

# **Studies on Herbaceous Perennials of Kashmir Valley for Landscape Use**

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(2006-146-D)



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**Studies on Herbaceous Perennials of  
Kashmir Valley for Landscape Use**

**SUMINA RAMZAN**  
(2006-146-D)



***THESIS***

**Submitted to**

**The Faculty of Postgraduate Studies  
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(Floriculture & Landscaping)**

**2010**



*to my Respected Parents*

&

*my Loving Son*

*(Hasnain)*



**Sher-e-Kashmir**  
**University of Agricultural Sciences & Technology of Kashmir**  
**Division of Floriculture, Medicinal & Aromatic Plants,**  
**Shalimar Campus, Srinagar**  
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**Certificate – I**

This is to certify that the thesis entitled “**Studies on Herbaceous Perennials of Kashmir Valley for Landscape Use**” submitted in partial fulfilment of the requirements for the award of the degree of **Doctor of Philosophy in Agriculture (Floriculture & Landscaping)**, to the Faculty of Postgraduate Studies, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, is a record of bonafide research work carried out by **Mrs. Sumina Ramzan (Regd. No. 2006-146-D)** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

It is further certified that any help or information received during the course of investigation have duly been acknowledged.

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**ABSTRACT**

The present investigation entitled “Studies on Herbaceous Perennials of Kashmir Valley for Landscape Use” were conducted during the years 2006-2009 in three districts of Kashmir valley. For this purpose four representative sites were selected and observations on prominent characteristics viz. morphology, habit, habitat and mode of propagation, mature height, foliage colour and texture characteristics of flower, fruit and landscape use were recorded by making exploratory trips to these sites. The study revealed a large number of ornamental herbaceous perennials growing satisfactory in this environment.

A total of 164 species belonging to 118 genera have been described. The study encompassed 82 herbaceous perennials, 53 bulbous plants and 29 ground covers.

Among the taxa, studied most of the species, 52.43 per cent were of erect nature, while as 16.46 per cent belong to the spreading groups, 14.63 per cent was observed to follow mound and 8.53 per cent to clump habit, 2.43 per cent resette forming and 1.82 per cent each of mat and arching nature while as 1.21 per cent with climbing and 0.67 per cent with creeping habit.

Phenological spectrum of the flora revealed maximum availability of flowers (61%) during spring followed by 19 per cent each during summer and winter whereas only 1 per cent during offseason (autumn). Among the various flower colours found maximum number (33) had yellow flowers followed by white, pink, purple, orange, blue, red, violet, offwhite, lavender, lilac, mauve, brown and magenta. A large number of species had mid green coloured foliage followed by dark green and greyish green. 4 species emitted fragrance owing to scented flowers.

Based on the morphological, phenological and landscape features worked out during the present study, 120 species are recommended for borders, 81 for beds, 79 for rock garden, 51 for woodlands, 10 for pools, 6 for specimen plant, 7 for pots, 4 for pathways, 4 for backdrops, 2 for companion plants, 31 for ground covers, 13 for sunny areas and 7 for lightly shaded areas.

**Key words:** Bulbous, Ground covers, Herbaceous Perennials, Phenological spectrum, Taxa

Signature of Student  
Dated: \_\_\_\_\_

Signature of Major Advisor  
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*Sumina Ramzan*

Place: Shalimar, Srinagar

Dated:

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## **CHAPTER – 1**

### **INTRODUCTION**

The state of Jammu and Kashmir is situated in the north of India and has an area of 138134 sq km (Kanth, 1985). The state is highly mountainous except for a short belt joining the Punjab plains. Floristically the state of Jammu and Kashmir is divided into three regions alpine desert of Ladakh, subtropical of Jammu and predominantly temperate of Kashmir (Singh and Kachroo, 1976).

The valley is known for its monumental natural landscape including rivers, lakes, mountains, flat plateaus and charming atmosphere with clear air to breath (Anonymous, 1994). The herbaceous perennials have an importance of their own. They comprise a vast group of plants of such widely differing types and characteristics that they are found in all the gardening countries of the world (Miles, 1963).

The monotonous spread of concrete and glass in cities can have a dehumanizing effect. Growing colourful flowers in the house compound and in the parks will greatly enhance the beauty of the surroundings in the countryside, the towns and cities. Flowers also bring happiness to life and boast the sagging spirits. Our old cities and towns are shabby looking. If the

citizens and the municipalities encourage the growing of flowers, at least partly, the cities will look much more gay. This is more true for the new industrial townships that are coming up so frequently and which offer an opportunity for growing flowers for beautification (Randhawa and Mukhopadhyay, 2004).

Plants in their natural habitat, the forest trees, that native shrubs and wild flowers preserved for public enjoyment in innumerable country, state and national parks and forests provide great pleasure and relaxation (Hartmann *et al.*, 1994).

The assemblage and display of colourful and attractive herbaceous perennials can achieve very significant and telling effects on the environment particularly in the landscaping of the house compounds, gardens, parks, health resorts and hotels. However, these plants should occupy only well thought of position in the landscape. Judicious selection of native and introduced herbaceous perennials species should camouflage with the type of habitation, building pattern, colour of the countryside etc. Identification of plant material for this purpose is one of the primary requisites. There are always a number of shady spots in our lawns/gardens especially towards north-east side of a structure where lawn grass fails to grow or show poor growth. These spots can be converted into perennial

herbaceous border of foliage plants. Planting shade loving bulbous plants in irregular clumps makes such spots an appealing and lawn maintenance herbaceous perennials borders (Miles, 1963).

Robin and Carr (1984) suggested the use of native species local to an area. As this opens up a wide new scope of interesting concepts and practices applied to horticulture and is a positive contribution to the process of conservation of world's flora.

Trees and shrubs are often the most dominant plants in landscapes but ground covers and vines play an important role too. The low spreading form of ground covers can connect and unify major planting areas and even serves as a focal point when the plants are flowering (Mielke 1986).

In contrast to annuals, perennials provide savings in time, labour and expenses each year because where adapted to a specific climate zone, they can successfully over winter and re-establish for more than a single growing season (Shuler, 1991).

Perennials are probably the most diverse plant group, providing a huge variety of shape, form, colour, texture and scent with which to design a planting. They range in height from low creeping plants useful for ground cover, to feature plants, such as *Rheum palmatum* to colourful foliage plants

can add contrast to a predominantly mid-green backdrop accentuating each plants structural form (Macoby, 1986).

The interest in landscaping generated during the recent years is no more confined to botanists, horticulturists, herbalists but has extended among the educated classes throughout the country. It is a major leisure activity for a very large number of people, and is a very important means of improving the environment (Corley, 1989).

Perennials with unusual shapes, arrangements, or textures of leaf can also produce eye-catching effects, especially when used as pot plants usually taller feature plants used to accentuate contrasts (Macoby, 1986).

Bulbous plants are grown mainly for their decorative and sometimes fragrant flowers. These can have the delicate appeal of tiny snow drops *Galanthus* or the imposing effect of tall *Gladiolus* spikes (Brickell, 1996).

Since there is an increasing trend and awareness of planned landscaping in the public and in view of its value in preserving the environment, there is an urgent need to identify and select the appropriate native, naturalized and exotic planting material for specific sites /locations in the study area. Little work has been done in this direction under Kashmir conditions so far.

In order to achieve this goal, the present study has been planned with the following objectives :

- To survey and identify the native, naturalized and exotic ornamental herbaceous perennial species.
- To evaluate and classify the identified plant material with respect to their use in landscape design.

## CHAPTER – 2

### REVIEW OF LITERATURE

A critical survey of literature was made to pool the information on “studies on herbaceous perennials for landscape use” which is briefly presented here under :

Kashmir a legendary valley with a wealth of nature’s bounties has excited and captured every one’s imagination for centuries. In this trefoil arch, nature reigns supremes in varied forms. From the imposing mountains, impregnable cliffs, mighty rivers and sparkling glaciers to the emerald streams, the steep hillsides, the beautiful valleys, the boundless plains and the forest clad slopes. This beauty is further boosted by the rich flora which is present in the region. Many of these plants with their magnificent array of flower, foliage and fruit have fascinated tourists, naturalists and flower lovers (Dar *et al.*, 1995).

The important hilly areas of India are located in the temperate northwest Himalayas (Jammu and Kashmir, Himachal Pradesh, Uttar Pradesh) and subtropical east Himalayas (West Bengal, Sikkim, Meghalaya and Arunachal). Although the plant wealth of the Himalayas has been well

documented (Hooker, 1889; Singh and Kachroo, 1976; Kachroo *et al.*, 1977; Lall and Moddie, 1981; Polunin and Stainton, 1984) little has been contributed especially on ornamentals.

