is effective.

WHITE FLY.
As for Azalea (see page 171).

WOODLICE.
See Chapter III. page 32.

MUSHROOM

FUNGUS GNATS.
See CUCUMBER (page 179).

Control Measures. 5% D.D.T. dust should be sprinkled on the beds before spawning at 1 oz. per square yard, and again after the casing soil is in place.

MITES.
These may occur in large numbers before the mushrooms appear. They often, in fact, prevent the mushrooms appearing. When they attack the formed edible fungi they produce deep cavities, both in the stems and caps. If these are examined under a powerful magnifying glass they will be seen to be greyish-white. They are introduced into the house with the horse manure.

Control Measures. Use mortopal at a dilution of 4 ounces to 10 gallons of water. Apply liberally to the caking soil every other day for a week. Apply before the first flushes appear.

SPRING TAILS.
These not only attack mushrooms but many seedlings in greenhouses as well. They often attack orchids also. In the case of mushrooms they gnaw the caps, stems and gills, producing large holes. They are commonly known as brown fleas.

They are never larger than ¼ inch in length, being dark brown
or black and wingless. Sometimes green forms are found. They prefer moist conditions and seem to do the greatest amount of damage in the autumn and spring.

Control Measures. Spray the beds with a nicotine spray; formula: \( \frac{1}{4} \) ounce nicotine to \( 2\frac{1}{2} \) gallons of water. Give a thorough soaking.

It is possible to fumigate also with nicotine; but this has to be done with great care as the forming mushrooms may be damaged more by the nicotine than by the pest itself.

ROSE

APHIDES \((Macrosiphum rosæ)\).

Numbers of reddish or greenish aphides may be found collecting on the shoots, leaves and flower buds of roses. The colonies increase rapidly and will soon smother the plants.

Control Measures. See CARNATION, page 175.

LEAF HOPPERS.

The leaves will be bleached in parts, typical insects being found underneath.

For full details see GERANIUM, page 181.

SCALES \((Aulacaspis rosæ)\).

This is commonly known under glass as the scurfy scale. It is yellowish and somewhat opaque and may measure \( \frac{1}{8} \) inch across. Sometimes it looks more white than opaque.

Control Measures. The leaves should be washed with soap and water first to remove the scales, then the plants should be sprayed with nicotine (usual formula).

SWEET PEA

THRIPS.

When sweet peas are attacked by thrips the leaves assume a yellowish tinge and appear bleached in parts. The typical tiny elongated blackish insects will be found on the under sides of the leaves. The flowers, too, may be full of little thrips which will be no longer than \( \frac{1}{16} \) inch long.

Control Measures. See CARNATION, page 175.
APHIDES.

Aphides or green fly attacking sweet peas, stunt the shoots, causing them to be curled and malformed. The leaves will go yellow and may be slightly curled also. Aphides will be found on the under surface of the foliage.

**Control Measures.** See Carnation, page 175.

SYMPHYLIDS.

The plants show definite signs of wilting. They turn a sickly yellow hue also. If the roots are examined, they will be found to be eaten away and there may be a certain amount of gnawing towards the surface.

**Control Measures.** See Lettuce, page 182.

TOMATO

LEAF HOPPERS.

Bleached, uneven patches appear on the leaves giving them a mottled appearance. When examined closely, the typical hopping yellow insects will be found on the backs of the leaves.

**Control Measures.** See Geranium, page 181.

THRIPS.

As usual with a thrip attack, the leaves have a mottled appearance and in bad cases may be bleached or look yellow. Blackish or orange insects will be found on the backs of the leaves.

**Control Measures.** See Carnation, page 175.

RED SPIDER.

In bad cases the leaves turn yellow. When they are first attacked, bleached spots appear, giving the appearance of mottling.

**Control Measures.** See Carnation, page 174.

SYMPHYLIDS.

When attacked by these pests, the plants wilt, and when dug up the little white insects will be found at the roots.

**Control Measures.** See Lettuce, page 182.

SPRING TAILS.

As in the case of the symphyllids, the plants wilt badly. When
the roots are examined, purple insects or whitish pests will be
found at the roots. They usually hop.

Control Measures. See Mushroom, page 185.

ROOT KNOT EELWORM.

When attacked no growth is made, the plants wilt. When dug
up, hard and woody galls will be found on the roots.

Control Measures. See Cucumber, page 46, and Chapters
III and XIV, pages 22 and 209.

POTATO EELWORM (*Heterodera schachtii*).

No growth is made by the plants but wilting usually occurs
during the day only, as if the plants were suffering from drought.
When dug up, little white knobs or cysts will be found on the
roots.

For further details, see Chapter III, Potato, page 22.

Control Measures. The only satisfactory method of control
is to sterilise the soil by heat or steam. Attacked plants should be
dug up carefully and burnt.

TOMATO MOTH (*Poria oleracea*).

The caterpillars usually feed on the under sides of the leaves
when young and after this they eat the whole of the leaf. They
do the main part of their damage at night time, and usually
remain hidden during the day. When disturbed they curl up and
drop to the ground. They are usually greenish in colour but they
may be reddish-brown, greenish-brown or pale yellow. When
fully grown they are usually 1½ inches long.

Control Measures. 5% D.D.T. dusts should be applied
regularly from the propagating stage onwards whenever the pest
is visible. As an alternative to dusting a 0·02% D.D.T. emulsion
spray is useful. This control will also be effective against Red
Spider in the greenhouse.

When the fruits start to form it is dangerous to use an arsenical
spray and they can then be killed with a strong solution of liquid
derris, like I.T.P. Give the plants a good soaking, taking care
to spray the ground as well, for then if any caterpillars should have
dropped to the ground during spraying, they will be killed there.

WHITE FLY (*Trialeurodes vaporariorum*).

The small white flies will be seen on the plants and underneath
the leaves will be found yellowish or whitish scales. The leaves will have a mottled bleached appearance.

**Control Measures.** See Azalea, page 171.

**THRIPS** (*Thrips tabaci*).

See Bean, page 172.

*Other pests* that may attack tomatoes are: Leather Jackets, Wire Worms and Woodlice. For details see Chapter III, pages 31, 32 and 33.

**VINE**

**MEALY BUGS** (*Pseudococcus spp.*).

The mealy bugs have a whitish cotton-woolly appearance and produce mealy egg sacks which are similarly white. These may be found in abundance on the bark, on the leaves and even on the fruit itself. The pest seems to prefer the bases of leaves.

**Control Measures.** Scrape the rods in the winter to remove all fibrous bark and then wash down with a 10% solution of a good tar distillate wash. Spray the rods when growth commences in the spring with nicotine and soft soap (for formula, see Chapter XV, page 212).

Fumigate the house with calcium cyanide at the rate of ½ ounce per 1,000 cubic feet. Do not do this during blossoming or stone development, but it is quite safe to carry out this treatment any other time. Sprinkle the powder down the path in the evening before shutting up the house. Then open up very early in the morning before the sun's rays strike it.