## 2.1 Morphology

Blatter (1984) enlisted some commonly grown herbaceous perennials of Kashmir valley like *Aconitum heterophyllum*, *Anemone biflora*, *Caltha palustris*, *Delphinium cashmirianum*, *Dianthus caryophyllus*, *Eryngium*, *Geranium wallichianum*, *Geum elatum*, *Inula grandiflora*, *Lathyrus luteus*, *Lychnis cashmeriana*, *Nelumbium speciosum*, *Paeonia emodi*, *Papaver dubium*, *Podophyllum emodi*, *Ranunculus falcatus*, *Saxifraga ciliate*, *Sedum asiaticum*, *Senecio ligularia*, *Solidago virga-aurea*, *Thlictrum alpinum*, *Trapa bispinosa*, *Trallius acaulis*, *Viola odorata*.

Coventry (1984) while describing the wild flowers of Kashmir enlisted following herbaceous perennials of Kashmir valley like *Colchicum luteum*, *Fritillaria imperialis*, *Saxifraga ligulata*, *Tulipa stellata*, *Anemone obtusiloba*, *Paeonia emodi*, *Podophyllum emodi*, *Nymphaea alba*, *Primula denticulate*, *Primula rosea*, *Caltha palustris*, *Geranium wallichianum*, *Lilium polyphyllum*, *Saxifraga flagellaris*, *Aster diplostephioides*, *Salvia hians*.

Dar *et al.* (1995) reported 184 new records/new taxa of flowering plants of Jammu and Kashmir state belonging to 55 families, 148 species, 12 sub-species, 21 varieties and 3 forms. Vidyarthi (1997) documented the scientific as well as indigenous knowledge about the wild and cultivated plants of Jammu, Kashmir and Ladakh. Hooker (1872) described over 3,80,000 species of plants of India and its adjoining areas based on the collections made in Europe, America and India.

In the continental United States and Canada, Bailey (1949) compiled information on over 2700 plant species of horticultural importance. Hay and Beckett (1971) described 3000 plants, selected for the appeal of the flowers, foliage or fruits along with information on how to identify, cultivate and propagate them, subsequently (Graf, 1973) prepared a comprehensive record of over 11300 plant illustrations, representing 8870 plant species introduced from far tropical and warm climate regions of the world was presented along with the information like growth, shape, texture, flower and foliage description .

Brickell (1996) described the detailed profiles of over 15,000 ornamental plants introduced from temperate climates and illustrated the diverse forms and colour of a spectacular array of plants with the help of over 6,000 photographs.

Sharma (1976) described the native and naturalised ornamental plants of Himachal Pradesh. Among these the important ones were *Bauhinia variegata*, *Clematis montana*, *Eremurus himalaicus*, *Gloriosa superba*, *Jasminum* spp., *Primula* spp. and *Rhododendron arboreum*, which are being used in landscaping.

Conventry (1984) reported that of the total number of different kinds of wild flowers to be found in Kashmir about two hundred and fifty species occur in Great Britain. Kachroo (1985) enlisted several wild plants of interest in Srinagar as *Achillea millefolium*, *Artemisia nilagirica*, *Bergenia liqulata*, *Cannabis sativa*, *Cuscuta reflexa*, *Daphne oleoides*, *Delphinium denudatum*, *Foeniculum vulgare*, *Geranium nepalense*, *Jasminum humile*, *Onosma hispidum*, *Nepeta cataria*.

Hooker (1872) described over 3,80,000 species of plants of India and its adjoining areas based on the collections made in Europe, America and India. Gupta (1928) described the native and naturalised plants of temperate, tropical and subtropical climate in Chakrata, Dehradun and Saharanpur Forest Division of Uttar Pradesh and classified 1150 flowering plants on the basis of their flowering period.

Hitchmough and Woudstra (1999) made a survey of species of exotic (non-native) herbaceous perennials naturalised in grassy swards in a

range of garden and other sites in Britain. Information on site, climate, productivity status and the management regime in operation were provided together with an assessment of the extent to which species are increasing, stable or decreasing.

Kingsbury *et al.* (2004) reported that mild winters in Europe, combined with a long growing season, are favourable to a wide range of plants, including a very wide range of herbaceous perennials in many southern hemisphere species.

Brown (1989) while describing the exceptional flowering perennials for Central Florida presented brief notes on the chief characteristics of *Evolvulus glomerata*, *Salvia farinacea*, *Chrysanthemums*, *Cuphea hyssopifolia*, *Gamolepsis* spp., *Euryops* spp., *Hemerocallis* spp., *Justicia carnea*, *Lantana* spp., *Pentas lanceolata* and *Verbena hybrida*. These species were noted for their outstanding bloom and colour.

Smyth (1937) gave an account of herbaceous perennials in the Himalayan ranges of Garhwal in the state of Uttaranchal. His collection includes *Clematis montana*, *Anemone rupicola*, *Ranunculus hyperboreus*, *Caltha palustris*, *Aquilegia*, *Delphinium denudatum*, *Aconitum heterophyllum*, *Actaea spicata*, *Astilbe rivularis*, *Bergenia stracheyi*,

*Gerbera kunzlana, Primula denticulata, Fritillaria roylei, Iris kumaonensis, Allium humile, Gagea lutea.*

## **2.2 Landscape use**

Landscaping means the beautification of an area by growing plants of different kinds, and organization and development of outdoor space to provide a suitable environment (beauty in form, colour or texture of plant materials) for the living of mankind. Although we depend on nature for our survival, most of us lack an understanding of the ways in which living plants support our life and can improve its conditions. Hence the landscape architect has a primary responsibility for the use of plant materials.

Landscaping today is more important than ever before as the highways, parks and banks of lakes/rivers become more crowded. Beautiful places and quiet retreats where people can relax and enjoy nature became more essential. The planting of landscape plants is an easy and effective way to increase the beauty of tourist sites (Spooner, 1973).

Padha *et al.* (1995) reported that there is a preponderance of bulbous angiosperm vegetation in the Kashmir valley. A definite flowering pattern is suggested with greenish or white flowered plants flowering first followed by yellow, blue and red as atmospheric temperature increases. Chaurasia *et al.* (2006) studied 24 plant species of ornamental values from Ladakh

Himalaya based on ethanobotanical information and aesthetic plant characteristics. Roberts (1989) studied some species which have performed well at the Arboretum as evergreen landscape plants under arid conditions. They are mainly trees and shrubs but included some herbaceous perennials like hostas, bergenias as ground covers under dry California conditions.

Bluhm (1989) listed the native herbaceous perennials of the Pacific Northwest into two groups. The first listing with brief plant description and the 2<sup>nd</sup> list comprising of scientific and common names.

Bulbs demand companionship; they may lead to ground covers to perennials to space out the flowering season, even to trees and shrubs to round out your plantings. This ability to merge into the total garden picture is one of the greatest charms and benefits of bulbs (Miles, 1963).

Ground cover plants with various colours, textures and forms may be combined to make garden features in their own right, or may provide an attractive linking element in a design. A patchwork effect can be created by combining low ground cover plants of different colour and leaf size (Brickell, 1996).

Macoboy (1986) while describing the ways to use perennials reported that on a semi-shaded bank with cool soil one can extend the colour display of Azaleas for months with showy *Astilbe* and *Primula*

species and add foliage interest with variegated *Hostas*. Jindal (1986) described that *Convallaria majalis* is often grown a perennial and is ideal for planting in clumps along lakes or water channels. It is used as a colourful ground cover in areas which are constantly under shade and where grasses cannot grow.

Sehgal and Bhat (1978) Prepared a scheme using woody and herbaceous plants to get round the year flowers for landscaping in the mid hills of Himachal Pradesh.

For the pond, stream or water garden there are moisture loving irises which apart from water, have only one need to be left undisturbed for years on end like *Iris kaempferi*, *Iris laevigata*. For the rock garden there are dwarfs with fascinating flowers in early spring and foliage which need to be unsightly for the rest of year like *Iris innominata* (Harry, 1969).

Miles (1963) reported that bulbs do wonders in the foreground of shrubbery, blend in beautifully with a woodland scene, liven up any border, and some can even compete with turf if their foliage is always allowed to ripen before the grass is mowed. Chas and Unwin (1973) described *Hyacinths* and *Tulips* are the chief formal bedding and border bulbs and they can be most spectacular when planted in blocks of a single colour or in patterned designs of colour and shades. Subsequently, they described that

bulbs in formal beds can be used with other spring flowering subjects for lovely effects. *Pansies, Violas, Aubrieta, Polyanthas, Primorosa* and wall flowers set out as ground cover beneath *Hyacinths, Tulips* and *Daffodils* can be delightful.