Spraying with a good D.D.T. emulsion has given satisfactory results.

**THRIPS** (*Thrips tabaci*).

The under sides of the leaves will be found to be speckled with black. The upper surfaces will be bleached and have a mottled appearance, though in bad cases the whole of the leaf will turn yellow. Minute elongated black or yellow insects will be found on the under sides of leaves.

**Control Measures.** See Azalea, page 171.

**SCALE INSECTS** (*Lecanium persicae)*.

A pest of peaches and nectarines as well as vines. The scales
may be \( \frac{1}{2} \) inch in length and \( \frac{1}{4} \) inch in width, either yellowish-brown or yellowish-green in colour.

**Control Measures.** See *Mealy Bugs* on previous page.

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**“AZE-BENZENE AND D.D.T.”**

N.B.—Azobenzene and D.D.T. “smokes” will control many glass-house pests. The chemical is packed in aluminium canisters, which are ignited by means of a fuse, and the vapour disperses throughout the house. The D.D.T. smokes will control white fly and caterpillar on tomatoes and many other plants (but not cucumbers and melons). It also controls thrips, capsids, leaf hoppers, leaf miners, chrysanthemum midge, mushroom fly and house flies.

The Azobenzene “smoke” is for red spider on tomatoes, cucumbers, grapes, carnations and ferns. It will kill 100% of the eggs and 90% of the spiders. Do not use on schizanthus, sweet pea or zinnia. Azobenzene is harmless but it is not advisable to breathe the fumes.
CHAPTER XII

THE DISEASES OF GLASSHOUSE CROPS

Note that:—
1. Deep planting causes carnation root rot.
2. A stuffy atmosphere encourages mildew.
3. Only healthy plants should be propagated from.
4. Cleanliness helps a lot.
5. Overcrowding should be avoided.

There are a very large number of diseases that attack glasshouse crops, but only the most important ones will be found in this chapter.

Naturally, most plants can be grown under glass, but in this chapter only those plants that are normally grown under glass in Great Britain are dealt with. For details, for instance, of potato diseases the reader should look in Chapter VI, which deals with the diseases of vegetables.

CARNATION

DIE BACK (Fusarium sp.).

If flowers are cut badly the remaining stems do not heal properly but die from the cut end downwards. They first go yellowish-green, then bright yellow, and finally die.

Control Measures. As high temperatures seem to favour this disease, more ventilation should be given and less heat. Rapid, soft growth should be avoided. Overcrowding always encourages this trouble.

Cuts should always be made with the sharp blade of a knife, cleanly. Any overhead syringing to be done should take place in the morning. Thus the foliage has time to dry before the evening.

Diseased portions should be cut away and burnt.

LEAF MOULD (Heterosporium echinulatum).

Pale grey spots, $\frac{1}{4}$ inch in diameter, will be found on the leaves.
They turn a light brown colour later. On these spots will grow a dense mass of fungus growth which may be covered with tiny little olive-coloured spores.

**Control Measures.** Dust regularly with a proprietary sulphur dust, or spray with liver of sulphur (for formula see Chapter XV, page 214), or colloidal sulphur.

Ventilate the house efficiently and water more carefully.

**LEAF SPOT** (*Macrosporium dianthi*).

Elongated or circular spots appear on the leaves. First of all they are pale grey and later are covered by a black tufty growth. The leaves may die, and in bad cases, the stems too.

**Control Measures.** Spray with Bordeaux mixture (for formula, see Chapter XV, page 214), or spray with colloidal copper.

Remove all diseased leaves and burn them. Avoid excess of moisture in the house and increase the temperature somewhat.

**LEAF SPOT** (*Septoria dianthi*).

With this disease light brown patches appear on the stems and leaves. The attack starts at the base and usually causes the leaves to bend downwards. Sometimes the leaves curve longitudinally and on the whole are much shorter. When the stems are attacked the trouble is usually seen on the inter-nodes. As the leaf dies, tiny black spots occur on the surface. These are the fruiting bodies.

**Control Measures.** See **Leaf Mould** above.

**POWDERY MILDEW** (*Oidium sp.*).

Powdery patches can be seen not only on the leaves but round about the bases of the flowers and on the calyx.

**Control Measures.** Grow varieties which are not particularly susceptible. Three known to be bad are: Bridesmaid, British Triumph and Allington.

Dust with a good sulphur dust in the early stages or spray with liver of sulphur (usual formula, see page 214). Colloidal sulphur (Sulcol) has given good control also.

Ensure efficient ventilation and keep the atmosphere of the house buoyant.

**ROOT ROT** (*Rhizoctonia solani*).

Attacks the lower parts of carnations and the roots. A brown rot develops.
The entire plant will be affected though in rare cases only one or two shoots will show the typical yellowing. In bad attacks the plant may wilt during the day.

**Control Measures.** Avoid high temperatures and too much water. Never feed excessively and do not plant deeply.

Sterilise the soil in which plants are grown by baking or steaming (see Chapter XIV, pages 205–208), or soak thoroughly with a 2% solution of formaldehyde. Sterilise the pots in which carnations are grown with boiling water or by steeping in 2% formaldehyde solution.

When the disease occurs it is possible to check the trouble by watering with a solution of Cheshunt Compound (for formula, see Chapter XV, page 215).

**RUST** (*Uromyces caryophyllinus*).

Perhaps the commonest carnation disease. Blisters will be found on the stems and leaves producing numerous brown spores. This gives them a reddish-brown appearance. The disease starts on the lower leaves and may, if unchecked, spread all over the plant. Attacked leaves turn yellow and in bad cases curl up and die.

**Control Measures.** Reduce the temperature of the house and reduce the amount of water given to the plants. Cut off the lower foliage to prevent it touching the ground.

In the case of a few plants, sponge the leaves with a weak solution of potassium permanganate. In larger cases spray with liver of sulphur (for formula, see Chapter XV, page 214) or with colloidal sulphur (Sulsol).

Care must be taken when propagating by cuttings only to use healthy stock plants.

**CHRYSANTHEMUM**

**LEAF BLIGHT** (*Cylindrosporium chrysanthemi*).

Fortunately not a common disease in this country but it can do very serious damage. Dark brown areas occur on the leaves edged with yellow. The leaves die and droop.

**Control Measures.** A very difficult disease to control. Quite good results, however, have been achieved by spraying with colloidal copper.
It is better, though, to make sure of eliminating the disease by burning the affected parts immediately.

**LEAF SPOT (Septoria chrysanthemella).**

Dark brown spots are found underneath the leaves and in bad cases, on the stems. The spots often grow together, the leaves curl up, and may fall to the ground.

**Control Measures.** Remove all diseased leaves and burn them immediately. Give the plants a thorough spraying with colloidal sulphur or liver of sulphur (for formula, see page 214).

**POWDERY MILDEW (Oidium chrysanthemi).**

The foliage is covered with a powdery white fungus. This may extend to the stems, and sometimes to the flowers.

**Control Measures.** Avoid overcrowding at all costs. Keep the atmosphere buoyant and prevent too high or too low temperatures.

When the trouble is first seen dust with sulphur dust, or spray with colloidal sulphur (Sulsol) or liver of sulphur, see page 214.

**RUST (Puccinia chrysanthemi).**

A bad disease of chrysanthemums outside as well as under glass. Red spots will be found on the under surface of the leaves and these may spread to the stems. The trouble always seems to be bad in dry seasons or when little watering has been done. Plants that have been manured excessively with nitrogen are more easily attacked also.

**Control Measures.** Certain varieties such as Niveus are very susceptible, and these should not be grown. Plants that have proved highly resistant include Favourite, Baldock’s Crimson, Tuxedo and Gladys Lane.

Care should be taken only to propagate by cuttings from healthy stock. All leaves and old plants that have been affected should be burnt.

Spray the plants immediately the trouble is first seen with colloidal copper (Bouisol).

**CUCUMBER**

See Chapter VI, page 62.
MELON

See Chapter VI, under Cucumber, pages 62–64.

ROSE


TOMATO

TOMATO CANKER (*Didymella lycopersici*).

*Didymella lycopersici* is a root disease, fruit infection occurring rarely under glass although in the open, the fruit only may be attacked.

First signs appear as dark brown scars girdling the stem just below soil level. Tiny black spore cases can be discerned in these brown patches, and from these flesh-pink tendrils eventually issue. If the attack is not checked, secondary infections occur higher up the stem. In very damp conditions grey lesions form on the leaves. Plants are readily infected through wounds, therefore care should be taken when de-shooting.

**Control Measures.** The best way to prevent this disease is to make a really clean start, scrubbing the houses both outside and inside with cresylic acid. Have all boxes, pots, staging, etc., clean, and before planting burn sulphur at 1 lb. per 1,000 cubic feet. Grow the plants "hard"—soft sappy weak growth will favour the fungus. If, in spite of all these measures, the disease does occur, remove the infected plants and mulch with 1½ inches of moist granulated peat (the fungus does not spread in peat).

BOTRYTIS STEM ROT.

Grey sunken areas will be found on the stem around ragged wounds or dead leaf bases. Usually occurs only when conditions are excessively humid and when pruning has been badly done with a blunt knife.

**Control Measures.** Prune all leaves carefully. Ensure efficient ventilation. Make clean cuts with a sharp knife. When defoliating, cut back the main stem and do not leave stumps.

When seen, cut out the brown tissue and rub the wound thus made with a crystal of copper sulphate.
MOSAIC.

For general remarks re virus diseases, see Chapter IV, page 35. When tomatoes are affected by mosaic they are stunted, paler in colour and usually show mottled foliage. The leaf margins may be distorted or blisters may be produced on the leaf surface. Sometimes fern-like leaves are produced without the mottling.

Control Measures. See Chapter IV, page 36.

For other diseases that attack tomatoes under glass see Chapter VI, page 73.

VINE

MILDEW (*Uncinula necator*).

Vine mildew always develops more rapidly in dull weather or when grown in shady positions. It entirely disappears, as a rule, when the affected surfaces are exposed to strong sunlight.

The leaves appear to be covered with a white downy-like dust and this may spread to the stems and berries.

Control Measures. Ensure a buoyant atmosphere by keeping the heat in the house going and ventilating the house as well. Flood the bed thoroughly in the winter. Water the soil well in the summer.

Dusting with a fine sulphur dust has proved effective, the first application being made when the leaves are just full blown and the second when the vine is in full bloom. A third application is usually advisable as a kind of insurance a month later.

Spraying may be carried out with colloidal sulphur or liver of sulphur (potassium sulphide), the formula being 1 ounce liver of sulphur to 3 gallons of water.

Collect all fallen leaves and burn them and wash the rods down well in the winter with a 10% solution of a good tar distillate wash. See page 196.

BLACK ROT (*Guignardia bidwellii*).

Brown, irregularly shaped blotches will be found on the young leaves first. It looks like sun-scald but the difference can easily be seen because in the case of the fungus there are numerous black points appearing on the surface of the patches.

A month after the disease appears on the leaves it attacks the fruits. The grapes dry up and become shrivelled looking.
Control Measures. See that the house is properly ventilated and sufficiently early in the morning, too.

Collect all diseased fruit and leaves and burn them immediately.

Spraying may be done with colloidal copper (Bouisol), or with a solution consisting of \( \frac{1}{4} \) ounce of carbonate of copper, 1 ounce carbonate of ammonia, and 4 gallons of water. It is usually necessary to dissolve the two chemicals in a little hot water before adding the cold water.

N.B.—Mildew is always associated with dryness at the roots. The flooding in the winter makes certain the subsoil is wetted. Watering in the summer except when in flower and when the berries are ripening, keeps the leaves “turgid” and so the mildew spores don’t get such a chance of “getting hold.”
CHAPTER XIII
THE PESTS AND DISEASES OF LAWNS AND ORNAMENTAL TREES AND SHRUBS

Do note that:
1. Fairy rings can be killed with formaldehyde.
2. Leather jackets love grass roots.
3. Leopard moths make tunnels in trees.
4. Mussel scales attack many shrubs.
5. A Leaf miner will attack Lilacs.

Though lawns and ornamental trees and shrubs are put into one chapter for convenient purposes, it is proposed for ease of reference to divide them under their various headings.

LAWNS
INSECT PESTS OF LAWNS

LEATHER JACKETS.

For general remarks in regard to leather jackets, see Chapter III.

They are, however, a very serious pest of lawns, eating the roots of the grasses so badly that serious browning occurs and dying, and in many cases tufts of turf can be pulled out easily by the hand.

Control Measures. The best method of controlling leather jackets on lawns seems to be to water with a special solution of ortho-dichlorobenzene with which has been mixed a proportion of Jeyes' fluid. This may be obtained from the Board of Greenkeeping Research, Bingley, Yorks. 1 gallon of the emulsion is sufficient for 100 gallons of water, and the dilute solution should be used at the rate of 1 gallon per square yard.

Arsenate of lead powder may also be used at the rate of ½ ounce to the square yard. This should be applied each winter during the months of November and December.
Other pests that may damage lawns are: Cockchafer grubs (see Chapter III, page 20), and to control these it is necessary to inject carbon bi-sulphide into the soil. Special carbon bi-sulphide injecting tools may be purchased for this purpose.

Ants, which may be controlled either by the carbon bi-sulphide method, or by making up a poison bait (when sugar is plentiful) consisting of 1 ounce of Paris Green and 1 lb. of brown sugar, sprinkling this over the infested area. Watering with a strong solution of Liquid Derris I.T.P. will also control ants. Dusting with D.D.T. has given good results.