David (1989) described native ground covers as the most rugged and worthy plants for use in the modern landscape as they are well adapted to survival, require little maintenance and are aesthetically pleasing.

Since *Daffodils* can stand more shade than many other bulbs, their natural place in the garden is among shrubs, planted irregularly in grass or other less formal parts or grouped at the back of the herbaceous border. *Narcissi* combine excellently with early *Tulips* and *Hyacinths*, while *Chinodoxa* and *Muscari* are also good companions (Ewart et., al 1993).

Shewell (1959) listed some commonly used aquatic plants like *Caltha palustris, Hypericum, Iris laevigata, Oxalis, Ranunculus, Typha, Rumex, Polygonium*. Subsequently, he enlisted rock plants like *Achillea, Anemone, Aquilegia, Arabis, Aster, Aubretia, Bellis, Campanula, Cheiranthus, Chrysanthemum, Convolvulus, Corydalis, Dianthus, Delphinium, Geranium, Geum, Gypsophila, Helianthemum, Hypericum, Inula, linum, lychnis, Nepeta, Denthera, Oxalis, Papaver, Penstemon,*

*Phlox, Polygonum, Potentilla, Primula, Ranunculus, Saxifraga, Solidago, Statice, Viola.*

The tulip known throughout the temperate world represents the aristocrat of a pot, a garden, a field or a forest. Tulips are flowers of rich and brilliant colours and of good substance and the most showy of spring flowers; the habit and shape of the plant are so formal and definite that it is adapted to the vicinity of the buildings, walks and to patios. They are also a charming subject for spotting in singly and in little dumps among shrubbery and along well planted borders (Bailey, 1963).

Hitchmough (1995) studied the selection of herbaceous perennials for meadow or tussock grasslands on urban sites including their establishment and management. Nancy Arbuckle (1993) describes Ground Covers as the practical plants of the landscape-the problem solvers-and are used to integrate and accent the other elements of garden. A well chosen ground cover can be a useful and attractive addition to any home landscape. Sulgrove (1987) described the genus *Hedera*, as an alternative ground cover for shady areas and suggested its use as adornments on walls, fences or trees; as camouflage for stumps and rock piles; as outdoor topiaries; in baskets, barrels and window boxes; and in pleasing designs such as in rock

gardens and around patios. The leaf type of the genus provide a wide range of texture, sizes, shapes and colours to provide contrast in the landscape.

Foliage is one of the greatest importance in perennials as well as their shape and size, colour comes to the fore and it is all too seldom appreciated by gardeners that to arrange plants according to the colours and shape of their leaves is almost as vital as to do so according to the colours of their flowers (Kelly and Hiller, 1995).

Bulbs make perfect partners for specimen trees with deep roots and light deciduous canopies. The flowers of bulbs can complement a tree's habit effectively. White flowered bulbs mirror the white blossom of ornamental cherries (*prunus*), the crisp shape of crocuses echo the chalice form of magnolia blooms, and bulbs with pendent flowers imitate the habit of a weeping tree (Brickell, 1996).

Bhattacharjee (2003) while describing the importance and uses of bulbous plants reported that bulb crops constitute one of the most important groups of ornamental plants for garden decoration.

Whitehead (1965) while describing over 280 species of house plants described the following bulbous and cormous plants for the house as *Colchicum luteum*, *Convallaria majalis*, *Crocus* spp., *Eranthis* spp., *Fressia* spp., *Fritillaria* spp., *Galanthus elwesii*, *Hyacinthus*, *Dutch hyacanthus*, *Ixia*

spp., *Lilium longiflorum*, *Muscari* spp., *Narcissus tazetta*, *Scilla* spp., *Sparaxis* spp., *Tulipa* spp.

Hyacinth is another plant whose blooms give off a heavy fragrance. Wild flower gardening is very informal and while in the larger garden there is no problem in creating drifts of flower bedecked grassland or woodland carpeted with spring flowers (Kingsbury *et al.*, 2004).

Miles (1963) for the purpose of fragrance in landscaping described some bulbs as *Convallaria*, *Fressia*, *Gladiolus*, *Hedychium*, *Hyacinthus*, *Hymenocallis*, *Ixiolirion*, *Lilium*, *Lycoris*, *Muscari*, *Narcissus* and *Tulipa* species and for carpeting, *Anemone*, *Eranthis*, *Galanthus*, *Convallaria*, *Crocus*, *Muscari*, *Ornithogalum-umbellatum* and *Scillas*.

Bhat (1999) held the view that plants play a major role in the protection of our environment by reducing some of the harsher effects of heat, sound, wind, air etc. and delicately hold the balance of the forest by preventing soil erosion, controlling floods, supporting wild life and control air and sound pollution.

Lyons (2008) reported that the demand for and use of herbaceous plants in the landscape has witnessed major changes in the past 25 years in the United States, and often varies within different regions within the

country. A review of some of this plant material includes : perennials that climb and tender perennials for shade.

Jhon *et al.* (2007) evaluated thirty-four hardy ornamental bulbous plant species for their use in landscaping in temperate regions and reported that these plants produced a majestic display in the gardens from early spring until late-fall. Various planting schemes and proper placement of these plants for the maximum effect in the landscape have been suggested.

Korkut (1993) discussed success with landscape planning in urban and rural areas using plants from natural habitats. Natural habitats in the Thrace region have a great potential for provision of plants which can be grown under arid and salt-laden wind conditions. Herbaceous perennials adds to designs not only the interest of flower colour and textural expression but also further dynamic dimensions with their decline in winter and re-emergence in spring (Briggs 1986)

According to Raulston (1988) *Hemerocallis* are among the toughest, most beautiful and widely used landscape perennial plants whose golden yellow flowers contrast well with the plants handsome green foliage

## **CHAPTER – 3**

### **MATERIALS AND METHODS**

The present investigations entitled “Studies on Herbaceous Perennials of Kashmir Valley for Landscape Use” were conducted during the year 2006-07 through 2008-09 in Srinagar, Gulmarg, Sonamarg and Kokernag areas of the Kashmir valley. However, data of two years only are presented (2007-08 as first year and 2008-09 as second year). The year 2006-07 was utilized for preliminary survey and assessment in the natural habitats.