DISEASES OF LAWNS

FUSARIUM PATCH (*Fusarium nivale*).

The commonest disease of lawns to-day. The turf will be found attacked in September or October when unsightly brown patches will be found sometimes as small as a penny, at other times over 1 ft. in diameter. In mild conditions a cotton-like growth may appear on the surface. Infections seem to occur when the vigour of the grasses is on the decline.

**Control Measures.** As generous dressings of manures in the late summer encourage this disease, they should be withheld. Manures rich in organic nitrogen and soluble phosphates seem to encourage the fusarium. Grass which is cut in the winter is less susceptible than lawns which are left long.

Aerate the lawn by plunging a fork held perpendicularly all over the surface.

There are several proprietary organic mercury compounds on the market at the present time for controlling this disease. A simple formula is to mix up 2 ounces of finely powdered corrosive sublimate and 2 ounces of calomel, and apply these at the rate of 4 ounces per 1,000 square feet of turf. To do this it is necessary to mix the chemicals with about 30 lbs. of sand. This ensures even distribution.

FAIRY RINGS.

These are produced by various fungi that live in the soil. They grow out from a central point, producing an ever-widening circle.

**Control Measures.** Make up a solution of sulphate of iron. Formula: 1 ounce sulphate of iron to 1 gallon of water, or water the ground concerned with a 2% solution of formaldehyde, giving a thorough soaking.
Naturally, large numbers of the pests that attack fruit trees attack the ornamental trees and shrubs also, for so many of them are nearly related. The caterpillars, for instance, of the lackey moth, vapourer moth, winter moth, ermine moth, tortrix moth, will all of them be found on occasions attacking trees used for ornamental purposes, and methods of control will be found in Chapter IX under the headings of Apple, Pear or Cherry.

The caterpillars that tunnel up the trunks of trees, like those of the wood leopard moth, are also quite common unfortunately among ornamental trees, as are the shot-borer beetles. To eradicate these pests, the measures outlined in Chapter IX should be followed.

General advice, however, with regard to trees and shrubs may now be given. All prunings should be burnt, all dead twigs and branches removed for burning, and all wounds made painted over with a thick white lead paint. All suckers growing up from the base of trees and shrubs should be cut off below ground level the moment they are seen. Liberal dressings of nitrogenous manures such as sulphate of ammonia or nitrate of soda should not be given, as these encourage soft growth, as do over-liberal dressings of stable and farmyard manure mulchings.

The soil where the trees grow should be properly drained and deeply cultivated before planting. Badly drained soil only causes reduced vigour and this tends to make the trees susceptible to both insect and fungus attacks. All rubbish around trees should be collected and burnt and this especially applies to shrub borders and hedgerows; by removing such material, the sources of shelter of many insects are removed.

PESTS THAT ATTACK NUMEROUS SHRUBS AND TREES

APHIDES (Green fly).

There are a large number of species of aphides that will attack ornamental trees and shrubs. Some are black like those that attack the flowering cherries. Some are green like those that attack pyrus and prunus; some may be reddish in colour, but
they all suck the sap of the leaves and stems and they all deposit what is known as "honeydew", a sticky substance which seems to attract ants. It is on such substances that the sooty fungi grow.

**Control Measures.** The trees should be sprayed either with nicotine and soft soap (for formula, see Chapter XV, page 212) or with liquid derris in water.

Forcible spraying should be done and the whole of the shrub or tree should be covered.

Deciduous trees may be sprayed in the winter when they are dormant with a 5% solution of a good tar distillate wash. Some shrubs, like Viburnum, cannot be sprayed with a tar oil as the buds are not sufficiently protected.

**WOOLLY APHIS (Eriosoma lanigerum).**

For full details with regard to woolly aphis see Apple, Chapter IX, page 117.

It does attack the cotoneaster, the pyracantha and pyrus. The two latter may be sprayed in the winter with a 10% solution of a good tar distillate wash and all three may be sprayed with nicotine and soft soap or with liquid derris I.T.P. immediately the pest is seen.

**MEALY BUGS AND SCALES.**

Mealy bugs and scales have already been described in some detail in Chapter XI when dealing with orchids, palms, vines, etc. The Mussel Scale is dealt with also on page 118 under the heading of Apple.

There are numbers of scales, however, which are found on ornamental trees and shrubs. In the case of aucubas the scale is very conspicuous, being white, and may be seen on both the upper and lower surfaces of the leaves.

The mussel scale will attack cotoneaster, ceanothus and various species of pyrus.

Carpenteria, cotoneaster, escallonia, lonicera, etc., will be attacked by the peach scale which is reddish-brown and oval. This will also attack flowering currants.

Yews are often attacked by the yew scale, which is somewhat flatter and paler than the peach scale.

Elms, hazels, hawthorns, pyrus and pyracanthas may be attacked by the nut scale, which is similar again to the peach scale except that the sides of the scale often protrude beyond the base.
ORNAMENTAL PLANTS

Hollies, myrtles and ivies are sometimes attacked by a soft scale. It is yellowy in colour, and never has a scaly covering.

Bay trees and laurels are sometimes attacked by a similar scale which, because of the honeydew or sticky excreta that exudes, attracts the sooty fungi which add to the disfigurement.

Beech trees can be attacked by the felted beech scale which will cover the main branches and stems. It is whitish in appearance.

Flowering currants (ribes), false acacias (robinias), laburnums and ceanothus are often attacked by mealy bugs which are similar in appearance to scale insects only their bodies are protected by a waxy white secretion rather than by scales. They can also move about plants which scales cannot.

Control Measures. See that every part of the branches, shoots, leaves and stems of deciduous trees are sprayed with a good tar distillate wash in the winter, preferably December.

In the spring, spray with white oil and nicotine. Formula: 1 ounce of nicotine, 1 pint white oil emulsion to 10 gallons of water. It is best to spray in the evening after a warm day.

AZALEA
(Azalea Indica)

The leaves and buds of azaleas may be damaged by a fungus, Exobasidium japonicum, which attacks the terminal buds and the leaves near the tips of stems. As a result these become swollen, turn pinkish in colour and later are covered with a white bloom.

Control Measures. All affected parts should be pruned away carefully immediately the trouble is seen. They should be burnt immediately. It is very important to remove the trouble before the whitish bloom appears for this contains the spores which cause the spread of the disease.

CAMELLIA

A disease known as Pestalozzia guepini may attack camellias, causing silvery-white irregular or rounded blotches on the leaves. Minute black dots can be seen when these are examined carefully.

Control Measures. All diseased leaves should be removed and burnt directly they are seen. The remaining leaves should be sprayed with Bordeaux mixture.
As Bordeaux mixture will spot the blooms, many gardeners prefer to sponge the leaves with Bordeaux mixture instead of spraying them. This takes far more time.

LILAC

LEAF MINER.