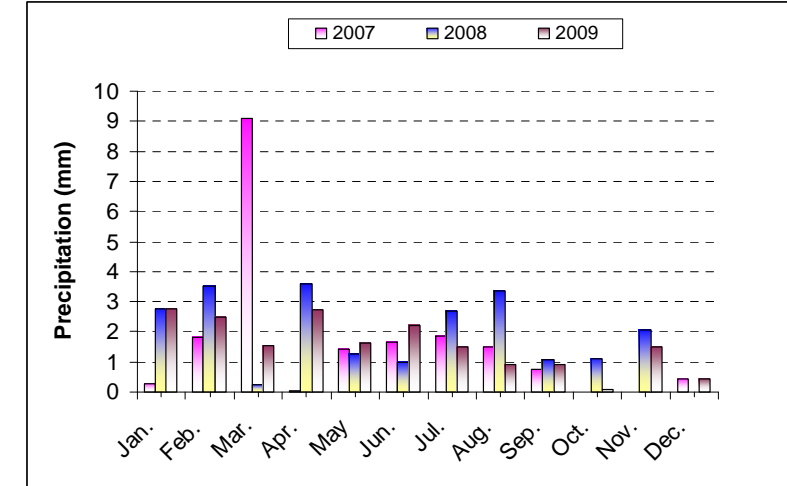
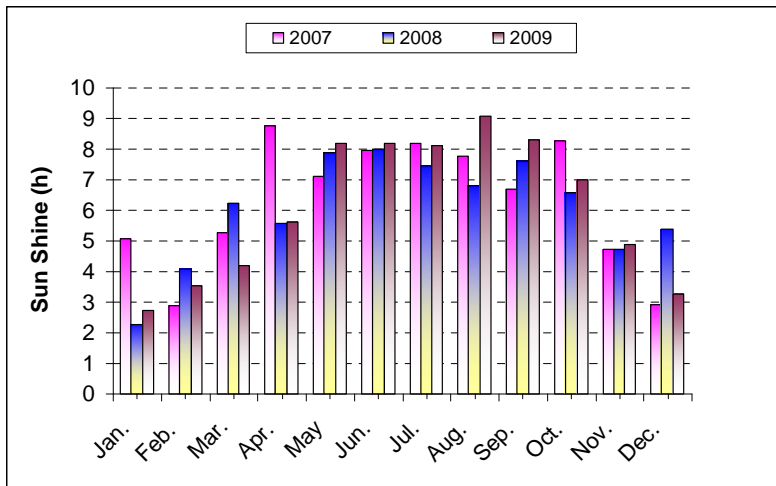
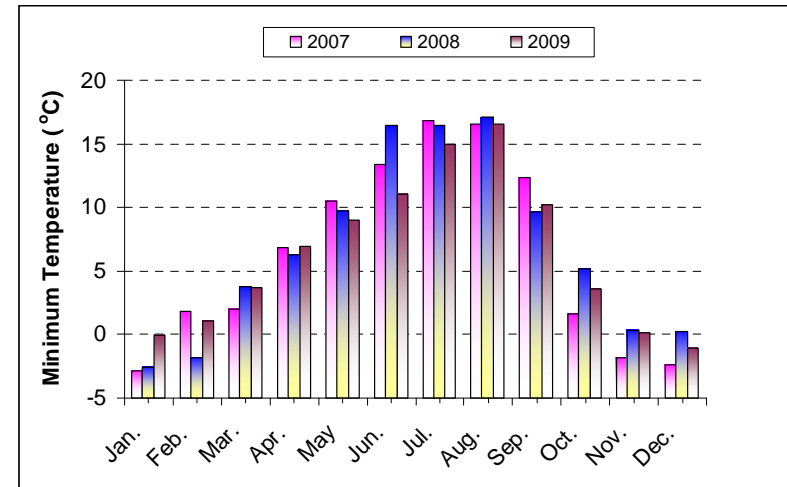
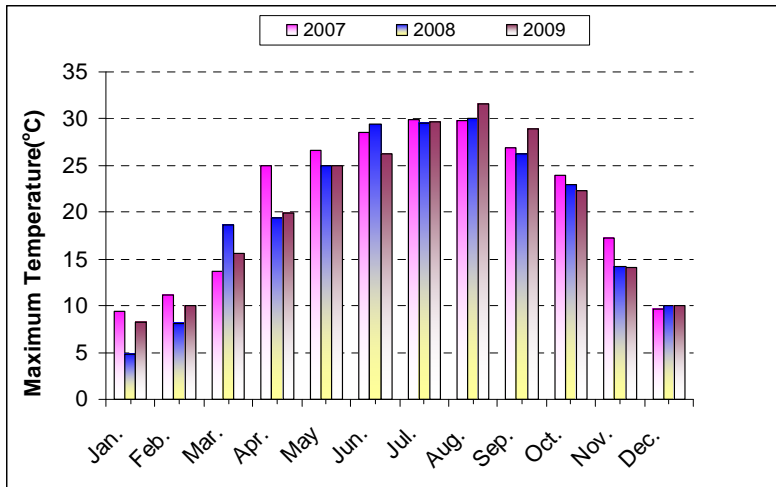
The valley of Kashmir lies between 33°-25' to 34°-50' N of equator and 74 to 75°-50' E of Greenwich and is roughly 135 km long and 114 km wide enclosing an area of about 15853 square kilometre. The average altitude of the valley is about 1800 m while some peaks exceed the height of 4000 m from m.s.l. Kashmir valley is a tectonic valley – an exaggerated dunlying in the synclinal trough between two anticlinal flextures (Pir Panjal and Zanskar) in the middle Himalayas (Kaul and Dar, 1985).

The mean meteorological data for the flowering season was recorded at Srinagar survey site only ( Fig. 1.) as no meteorological observatories are located at other sites of survey.

**Srinagar** : The summer capital of Jammu and Kashmir state, is situated along banks of river Jhelum, flanked on the south-east and north-east by lofty Himalayan ranges. On the base of these ranges on the eastern skirts of Srinagar is the Dal lake and towards the west is the gentle sloping alluvial soil terrain of Jhelum, extending upto Baramulla.

**Sonamarg** : “The meadow of gold” Strewn with flowers and surrounded by snow capped mountains lies on the left bank of Sindh Nallah 83 km towards northeast of Srinagar city situated at an altitude of 2749 metres above mean sea level and is surrounded by sculpturous mountains, dense forests and sparkling glaciers. Below these glaciers are the high level meadows bearing a variety of alpine and sub-alpine vegetation.

**Gulmarg** : Literally meaning “The meadow of flowers” is one of the best picturesque alpine meadows of Kashmir. 35 km to the northwest of Srinagar at an altitude of 2600 metres above mean sea level surrounded by



**Fig. 1 : Temporal change in weather parameter (monthly mean) during the period of study (2007-09)**

[Source : Division of Agronomy, SKUAST-K, Srinagar]

lush green fir forests with a backdrop of snow capped mountain peaks presents a captivating sight and is of immense interest to botanists.

**Kokernag** : is a picturesque place known for its sweet water spring, forest and botanical garden is 80 km from Srinagar at an altitude of 2020 m above mean sea level and is surrounded by many places of interest.

In the present studies, survey and identification of native and introduced herbaceous perennial, bulbous plants and ground covers of ornamental values were made and observations on prominent characteristics related to floristics and landscape use of different species were recorded by making exploratory trips to the following sites of Kashmir valley:

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<b>Site</b>	<b>Location</b>
A – Srinagar	Barzulla, Sheikh Bagh, Sonwar(Gupkar) Shankaracharya Hills, Zaberwan Hills, Dachigam, Nishat, Shalimar, Cheshmashahi, Telbal Hazratbal Naseembagh
B – Sonamarg	Sonamarg, Thajwas
C – Gulmarg	Gulmarg, Tangmarg, Baba Reshi
D – Kokernag	Kokernag, Wangan, Sagan

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### **3.1 Morphology and Distribution**

The valley of Kashmir with predominantly temperate climate is rich in diverse herbaceous flora. Taxonomic character of species have been recorded in accordance with Bailey (1949) and Hooker (1889). Its phytogeographic distribution was traced from various floras while the local distribution was assessed on the basis of presence of various species in different areas/study sites.

### **3.2 Habit and Habitat**

**3.2.1 Habit:** Based on the pattern of growth, different species were categorized in to different shapes as illustrated in Fig-2

**3.2.2 Habitat .**Observations of the herbaceous flora growing at different locations with respect to their light requirements and soil conditions were recorded.

### **3.3 Mature height and spread**

#### **3.3.1 Height**

Height depends on the overall climate, soil, aspect and proximity to other herbaceous perennials.

The height of five representative healthy and mature specimens of herbaceous perennial bulbous plants and ground covers was measured in



**Mat-forming**



**Prostrate and trailing**



**Cushion or Mound forming**



**Spreading**



**Clump forming**



**Stemless**



**Erect**



**Climbing and scandent**

**Fig. 2 : Silhouettes of herbaceous perennials, bulbous plants and ground covers**

cm with the help of measuring tape from the ground level to the top of the plant.

After recording the height, the flora was divided into the following groups as per the procedure/scheme given by McHoy (1985)

<b>Herbaceous perennials (cm)</b>	<b>Bulbs (cm)</b>	<b>Ground covers (cm)</b>
Upto 30	Upto 30	Upto 15
31-60	31-60	16-30
61-90	61-90	> 31
> 90	> 90	

### **3.3.2 Spread**

The spread of herbaceous perennials, Bulbs and ground cover plants was measured in both East - West and North South – direction in cm with the help of measuring tape and average of five representative specimens were calculated. After recording the spread, the flora was divided into the following groups

<b>Herbaceous perennials (cm)</b>	<b>Bulbs (cm)</b>	<b>Ground covers (cm)</b>
Upto 30	Upto 5-15	Upto 15
31-45	16-30	16-30
46-75	>30	> 30
> 75		

**3.4 Time of planting** Planting times of herbaceous perennials, bulbous plants and ground covers in Kashmir Valley was recorded as per season. This is in accordance with the general guideline given by Bob Doyle (1992)

- |   |                             |                         |                           |
|---|-----------------------------|-------------------------|---------------------------|
| • | Early spring<br>(March)     | Mid spring<br>(April)   | Late spring<br>(May)      |
| • | Early summer<br>(June)      | Mid summer<br>(July)    | Late summer<br>(August)   |
| • | Early Autumn<br>(September) | Mid Autumn<br>(October) | Late Autumn<br>(November) |
| • | Early winter<br>(December)  | Mid winter<br>(January) | Late winter<br>(February) |

### **3.5 Flowering Phenology**

Observations on flower emergence, peak blooming period and total duration were recorded from five representative specimens of each species wherever available.

### **3.6 Peculiarities of flower and fruit**

#### **3.6.1 Flower colour**

The colour of the full open flowers was visually recorded and on the basis of hue of flowers, plants were divided into following groups:

- i) White and Off White colour
- ii) Red and Pink colour
- iii) Blue and Violet colour
- iv) Yellow and Orange colour
- v) Brown colour

The flower colour was also recorded with RHS (Royal Horticulture Society) colour chart to ensure as much uniformity of result as possible. To record the colour the specimens comprising of two or three average blooms, the completely open flower were examined and matched indoor in a good north light as soon after cutting as possible; not in faded or limp condition.

### **3.6.1 Fruit shape**

Plants were grouped into various categories on the basis of shape of their fruit. These includes Cylindrical, Erect, Globular, Ovoid, Angled, Oblong, Hexagonal and Loculicidal shaped fruits.

## **3.7 Fragrance**

### **3.7.1 Fragrant flowers**

Fragrance of flowers was recorded by smelling for common man intresting in gardening and were divided into three groups.

- i) Mildly fragrant
- ii) Moderately fragrant
- iii) Strongly fragrant

**3.8 Foliage texture** Foliage texture was divided in to three groups on the basis of procedure given by Harlow et al;(1996)

- i) Coarse : A very rough surface, prickly,hairy
- ii) Medium : Compratively less rough surface, glabrous,finely tomentose
- iii) Fine : Very soft, glaucous surface

### 3.8 Propagation

On different modes of propagation of species, information has been drawn from a wide range of literature as well as from field observations.

### 3.9 Landscape use

Based on natural habit of growth, phenology, flower colour, fruit shape and colour, foliage colour, shape and texture, the species were grouped for the following landscape uses.

<b>Medium to tall growing herbaceous perennials</b>	<b>Bulbous plants</b>	<b>Ground covers (low growing herbaceous perennials)</b>
Beds	Rock garden	Rock garden
Borders	Beds	Beds
Pathways	At the base of trees	At the base of trees
Woodlands	Pond plants	Pond plants
Rock gardens	Ground covers	Ground covers
Companion plant	Specimen plants	Specimen plants
Ground covers	Back drop	Lightly shaded area
Specimen plants	Lightly shaded area	Sunny areas
Back drop	Pool	Pool

### **3.10 Percentage of Classified Taxa**

The percentage of perennials surveyed was calculated by dividing the plants into three different groups

- i) Herbaceous perennials
- ii) Bulbous plants
- iii) Ground covers

## CHAPTER – 4

### EXPERIMENTAL FINDINGS

The present investigation entitled “Studies on Herbaceous Perennials of Kashmir Valley for Landscape Use” was undertaken to generate information on morphology and distribution, habit, habitat, mature height and spread, foliage colour, texture, propagation and landscape use of herbaceous perennials of four representative locations of the valley viz., Srinagar, Sonmarg, Gulmarg and Kokernag.

The salient findings of the study are presented in this chapter.

#### 4.1 Morphology and Distribution

An analysis of the morphology and distribution of the floristic elements studied is detailed below :

##### *Achillea filipendulina* Lam

Clump forming, evergreen perennial with rosettes of oblong, 1 or 2 pinnate, mid- to grey-green leaves. Strong leafy stems bear golden yellow flower heads in flat corymbs 12 cm across from early summer to early autumn. Fruit an achene. Achenes without any pappus.

##### **Distribution**

**Global** : Caucasus

**Local** : Srinagar, Kokernag, Gulmarg. Alt.1585-2730 m.



*Gypsophila paniculata*



*Solidago canadensis*



*Liatris spicata*



*Achillea filipendulina*

Plate – 1 Herbaceous perennials

**Table-1 : Herbaceous perennials, bulbous plants and ground covers for landscape use**

S. No.	Scientific name	Vernacular name	English name	Family	Frequency	Status
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	<i>Achillea filipendulina</i> Lam	-	Fern leaf yarrow	Asteraceae	Moderate	Exotic
2.	<i>Achillea millefolium</i> L.	Pahel gasse, Berium	Milfoil	Asteraceae	Abundant	Native
3.	<i>Achillea ptarmica</i> L.	-	Sneezewort	Asteraceae	Moderate	Native
4.	<i>Aconitum heterophyllum</i> Wall.	-	Aconite	Ranunculaceae	Moderate	Exotic
5.	<i>Aconitum napellus</i> L.	-	Aconite, Monkshood	Ranunculaceae	Moderate	Exotic
6.	<i>Adiantum-capillus Veneris</i>	Geowtheer	True-maidenhair fern	Adiantaceae	Abundant	Native
7.	<i>Agapanthus africanus</i> Hoffmigg	-	Blue African lily, African lily	Liliaceae	Moderate	Exotic
8.	<i>Ajuga reptans</i> L.	-	Bugle	Labiatae	Moderate	Native
9.	<i>Alcea rosea</i> Cav.	Saze posh	Hollyhock	Malvaceae	Abundant	Native
10.	<i>Alstroemeria aurantiaca</i> D.Don	-	Peruvian Lily	Alstroemeriaceae	Moderate	Exotic
11.	<i>Amaryllis belladonna</i> L.	-	Belladonna lily	Amaryllidaceae	Moderate	Native

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)
12.	<i>Anemone biflora</i> D.C.	-	Windflower	Ranunculaceae	Abundant	Native
13.	<i>Anemone x hybrida</i> Paxt	-	Japanese anemone	Ranunculaceae	Moderate	Exotic
14.	<i>Aptenia cordifolia</i> Schwant	-	Dew plant	Aizoaceae	Rare	Exotic
15.	<i>Aquilegia canadensis</i> L.	-	Columbine	Ranunculaceae	Moderate	Exotic
16.	<i>Aquilegia vulgaris</i> L.	-	Alpine columbine, Granny's bonnet	Ranunculaceae	Rare	Native
17.	<i>Arundo donax</i> L.	Narkoon	Giant reed	Gramineae	Abundant	Native
18.	<i>Asparagus officinalis</i> L.	Parglass	Asparagus fern	Asparagaceae	Moderate	Exotic
19.	<i>Aspidistra elatior</i> Blume	-	Cast-iron plant	Liliaceae	Moderate	Native
20.	<i>Aster alpinus</i> L.	-	Michaelmas, Easter Daisy	Asteraceae	Abundant	Native
21.	<i>Aubrieta deltoide</i> D.C.	-	Aubretia	Cruciferae	Moderate	Exotic
22.	<i>Begonia evansiana</i> Andr.	-	Begonia	Begoniaceae	Moderate	Exotic
23.	<i>Begonia x semperflorens</i> Link & Otto	-	Fibrous rooted Begonia	Begoniaceae	Moderate	Exotic
24.	<i>Begonia x tuberhybrida</i> Voss.	-	Multiflora and pendula begonias	Begoniaceae	Moderate	Exotic
25.	<i>Belamcanda chinensis</i> D.C	-	Blackberry-lily, Leopard lily	Iridaceae	Rare	Native

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)
26.	<i>Bellis perennis</i> L.	-	True or English Daisy, Common Daisy, Shasta Daisy	Asteraceae	Abundant	Native
27.	<i>Bergenia ciliata</i> (How.) sternb	Zakhmi-Hayat	Elephant eared Saxifrage, Elephant's ears	Saxifragaceae	Abundant	Native
28.	<i>Caltha palustris</i> L.	-	King cup, Marsh marigold, Bigwatercup, Blob	Ranunculaceae	Abundant	Native
29.	<i>Campanula latifolia</i> L.	-	Giant bell flower	Campanulaceae	Abundant	Native
30.	<i>Campanula medium</i> L.	-	Canterbury bells	Campanulaceae	Moderate	Native
31.	<i>Canna indica</i> L.	-	Indian shot canna	Cannaceae	Abundant	Native
32.	<i>Centaurea montana</i> L.	-	Mountain Bluet, Hardheads, Knapweed	Asteraceae	Moderate	Native
33.	<i>Cerastium tomentosum</i> L.	-	Snow in summer	Caryophyllaceae	Moderate	Exotic
34.	<i>Cheiranthus cheiri</i> L.	-	Wall flower, Bee flower	Cruciferaceae	Moderate	Native