The larvae of a number of *Gracilaria* moths are leaf-mining. They not only injure the leaves of lilacs but privets as well. Blisters will be found on the leaves, many of which will roll up.

**Control Measures.** Spray with nicotine and soft soap (for formula, see Chapter XV, page 212) in May, and again in July to prevent the second brood.

RHODODENDRON

WHITE FLY (*Dialeurodes chilenensis*).

The leaves mottle, but no chocolate spotting is produced on the under surface, as there is in the case of the rhododendron bug. Mealy winged insects will be found on the highest leaves from mid-June to mid-July. They do not seem to fly much unless the branch is shaken. Sooty fungi will appear on the upper surfaces of the lower leaves because of the honeydew that these insects exude.

**Control Measures.** Spray with a nicotine and white oil emulsion (formula: 1 ounce nicotine, 1 pint white oil emulsion, to 10 gallons of water) in September and April.

Dust with either fresh derris dust or nicotine dust in the summer when any flies are seen.

RHODODENDRON BUG (*Stephanitis rhododendri*).

The signs of the above pest are similar to those made by white fly on rhododendron with the addition of chocolate spots on the under sides of the leaves.

**Control Measures.** Spray in June and July with D.D.T. emulsion. The shrubs can be dusted with D.D.T., if preferred.

Sycamore

ACER (*Acer pseudoplatanus*).

The leaves of sycamore trees are often covered with roundish black blotches. These prevent the leaves from functioning
properly and may, in bad cases, inhibit further growth taking place.

**Control Measures.** All leaves affected should be collected as they fall and be burnt. This usually prevents further trouble in future years.

It is hardly worth while spraying.
CHAPTER XIV

SOIL STERILISATION AND
WARM-WATER TREATMENT OF
PLANTS

This is an important subject.
1. You can build your own soil steriliser.
2. Soil can be baked or steamed.
3. Chemicals only kill insect pests.
4. Warm-water treatment is not difficult.

One of the most successful ways in which pests and diseases which live in the soil can be controlled is by what is called soil sterilisation, though actually the term refers to the partial sterilisation of soil. The author has had considerable experience in this subject, especially while he was Horticultural Superintendent of the Cheshire School of Agriculture.

Partial soil sterilisation ensures that all insects, their eggs or pupa are killed; all fungi are destroyed; all weed seeds destroyed also, and all non-spore-producing bacteria killed. The surviving ammonia-producing organisms are able to multiply in consequence, in an unrestricted manner and carry out their activities on a much larger scale immediately. Naturally, such soil is ideal for it gives almost perfect germination and much labour is saved on weeding. Further, the increased fertility of the soil, and the destruction of insect pests and diseases recompenses amply for any costs involved in the operation.

It would be difficult to sterilise large acres of soil in the open, but market-gardeners even do this. They take up soil from a depth of two or three inches from very large areas, sterilise it by baking, and put it back again. Though such an operation is expensive, they claim that the resultant saving in weeding and the like, and the better crops obtained, pay over and over again.

THE REASEHEATH STERILISER.

A brick-built structure for sterilising soil was evolved by the writer at the Cheshire School of Agriculture, Reaseheath, largely
SOIL STERILISATION

on the lines of the one built by Mr. W. Priestner of Northenden. It proved to be eminently satisfactory and was capable of holding several tons of soil at a time.

The dimensions of the structure were as follows:

- **Trough of brickwork**: 3 ft. 1½ ins. wide, 23 ft. long and 1 ft. 2 ins. deep. (All inside measurements).
- **Flues**: 4½ ins. wide and 15 ins. high.
- **Firebox**: 2 ft. 9 ins. by 18 ins. and, except where otherwise stated, common brick was used throughout. A rise of 9 ins. was arranged from one end of the steriliser to the other.

In order to construct the steriliser at ground level, a hole 4 ft. 6 ins. wide by 25 ft. long was dug. It was 4 ft. 6 ins. deep at the chimney end and 5 ft. 3 ins. deep at the firebox end. A square "well" was dug at the latter end for a stove-hole. A concrete bed, 6 ins. thick, was then laid over the platform, and the firebox was built in with firebricks. The outside walls of the trough were carried up 15 ins., and 3 mid-feathers were arranged, each of a single brick in thickness, at 4½ in. intervals.

In order to facilitate the draught, the ends of the outside feathers were cut away, and the central feather was set back 9 ins. Firebrick was used for the first 4 ft. 8 ins. For the top of the firebox, fireclay flags 24 ins. by 12 ins. were used. These extended about 4 ft. up the trough. It is only necessary to have firebrick for this length either for the flues or for the trough itself.

The flues, of course, must be carried through to the base of the chimney and the outside walls of the trough should be built up to ground level. The chimney should be built in the normal way and should include a damper to allow of regulation of draught.

Soil to be sterilised should be placed in the trough and in the size already described, 3 tons may be accommodated. A fire should then be kept going in the firebox and this will bring the whole bulk of soil to an average temperature of 210 deg. F. in 8 hours. In order to help conserve the heat, thick sacking should be placed over the soil. After baking for 4 hours or so, the soil in the trough should be double dug in order that the top becomes the bottom.

Gardeners should have no difficulty in designing brick-built soil sterilisers of a much smaller size on a similar principle. The author has seen excellent brick-built troughs only 4 ft. long, and it is possible in such structures to sterilise the soil in 4 or 5 hours. Care has to be taken not to burn the soil in the bottom of the trough; *Note* the drawings on the following pages.
THE REASEHEATH STERILISER

An alternative steriliser; the advantage of this type is that the flues return and go back up to the chimney, thus ensuring more even heat distribution.
STEAMING.

Those with acres of glasshouses will find it cheaper to sterilise the soil in situ. In this case, steam under pressure will be applied by means of a portable loco-type boiler. Such steam will be injected into the soil by means of a spike or grid system, but as this is a costly method it is not proposed to describe the scheme here.

HOT-WATER SYSTEM.

Some like to sterilise soil by means of boiling water. It takes, however, about 40 gallons of boiling water to the square yard in order to reach the right temperature to a depth of 10 inches. It is, therefore, a costly method and, because of the excess water used, is apt to ruin the texture of the soil.

CHEMICAL STERILISERS.

Chemicals are sometimes used with success in order to partially sterilise soil. They do, however, only kill insect pests and do not control weeds and weed seeds. Many of them do not prevent attacks either by eel worms or symphyllids.

Perhaps the three most common chemicals used for sterilisation are: (1) formaldehyde, (2) cresylic acid, and (3) carbon bi-sulphide.

In the case of cresylic acid, the 97-99% pure product should be used. It should be diluted with water to a strength of 1 in 40 (i.e. 1 pint cresylic acid to 40 pints of water), and should be used at the rate of 4 gallons of the dilution to the square yard. This should be washed in an hour later by heavy watering.

In the case of formaldehyde, 40% formaldehyde should be used, dissolving 1 pint in 49 pints of water and applying it at the rate of 4 gallons to 10 square yards.