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)
35.	<i>Chrysanthemum leucanthemum</i> L.	-	Marguerite daisy, Ox-eye Daisy, white weed	Asteraceae	Abundant	Native
36.	<i>Clivia miniata</i> Regel.	-	Kaffir lily	Amaryllidaceae	Rare	Exotic
37.	<i>Colchicum luteum</i> Baker	<i>Vir-e-koem,</i> <i>Suranjan-e-</i> <i>talkh</i>	Autum crocus, Naked ladies	Ranunculaceae	Abundant	Native
38.	<i>Convallaria majalis</i> L.	-	Lily of the valley, May flower	Convallariaceae	Moderate	Exotic
39.	<i>Coreopsis grandiflora</i> Hogg.	-	Tickseed	Asteraceae	Abundant	Native
40.	<i>Coreopsis lanceolata</i> L.	-	Tickseed, calliopsis	Asteraceae	Abundant	Native
41.	<i>Crococsmia masoniorum</i> L.	Planch	Montbretia	Iridaceae	Moderate	Native
42.	<i>Crocus chrysanthus</i> Herb	-	Winter crocus	Iridaceae	Moderate	Exotic
43.	<i>Crocus sativus</i> L.	Kong	Saffron crocus	Iridaceae	Anundant	Native
44.	<i>Cynara cardunculus</i> L.	-	Cardoon	Asteraceae	Moderate	Native
45.	<i>Dahlia variabilis</i> L.	-	Dahlia	Compositiae	Abundant	Exotic
46.	<i>Delphinium elatum</i> L.	-	Larkspur, Candle larkspur	Ranunculaceae	Moderate	Native

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)
47.	<i>Dendranthema x grandiflorum</i> Kitam	-	Florists Chrysanthemum	Asteraceae	Abundant	Exotic
48.	<i>Dianthus barbatus</i> L.	-	Sweet William	Caryophyllaceae	Abundant	Exotic
49.	<i>Dianthus caryophyllus</i> L.	Gulmirjan	Carnation, Clove pink, Gilly flower, Picotee Grenadine	Caryophyllaceae	Moderate	Exotic
50.	<i>Dianthus chinensis</i> L.	-	Indian pink, Rainbow pink, Chinese Pink	Caryophyllaceae	Abundant	Native
51.	<i>Digitalis lanata</i> Ehrh.	-	Foxglove, Grecian Foxglove	Scrophulariaceae	Abundant	Native
52.	<i>Digitalis purpurea</i> L.	-	Common Foxglove	Scrophulariaceae	Moderate	Native
53.	<i>Echinacea purpurea</i> Moench	-	Cone flower	Asteraceae	Moderate	Exotic
54.	<i>Eranthis hyemalis</i> Salisb	-	Winter aconite	Ranunculaceae	Moderate	Native
55.	<i>Eremurus himalaicus</i> Baker	-	Desert candle, Foxtail lily	Asphodelaceae	Abundant	Native
56.	<i>Eryngium biebersteinianum</i> Nevski ex Bobrov	-	Eryngo	Umbelliferae	Moderate	Native

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)
57.	<i>Euphorbia stracheyi</i> Bioss	-	Milkweed, spurge	Euphorbiaceae	Abundant	Native
58.	<i>Fressia x hybrida</i> Bailey	-	Fressia	Iridaceae	Rare	Exotic
59.	<i>Fritillaria imperialis</i> L.	Pilyari, Ganda, Pra- Neh-posh	Crown imperial, Fritillary	Liliaceae	Abundant	Native
60.	<i>Gagea elegans</i> Wallich ex. D.Don	-	Yellow-star-of- Bethlehem	Liliaceae	Moderate	Native
61.	<i>Galanthus nivalis</i> L.	-	Common snowdrop	Amaryllidaceae	Moderate	Native
62.	<i>Gazania niveae</i>	-	Gazania	Compositae	Moderate	Exotic
63.	<i>Gazania x splendens</i> Moore	-	Treasure flower	Composite	Moderate	Exotic
64.	<i>Geranium rectum</i> Trautv	-	Cranesbill	Geraniaceae	Abundant	Native
65.	<i>Geranium wallichianum</i> D.Don	Kow ashud	Wallich's Cranesbill	Geraniaceae	Abundant	Native
66.	<i>Gerbera jamesonii</i> Bol. ex Adlam	-	Barberton Daisy/ Transversal Daisy	Asteraceae	Rare	Exotic
67.	<i>Gladiolus byzanthus</i>	-	Gladioli	Iridaceae	Moderate	Exotic
68.	<i>Gloriosa rothschildiana</i> O'Brien	-	Glory or climbing lily	Colchicaceae	Rare	Exotic
69.	<i>Gypsophila paniculata</i> L.	-	Baby's-breath	Caryophyllaceae	Moderate	Exotic

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)
70.	<i>Hedychium gardnerianum</i> Wall.	-	Kahili ginger, False ginger lily	Zingiberaceae	Rare	Exotic
71.	<i>Helenium autumnale</i> L.	-	Sneeze weed, Helen's flower	Asteraceae	Moderate	Native
72.	<i>Helianthus autumnale</i>	-	False sunflower	Compositae	Moderate	Exotic
73.	<i>Helianthus x multiflorus</i>	-	Perennial sunflower	Compositae	Moderate	Exotic
74.	<i>Helleborus niger</i> L.	Hinn Khorosanikutki	Winter rose, Christmas rose	Compositae	Moderate	Native
75.	<i>Hemerocallis flava</i> L.	-	Common yellow- Day lily	Hemerocallidaceae	Abundant	Exotic
76.	<i>Hesperis matronalis</i> L.	-	Dame's violet, Sweet rocket	Brassicaceae	Rare	Exotic
77.	<i>Hippeastrum puniceum</i> Urban	-	Giant Amaryllis	Amaryllidaceae	Rare	Exotic
78.	<i>Hosta lancifolia</i> Engler	-	Narrow-leaved plantain-lily	Hostaceae	Moderate	Native
79.	<i>Hosta plantaginea</i> Aschers	-	Fragrant-plantain lily	Hostaceae	Moderate	Native
80.	<i>Hyacinthus orientalis</i> L.	-	Common hyacinth	Hycinthaceae	Abundant	Native
81.	<i>Inula royleana</i> C.B. Clarke	-	Eye of christ	Asteraceae	Abundant	Native

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)
82.	<i>Iris ensata</i> Thunb.	Krashim, Krishum	Blue flag, Japanese iris	Iridaceae	Abundant	Native
83.	<i>Iris germanica</i> L.	-	German iris, Tall bearded iris	Iridaceae	Moderate	Exotic
84.	<i>Iris 'Gingerbread Man'</i>	-	Iris	Iridaceae	Rare	Exotic
85.	<i>Iris japonica</i> Thunb	-	Iris	Iridaceae	Rare	Exotic
86.	<i>Iris kashmeriana</i> Baker	Mazarmond	Iris	Iridaceae	Abundant	Native
87.	<i>Iris reticulata</i> M. Bieb	-	Spanish iris	Iridaceae	Abundant	Native
88.	<i>Iris tectorum</i> Maxim	-	Roof iris	Iridaceae	Rare	Exotic
89.	<i>Iris unguicularis</i> Poir	-	Iris	Iridaceae	Rare	Exotic
90.	<i>Ixiolirion karateginum</i> Lipsky	-	Ixiolirion	Amaryllidaceae	Rare	Native
91.	<i>Kalanchoe blossfeldiana</i> V. Poellnitz	-	Kalanchoe	Crassulaceae	Rare	Exotic
92.	<i>Kniphofia uvaria</i> Hook	-	Red hot poker, Torch lily	Asphodelaceae	Moderate	Native
93.	<i>Lathyrus latifolius</i> L.	-	Everlasting pea	Leguminosae	Moderate	Exotic
94.	<i>Lavendula angustifolia</i> Mill.	-	Lavender	Labiatae	Moderate	Native
95.	<i>Leucojum aestivum</i> L.	-	Snowflake	Amaryllidaceae	Moderate	Native

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)
96.	<i>Liatris spicata</i> Willd.	-	Blazing star Gay-feather	Asteraceae	Rare	Exotic
97.	<i>Lilium auratum</i> Lindl.	-	Goldband lily, golden rayed lily	Liliaceae	Moderate	Exotic
98.	<i>Lilium candidum</i> L.	-	Madonna lily	Liliaceae	Moderate	Exotic
99.	<i>Lilium longiflorum</i> Thunb.	-	White trumpet lily, Easter lily	Liliaceae	Moderate	Native
100.	<i>Limonium latifolium</i> Kuntze	-	Sea-lavender	Plumbaginaceae	Moderate	Native
101.	<i>Lunaria annua</i> L.	-	Moonwort, Satin-flower, Honesty	Cruciferae	Rare	Exotic
102.	<i>Lupinus polyphyllus</i> Lindl.	-	Lupine	Caryophyllaceae	Abundant	Native
103.	<i>Lycoris radiata</i> Herb.	-	Red spider lily	Amaryllidaceae	Moderate	Native
104.	<i>Lythrum salicaria</i> L.	-	Spiked or Purple loose strife	Lythraceae	Moderate	Exotic
105.	<i>Matthiola incana</i> R. Br.	-	Gilly flower, Stock	Brassicaceae	Rare	Native
106.	<i>Mimulus nepalensis</i> Benth.	-	Monkey flower, Mush flower	Scrophulariaceae	Abundant	Native
107.	<i>Mirabilis jalapa</i> L.	Abose	Four O'clock flower, Marvel-of-Peru	Nyctaginaceae	Moderate	Native

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)
108.	<i>Muscari armeniacum</i> Leicht.	-	Grape hyacinth	Hyacinthaceae	Moderate	Native
109.	<i>Narcissus pseudonarcissus</i> L.	-	Trumpet narcissus	Amaryllidaceae	Abundant	Native
110.	<i>Narcissus tazetta</i> L.	Yamberzal	Polyanthus narcissus, white narcissus	Amaryllidaceae	Abundant	Native
111.	<i>Nelumbo nucifera</i> Gaertn.	Nadur	Lotus, Chinese water lily	Nelumbonaceae	Abundant	Native
112.	<i>Nepeta nervosa</i> Royle ex benth	-	Catmint	Labiatae	Moderate	Native
113.	<i>Nerine bowdenii</i>	-	Spider lily	Amaryllidaceae	Moderate	Native
114.	<i>Nymphae stellata</i> Willd.	Bum-e-posh	Indian blue water lily	Nymphaeaceae	Abundant	Native
115.	<i>Oenothera biennis</i> L.	Sham Sunder	Evening primrose	Onagraceae	Moderate	Native
116.	<i>Ornithogalum umbellatum</i>	-	Star of Bethlehem	Hyacinthaceae	Moderate	Native
117.	<i>Paeonia emodi</i> Wall. ex Royle	Mid	Himalayan peony	Paeoniaceae	Abundant	Native
118.	<i>Paeonia lactiflora</i> Pall	-	Peony	Paeoniaceae	Rare	Exotic
119.	<i>Papaver orientale</i>	-	Oriental poppy	Papaveraceae	Moderate	Exotic
120.	<i>Penstemon barbatus</i>	-	Bearlip penstemon	Scrophulariaceae	Moderate	Exotic

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)
121.	<i>Phlox paniculata</i> L.	-	Summer perennial phlox	Polemoniaceae	Moderate	Native
122.	<i>Physalis alkekengi</i> L.	-	Winter cherry Chinese lantern plant	Solanaceae	Moderate	Native
123.	<i>Platycodon grandiflorum</i> A.DC.	-	Balloon flower	Campanulaceae	Rare	Exotic
124.	<i>Primula denticulata</i> Smith	-	Drum stick primula	Primulaceae	Abundant	Native
125.	<i>Primula rosea</i> Royle	-	Primrose	Primulaceae	Abundant	Native
126.	<i>Primula vulgaris</i> Huds	-	Primrose	Primulaceae	Abundant	Native
127.	<i>Ranunculus falcatus</i> L.	-	Turban flower	Ranunculaceae	Moderate	Exotic
128.	<i>Rheum australe</i> D. Don.	Pumbachalan	Rhubarb	Polygonaceae	Moderate	Native
129.	<i>Rudbeckia fulgida</i> Ait.	-	Black eyed susan	Asteraceae	Abundant	Native
130.	<i>Rudbeckia laciniata</i> L.	-	Cone flower	Asteraceae	Abundant	Native
131.	<i>Salvia sclarea</i> L.	-	Biennial clary	Labiatae	Moderate	Exotic
132.	<i>Santolina chamaecyparissus</i> L.	-	Cotton lavender	Asteraceae	Abundant	Exotic
133.	<i>Saxifraga stonilfera</i>	-	Saxifrage	Saxifragaceae	Moderate	Native
134.	<i>Scilla bifolia</i> L.	-	Blue bell, squill	Hyacinthaceae	Moderate	Native
135.	<i>Scilla siberica</i> Haw.	-	Siberian squill	Hyacinthaceae	Moderate	Native
136.	<i>Sedum spectabile</i> Boreau	-	Ice plant	Crassulaceae	Abundant	Native
137.	<i>Senecio cineraria</i> DC.	-	Dusty miller	Asteraceae	Moderate	Exotic
138.	<i>Sisyrinchium striatum</i> Smith	-	Satin flower	Iridaceae	Rare	Exotic
139.	<i>Solidago canadensis</i> L.	-	Golden rod	Asteraceae	Moderate	Native

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)
140.	<i>Sprekelia formosissima</i> Herb.	-	Jacobeian lily Aztec lily	Amaryllidaceae	Rare	Exotic
141.	<i>Stachys byzantina</i>	-	Lams's ears, Lams's lugs, Lams's tails	Labiatae	Rare	Exotic
142.	<i>Sternbergia lutea</i> Roem and Schult	-	Autumn daffodil	Amaryllidaceae	Abundant	Native
143.	<i>Thymus serpyllum</i> L.	Javend	Thyme	Labiatae	Abundant	Native
144.	<i>Tradescantia sillamontana</i>	-	White velvet	Commelinaceae	Moderate	Exotic
145.	<i>Tradescantia virginiana</i> L.	-	Trinty flower common spiderwort	Commelinaceae	Rare	Exotic
146.	<i>Tragopogon pratensis dubins</i> Scop.	-	Goats beard	Compositae	Rare	Native
147.	<i>Tulipa clusiana</i> D.C.	-	Lady Tulip	Liliaceae	Abundant	Native
148.	<i>Tulipa lanata</i> Rgl	-	Mughul Tulips	Liliaceae	Abundant	Native
149.	<i>Typha angustifolia</i> Bory and Chaub	Petch, kala roow	Lesser bulrush	Typhaceae	Abundant	Native
150.	<i>Verbascum thapsus</i> L.	Budertant	Aaron's rod, great mullein.	Scrophulariaceae	Abundant	Native
151.	<i>Viola odorata</i> L.	Banufsha	English violet, garden violet, sweet violet	Violaceae	Abundant	Native
152.	<i>Zantedeschia aethiopica</i> Spreng	-	Arum lily, calla of gardeners	Araceae	Abundant	Native
153.	<i>Zantedeschia elliottiana</i> Engler	-	Golden arum, golden calla	Araceae	Rare	Exotic



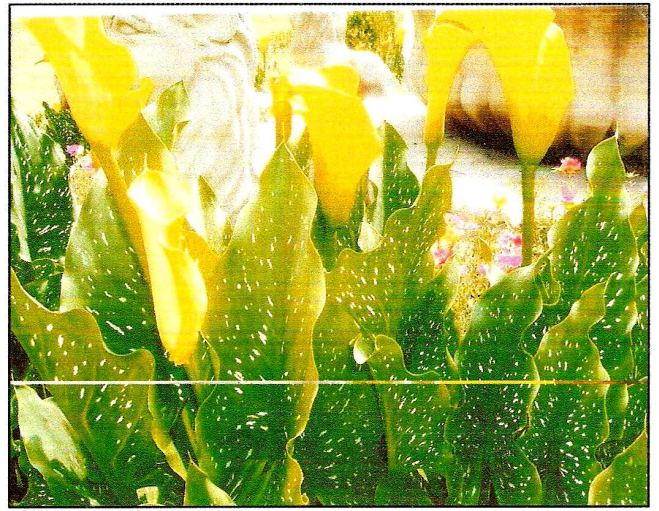
*Crocus chrysanthus*



*Galanthus nivalis*



*Fritillaria imperialis*



*Zantedeschia elliottiana*

Plate – 2 Bulbous plants

***Achillea milifolium* L.**

Mat forming and invasive perennial with 2 to 3 pinnate, lanceolate leaves the lower being petiolate. Stems erect, simple, somewhat woolly. Inflorescence composed of numerous heads arranged in a corymb. Heads 5 mm in diameter. Bracts of the involucre with brown or blackish papery margins Ray florets female, disk florets hermaphrodite. Achenes without pappus 2 mm long not ribbed. Plant strongly scented.