Carbon bi-sulphide may either be injected into the soil by means of a soil injector, or can be made up with sulphonated castor oil in the form of an emulsion. The formula should be 1 pint to 60 pints of water, applied at the rate of 3 gallons of the diluted emulsion per square yard.

Carbon bi-sulphide will destroy millipedes, symphyllids and reduce root knot eel worm infection. It has a stimulative effect also on subsequent crops. Formaldehyde has a similar stimulating effect on plant growth but is ineffective against symphyllids and wire worms, though it usually gives some control of eel worms.

Cresylic acid must not be thought of as having a high insecticidal value, either.
At least a month, and longer if possible, should be allowed to elapse before any planting takes place.

WARM-WATER TREATMENT OF PLANTS.

The warm- or hot-water treatment of plants was originally designed to destroy the grubs of the narcissus fly found in bulbs. Since that time warm water has been used to treat strawberries in order to control eel worm, tarsonemid mites, etc., and may be used for treating violets, phlox, chrysanthemums and other plants that are attacked by eel worms.

The general scheme is as follows:

The plants concerned should be immersed in water at a temperature of exactly 110 deg. for 20 minutes, three degrees on either side being the safest margin. Bulbs should be treated when they are in a dormant condition, say 6 weeks after lifting in the autumn and should be in the hot-water bath for 4 hours. Chrysanthemum stools may be treated in the autumn after the plants have been cut down, or the cuttings themselves may be treated before planting. Young violet and strawberry plants are usually treated before they are planted, and warm-water treatment usually gives them a check for about a fortnight; the wise gardener, therefore, tries to get his planting done as early as possible.

It is important to see that the whole of the water in the bath is at the right temperature so some arrangement must be made for seeing that the water is stirred. The thermometer must read correctly, and it is advisable to have a false bottom to the tank, so that the water can circulate under the bulbs or plants that are being treated, as well as over them.

Bulbs do not need to be cooled down quickly after being taken out of the bath, but other plants do. They should be put under a tap of cold water or plunged in a bath.

Having sterilised plants in this way it is, of course, foolish to replant them in infected soil.

There are various baths on the market which are made especially for sterilising purposes, but the ingenious gardener will be able to rig up his own apparatus quite cheaply.

N.B. Sometimes hot water treatment fails to kill Narcissus eelworm. This is due to the air bubbles round the eelworm "wool." Unless this wool is wetted, the eelworms are not killed. The trouble can be overcome by adding 0.25 per cent Chlorphenol plus a wetting compound to the bath before the 3 hour treatment at 110° F.

The chemical is sold under the name 'Phagol.'
BULB STERILIZATION

The
Hearson
Bulb Bath
No. 1
All copper,
to hold about
7 lbs.
CHAPTER XV

FORMULÆ OF INSECTICIDES AND FUNGICIDES, AND DETAILS OF FUMIGANTS AND DUSTS

Combat the enemy by:—
1. Stomach poisons.
2. Contact sprays.
3. Dusts.
4. Fungicides.
5. Fumigants.

Throughout the book, instructions have been given as to the best insecticides or fungicides to use for the particular purpose on hand. In this chapter definite formulæ will be found with regard to the various washes and dusts to be used, together with other information that will prove useful to the gardener.

POISONS

It must be remembered that there are certain insecticides which are poisonous to human beings and animals and must, therefore, be handled with great care. Under the Pharmacy and Poisons Act, gardeners may only purchase poisons from a chemist’s shop where they are known, and they must sign the Poison Book. They cannot purchase poisons by post.

LEAD ARSENATE.

Formula:—
\[ \frac{1}{4} \text{ lb. lead arsenate powder or } \frac{1}{4} \text{ lb. lead arsenate paste, 10 gallons water.} \]

The lead arsenate should be placed in a bucket. A little water should be added, stirring being done and more water added each time till the whole has been dissolved.

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Avoid using this wash on fruits or vegetables that are soon to be used in the house.

N.B.—Other poisons are nicotine and Paris Green, but these appear under other headings.

**MERCURIC CHLORIDE** (Corrosive Sublimate).

This is a deadly poison and as such should be handled with care. It is used for control of club root of brassicas at a strength of 1 ounce in 10 gallons of water. It does not dissolve readily and hot water should be used in the first place to accelerate the process. Do not use metal vessels.

**CONTACT SPRAYS**

Sucking insects can only be controlled by contact sprays, for they do not eat the leaves and stems.

**NICOTINE AND SOFT SOAP.**

Formula:—

1 ounce nicotine (95–98%), 1 lb. soft soap,* 10 gallons water.

Alternative formula:—

½ ounce nicotine, ¼ lb. soft soap,* 10 gallons water.

The soft soap should be dissolved in a little warm water first of all and be allowed to cool. The nicotine should then be added and the solution made up to 10 gallons.

**PYRETHRUM EXTRACT.** (Can be bought as Pyrethrex.)

Formula:—

$\frac{1}{2}$ pint concentrated extract, 100 gallons water.

**PARAFFIN EMULSION.**

Formula:—

½ gallon paraffin, 1½ lbs. soft soap, 10 gallons water.

Boil the soap and water. Pour in the paraffin slowly while boiling, stirring all the time. Allow to cool before using.

**WHITE OIL EMULSION.**

Highly refined petroleum oils of high boiling point may be used for controlling scale insects and red spiders.

Formula:—

According to instructions on container.

*If soft soap is not easy to obtain, use a spreader such as Shellestol instead, see page 217.
DERRIS.
A non-poisonous wash.
Formula:—
According to instructions on container.
Liquid derris gives excellent results.

DUSTS

NICOTINE DUST.
Usually three grades, 2%, 3%, and 4%. Use 2% for green fly, use 3% for capsids, green fly and caterpillars, use 4% when combined with arsenate or derris for controlling both biting and sucking insects.
Use on calm days when warm.

ORGANO-MERCURY COMPOUNDS.
These preparations can be obtained in proprietary form and are used for dressing the seed of peas, cereals, etc., in order to prevent fungal rots which ruin the seeds.

DERRIS DUST.
Similar to derris sprays but never so effective. Non-poisonous. Apply with dusting machine. Use liberally.

SULPHUR DUST.
For controlling fungus diseases as recommended in the book. Be sure not to buy just flowers of sulphur, but buy the specially manufactured dust for this purpose.

COPPER-LIME DUST.
To be used instead of Bordeaux mixture. Useful for controlling potato blight, celery blight, tulip fire, etc.

CALOMEL.
This is in the form of a white powder; the pure form can be used for coating onion seed in order to avert attack by the onion fly. A 4% dust is used against cabbage root fly.

GAMMEXANE.
This has so far proved to be the best control for flea beetles, and is applied in the form of a greyish white dust.
LIME-SULPHUR.
A brownish-red liquid; purchase with a polysulphide content of 25% and a specific gravity of 1.3.
Use according to instructions given throughout the book.
Must not be mixed with soap.

BORDEAUX MIXTURE.
Can be bought mixed in paste form but is cheaper to make at home.
Formula:
- 4 lbs. quicklime, 6 lbs. copper sulphate, 100 gallons water, or
- 6 lbs. quicklime, 4 lbs. copper sulphate, 100 gallons water.
This latter is known as excess lime Bordeaux and is better for celery, or any plants where there is a danger of damage being done by the copper.
Don’t place the copper sulphate or the final mixture in a metal bucket. Slake the quicklime gradually with a little water and then add the rest of the water. Dissolve the copper sulphate overnight. Pour this into the lime gradually, stirring all the time. It is possible to buy Bordeaux Paste ready for diluting with water. (Other formulas used with fruit trees are found in the text dealing with diseases).

LIVER OF SULPHUR.
Formula:
- 5 ounces liver of sulphur, 1/2 lb. soft soap, 10 gallons water.

COLLOIDAL SULPHUR.
Liquid sulphur in a very finely divided state. Usually sold as Sulsol.

COLLOIDAL BORDEAUX.
Liquid Bordeaux in a finely divided state. Usually sold as Bouisol.
N.B.—Use Sulsol and Bouisol according to instructions on container.

BURGUNDY MIXTURE.
Formula:
- 8 ounces copper sulphate, 10 ounces washing soda, 5 gallons water.
Dissolve copper sulphate in 4 gallons water and washing soda in 1 gallon. Pour washing soda solution slowly into copper sulphate solution, and stir all the time. Use at once and keep agitated. It is safer to use wooden or enamel vessels.

CLEANSING TREES IN WINTER

TAR DISTILLATE WASH.
Use according to instructions on container. Not only cleans trees but smothers insect eggs.

CAUSTIC SODA.
Old-fashioned wash for trees. Still used sometimes late in winter against brown rot.
Formula:—
1 lb. caustic soda, 10 gallons water.

DINITRO-ORTHO-CRESOL EMULSION.
Popularly called D.N.C., this is a combined wash of dinitro-ortho-cresol and petroleum oil. By means of this spray the complete winter wash programme can be carried out in one operation. It is particularly effective against fruit tree red spider, apple capsid bug and the common green capsid, used at a strength of 4–7%. D.N.C. gives only partial control of the eggs of the winter moth group, and so in this case it must be followed by a lead arsenate spray at the green "cluster" stage of bud development.

SOIL STERILENT

CHESHUNT COMPOUND.
Formula:—
2 parts by weight copper sulphate, 11 parts by weight ammonium carbonate.
Crush the ammonium carbonate to a powder. Mix with the powdered copper sulphate and store in tightly corked jar for 24 hours before using. Prepare the solution by dissolving 1 ounce of the dry mixture in a little hot water and then adding 2 gallons of water. Use iron or tin containers and only prepare just as much as is needed for immediate use.
FORMalin.
A 2% solution is useful for disinfecting the wood of empty glasshouses and frames, and for washing pots and boxes. It is also used for sterilising soil.

Cresylic acid.
This is a pale straw-coloured liquid, and is useful for scrubbing down empty glasshouses, pots, and for sterilising soil. Use according to instructions on container.

Poison Baits

Bran and Paris Green.
Formula:—
\[
\frac{1}{2} \text{ lb. Paris Green, } 14 \text{ lbs. Bran, } 1 \text{ gallon water, or }
\]
\[
1 \text{ lb. Paris Green, } 14 \text{ lbs. Bran or } \frac{1}{2} \text{ lb. Paris Green, } 28 \text{ lbs. Dried Blood.}
\]
Mix the Paris Green thoroughly with the bran and add sufficient water to moisten the mixture only.

Bran and Meta fuel.
Formula:—
\[
1 \text{ saltspoonful of Meta fuel, } 1 \text{ handful of Bran or Bone Meal.}
\]
Powder the Meta fuel, add to the bran, mix well and sprinkle on ground or put in little piles where slugs are. They will leave any crop for this and are thus killed.
Dried lawn mowings can be used instead of bran when not obtainable, and so can bread crumbs.

Spreaders

It is usual when mixing sprays to add a spreader to increase the efficiency of the spray and make it easier to apply.
Various spreaders are:—

1. Soap. Useless as a spreader with such washes as Bordeaux, lead arsenate and lime-sulphur, but commonly used with nicotine. Normally 10 lbs. of soft soap per 100 gallons of water are used.

2. Calcium caseinate. Used chiefly with lime-sulphur at the rate of 2½ lbs. to 100 gallons of water.
3. Agrals. Agral I and Agral N are used as spreaders. As a rule 2 lbs. of Agral I, or 1 lb. of Agral N per 100 gallons of water are used.

Agral I has been found to improve a sulphur spray in the case of mildew.

4. Sulphur Lye. Use \( \frac{1}{2} \) gallon to 100 gallons of water.

5. Saponin. Use at the rate of 2 ounces per 100 gallons of water.


FUMIGANTS

NAPHTHALENE.

Use either in the crude form as whizzed naphthalene or in the white crystalline form as flaked naphthalene.

Formula :

- Light soils: 3 ounces per square yard.
- Heavy soils: 6 ounces per square yard.

Spread evenly, fork in thoroughly. Water copiously.

Will drive away wire worms, millipedes, root maggots, woodlice, root-feeding aphides, and other larvae.

NAPHTHALENE, Grade 16.

Used under glass to control red spiders and thrips.

Vaporise over special lamps.

Formula :

4–6 ounces grade 16 naphthalene to 1,000 cubic feet.

Fumigate after house has been damped down in the evening. Continue for 12 hours. Keep temperature at 70 deg. F.

In bad cases of thrip on carnations, cyclamen and arums, this grade naphthalene should be broadcast at the rate of 10 ounces per 1,000 cubic feet.

CARBON BI-SULPHIDE.

Highly inflammable. Don’t smoke when using.

Formula :

Make holes with crowbar or stake 2 ft. deep, pour in chemical
at rate of 2 ounces per cubic foot. Cover each hole immediately to conserve fumes.
Useful for heaps of soil. Will control wire worms, chafer larvae, root aphides, ants.

NICOTINE.
Fumigant for glasshouses. May be used as "shreds" or liquid. Poisonous.
Formula:---
Use liquid nicotine at rate of ½ fluid ounce, ½ fluid ounce methylated spirit to 1,000 cubic feet of space.
Vaporise in small pan placed over spirit lamp.

TETRACHLORETHANE.
Very useful in amateur's greenhouse against white fly.
Often obtainable under proprietary name.
Formula:---
3 to 5 fluid ounces to 1,000 cubic feet. Pour on paths in evening.
Never use this fumigant for azaleas, chrysanthemums, cinerarias, dahlias and salvias.

PARADICHLORBENZENE.
This is effective against wire worms. Break it up into portions about the size of a French bean and bury these in holes 6 inches deep and 2 feet apart, closing the holes when the chemical is in position with the heel of your boot.
INSECTICIDES, ETC.

HOW TO CALCULATE CUBIC CONTENTS OF GREENHOUSE

For an ordinary "lean-to" house (Fig. A) add the height to the eaves (XY) in feet to the height to the ridge (RD) in feet and divide by 2. Multiply this result by the width of the house (YD) in feet, and then multiply this result by the length of the house in feet.

In the example (Fig. A) XY (=5 ft.) added to RD (=12 ft.) amounts to 17 feet. Half of this is $8\frac{1}{2}$ ft. The width of the house YD (=15 ft.) multiplied by this result ($15 \times 8\frac{1}{2}$) comes to $127\frac{1}{2}$ ft. Supposing the house is 100 ft. long, the cubic contents would be $127\frac{1}{2} \times 100$, amounting to 12,750 cubic feet.

Exactly the same process applies to an "even-span" house (Fig. B), the height to the eaves in feet (5 in the example figured) added to the height to the ridge in feet (10) amounts to 15 ft. Half this is $7\frac{1}{2}$ ft. This result multiplied by the whole width of the house (20 ft.) amounts to $20 \times 7\frac{1}{2} = 150$. Again, supposing the house to be 100 ft. long, the cubic contents would be 150 multiplied by 100, amounting to 15,000 cubic feet.

In a "three-quarter span" house (Fig. C) each span is calculated separately, as for a "lean-to," and the results added together.
HOW TO CALCULATE CUBIC CONTENTS OF DIFFERENT GREENHOUSES

(See previous page)
CHAPTER XVI

HARMLESS AND BENEFICIAL INSECTS

It will be quite a relief to readers of this book to know that there are a very large number of harmless and even beneficial insects. It would be a pity not to end a book of this kind on a bright note and it is hoped, therefore, that Chapter XVI will help to cheer gardeners up who may be depressed as the result of wading through the hundreds of injurious pests and diseases there are.

There are a number of insects, for instance, that are called predaceous. That is to say, they live by feeding on insect pests. Ladybirds are perhaps the best known of these. The two common species being the 7-spot and the 2-spot ladybird beetles. They feed on the green fly and on the scale insects.

Now most people recognise ladybirds but unfortunately they fail to recognise the young which are commonly called "niggers." These niggers are, as their name suggests, black, and may have little round spots on their backs. They are a little bit longer...
than a ladybird, a little bit less wide and not so “high.” They look like tiny little alligators.

Do not destroy ladybirds or the niggers and, in fact, encourage them all you can.

Another predaceous insect is the hover-fly. Perhaps you have often seen, as you go down a path, a little fly smaller than a wasp, of a similar colour, hovering in the air and remaining stationary. As you approach, it may dart to one side, and continue to hover, its little wings seeming to beat thousands of times per minute.

These are particularly abundant on warm days in the summer and autumn. They lay their eggs on leaves and shoots where aphides (green flies) are feeding. Tiny little reddish-green or green slug-like maggots emerge which feed on the aphides.

Lace-wing flies, sometimes called fly-goldings, are lovely little fragile insects which have light green bodies and four lace-patterned wings. They are very fond of green fly and they feed voraciously on woolly aphides. Their eggs are very noticeable for they are attached to long, thread-like stalks and may be found anywhere where green flies congregate.

They sway readily in the wind. The grubs that hatch out suck the body juices of the insects.

There are capsid bugs which are destructive to pests. They will feed on tortrix caterpillars, and other caterpillars too; on red spiders and on aphides, and when other food is scarce, they will eat one another.
HARMLESS AND BENEFICIAL INSECTS

There are small, flattish red bugs which look something like tiny capsid bugs and are often erroneously called red spiders. These large red bugs feed on the red spiders and suck their eggs dry. Its proper name is the anthocorid bug.

There are numbers of ground beetles and rove beetles which are most useful to the gardener. The devil's coach-horse beetle, for instance, devours hundreds of harmful insects in a year. It can be recognised by its habit of cocking its tail up into the air.

Sometimes I am asked how to tell a "good" insect from a harmful insect and the only rule of thumb method I can suggest is that the good insects at their grub or caterpillar stages are very active, while the harmful insects, on the whole, are more sluggish.

Another mite is known as the red velvet mite. It is a bright velvety red and is usually found walking about the branches of fruit trees in a rather "stately" manner. It is not a red spider and is a useful insect in that it feeds on woolly aphides. Its Latin name is *Allothrombium fuliginosum*.

Gardeners will be delighted to know that there is at least one slug which is a friend. Its Latin name is *Pestacella*. It is pale yellow in colour. Its length when moving is about 3 inches, closing to about 1 inch. It can be distinguished from the harmful species by the small flat shell on its tail end. It feeds on slugs and other ground creatures.

Centipedes are definitely beneficial and are distinguishable from millipedes because they have only one pair of legs to each body segment, compared with two pairs in each segment on millipedes. They are more rapid moving than millipedes, and have longer legs too.

Earthworms are, of course, beneficial and are useful aerators of the soil. They help to reduce organic matter into such a condition that it is available for plant food.

Bees are particularly useful for pollinating the blossom of fruit and during the spring and early summer, wasps are useful, too, for they feed on aphides and other small insects, taking them to their nests. Later, however, they feed on the fruit, and their nests should then be destroyed.

The greenhouse white fly parasite mentioned in Chapter XI, page 172, is *Encarsia formosa*, or chalcid wasp. It lays eggs in the young of the white fly, the larvae that hatch out feeding on the white fly scales and causing them to turn black. It is fairly easy to set up a colony of these predaceous insects in a greenhouse. Particulars may be obtained from: The R.H.S. Gardens, Wisley,
One of the most interesting parasites is that of the cabbage caterpillar (*Apaneles glomeratus*). This Ichneumon fly lays its eggs in the young caterpillars, the larvæ of which feed inside, thus killing them. The larvæ then emerge as yellow cocoons; the gardener, therefore, should never destroy caterpillars surrounded by such cocoons.

Frogs and toads are very useful for they devour large numbers of insects, while many birds are beneficial, too.
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Mr. Liquinure says:

USE LIQUINURE
FOR STRONGER,
HEALTHIER
PLANTS

Liquinure is the perfectly balanced liquid food that plants need for health, strength, or recovery. Besides giving plants the rich potash phosphate and nitrates they need, Liquinure gives it to them as a fluid which plants easily absorb through their tiny root-hairs. Liquinure is a splendid guard against plant diseases, and fine builder-up when plants have been attacked. Liquinure can be applied with the new Automatic Diluter for direct connection with your garden hose 10/6, Rose 3/-, 2 Nozzles 4/6, Extension Lance 3/-, Complete Outfit 21/-.

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Also in containers 10/6 carriage paid.

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