**Distribution**

**Global** : Europe, W. Asia

**Local** : Srinagar. Alt. 1585 m.

***Achillea ptarmica* L.**

Strong, rhizomatous perennial with simple linear lanceolate, sessile, finely toothed dark green leaves 1.5 to 7.5 cm long. Stem erect, angular. Inflorescence a lax corymb of heads. Heads heterogamous, 1.2 to 1.7 cm in diameter. Ray florets female, ligulate white. Disk florets hermaphrodite, tubular creamy or greenish white. Achenes without pappus, 1.5 mm long.

**Distribution**

**Global** : Greece, Turkey, Europe

**Local** : Srinagar. Alt. 1585 m

***Aconitum heterophyllum* Wall**

Perennial, erect, leafy, lower leaves petioled, upper ovate cordate, incised, amplexicaule; racemes paniced, follicles 5; flowers blue in colour. Fruit is a follicle. Follicles five in number.

**Distribution**

**Global** : Central, South and Eastern Europe

**Local** : Sonmarg, Gulmarg. Alt. 2439-2730 m.

***Aconitum napellus* L.**

Variable erect perennials with rounded, deeply 5-7 lobed, dark green leaves, the lobes toothed or further divided. Bears dense racemes of indigo blue flowers in mid and late summer. Fruit is of 3-5 hairy follicles, cylindrical in shape.

**Distribution**

**Global** : North and Central Europe

**Local** : Gulmarg, Sonamrg. Alt. 2439-2730 m

***Adiantum capillus - Veneris* L.**

A very delicate tufted fern. Fronds 6 inches to near a foot long, twice or thrice pinnate, usually broadly ovate in general outline, their slender stalk

of a shining brownish black. Segments obovate or fan shaped, 4 to 8 lines broad, all narrowed at the base in to a short, slender stalk, more or less divided in to wedge shaped, obtuse lobes, thin and of a bright green without any midrib, but numerous forked veins converging at the base sori conspicuous occupying the extremities of most of the lobes of the segments.

**Distribution**

**Global** : Temperate and tropical regions world wide

**Local** : Nishat, Shalimar, Cheshmashahi. Alt. 1585-1676 m

***Agapanthus praecox* Hoffmg**

Clump forming evergreen perennials with broad, strap-shaped dark green leaves 30 to 70 cm long. Bears large, rounded umbels, 15 to 30 cm across of trumpet shaped rich mid blue flowers 4 to 6 cm long in late summer and early autumn. Fruit is loculicidal capsule.

**Distribution**

**Global** : South Africa

**Local** : Cheshmashahi, Dachigam. Alt. 1676-1829 m.

***Ajuga reptans* L.**

Creeping, evergreen rhizomatous perennial with decussate, leaves 7.5 cm long, obovate to oblong margins usually crenate; the lower forming

the basal rosette. Flowers in several usually distant whorls, supported by leaf like bluish bracts, zygomorphic hermaphrodite. Calyx campanulate, Corolla bilabiate. Fruit of 4 nutlets, obovoid, surface reticulate.

**Distribution**

**Global** : Europe, Caucasus, Iran

**Local** : Srinagar, Kokernag, Gulmarg. Alt. 1585-2730 m.

***Alcea rosea Cav***

Vigorous, upright perennial producing rounded roughly hairy, light green leaves to 3.5 cm long, cut in to 3 to 7 shallow lobes. Long terminal racemes of single, purple pink, white or yellow flowers 5 to 10 cm across are borne in early and mid summer. Consists of compressed beakless. 1-seeded carpels.

**Distribution**

**Global** : W. Asia

**Local** : Srinagar, Gulmarg. Alt. 1585-2730 m

***Alstroemaria aurantiaca D. Don***

Tuberous perennial bearing 3 to 7 rayed umbles each ray with 1 to 3 bright orange or yellow, funnel shaped about 8 cm across flowers, the inner

tepals streaked dark red in summer. Leaves lance shaped grey green in colour. Fruit is a loculicidal capsule.

**Distribution**

**Global** : South America, Chile

**Local** : Bagat, Sheikhabagh, Nishat, Shalimar. Alt. 1585 m

***Amaryllis belladonna* L.**

Bulbous perennial producing, stout, purple or purple-green stems with umbels of 6 or more funnel shaped, scented pink flowers, 6 to 10 cm long, in autumn strap shaped, fleshy leaves, 22 to 40 cm long are produced after flowering. Fruit a capsule, with several seeds, opening in 3 valves.

**Distribution**

**Global** : South Africa

**Local** : Nishat, Shalimar, Cheshmashahi. Alt. 1585-1676 m

***Anemone biflora* D.C**

A small tuberous perennial, with radical leaves, 2-5 cm in diameter, long petioled, 3-partite or 3 foliolate, the leaf segments rounded or cuneate, deeply cut in to narrow lobes or toothed. Flowers appearing at the same time as the leaves; when freshly opened pure white or bright carmine or white diffused with carmine, turning brownish or dull red when over

mature; 2-3 cm in diameter on a leafless scape bearing 1 to 3 pedicelled flowers with 3 involucre bracts at the base of the pedicles. Achenes with short styles imbedded in dense wool.

**Distribution**

**Global** : Turkestan and Eastwards to Persia

**Local** : Shalimar, Nishat, Shankaracharya. Alt. 1585-1864m.

***Anemone x hybrida* Paxt.**

Vigorous, erect woody based perennial with suckering shoots and oval, usually 3-palmate, toothed mid green leaves, softly hairy beneath. Basal leaves are 10 to 20 cm long. Stem leaves are 5 to 12 cm long. Branched stems bear umbels of 12 to 18 cm, single white flowers, pink tinged on the reverse with golden yellow stamens in late summer and mid-autumn. Fruit a group of achenes, oblong in shape.

**Distribution**

**Global** : East Asia

**Local** : Barzulla, Nishat, Shalimar, Telbal. Alt. 1585 m

***Aptenia cordifolia* Schwant**

Freely branching, perennial succulent with cylindrical, greyish green stems, to 60 cm long and broadly ovate, fleshy bright green leaves 2.5 cm

long. Solitary, terminal or lateral, red purple flowers, to 1.5 cm across are borne in summer and autumn. Fruit is a 4-celled capsule.

**Distribution**

**Global** : East South Africa

**Local** : Nishat, Shalimar, Cheshmashahi. Alt. 1585-1676 m

***Aquilegia canadensis* L.**

Airy, Perennial with 2 ternate, fern like, dark green leaves divided in to leaflets, 1 to 2 cm long. Bears terminal, leafy racemes of up to 20 nodding flowers from mid-spring to mid-summer. The sepals are scarlet and forward pointing, lemon yellow petals taper in to straight, erect red spurs, 1.5 cm long; the stamens and styles extend outwards and downwards. Fruit is a follicle.

**Distribution**

**Global** : East Canada to South USA

**Local** : Sonmarg, Gulmarg. Alt. 2439-2730 m

***Aquilegia vulgaris***

These aquilegias of rare beauty are numbered amongst the tall mountain perennials. Upright perennial with finely divided ternate or 2 ternate bluish green leaves divided in to leaflets, 3 cm long. Bears terminal leafy racemes of 2 or 3 nodding blue flowers, sometimes with white petal

tips and with straight and curving spurs, to 2.5 cm long, in late spring. Fruit is a follicle.

**Distribution**

**Global** : France, Switzerland, Austria

**Local** : Sonmarg, Gulmarg. Alt. 2439-2730 m

***Arundo donax* L.**

Clump forming rhizomatous perennial with stout stems and arching, broadly linear, mid-green, glaucous leaves, to 60 cm long. In mid and late autumn, produces terminal panicles of light green to purple spikelets to 60 cm long. Fruit is a nut, ovoid in shape.

**Distribution**

**Global** : South Europe

**Local** : Srinagar Alt. 1585 m

***Asparagus officinalis* L.**

Stems erect and much branched; usually 2 feet high in the wild state attaining 4.5 feet when cultivated and elegantly featured by the numerous clusters of fine subulate cladodes, about 2 cm long. Flowers small of a greenish white, hanging on slender pedicels, 2 or 3 together in the axils of

the principal branches, many of them with stamens only. Fruit a berry, berries small, red and globular.

**Distribution**

**Global** : South Africa

**Local** : Gulmarg. Alt. 2730 m

***Aspidistra elatior* Blume**

Rhizomatous perennial, usually grown as a house plant, with ovate to lance-shaped glossy, dark green leaves, 30 to 50 cm long, produced single at short intervals along the rhizomes. Erect, fleshly, broadly bell shaped 8 lobed cream flowers, 2 to 3 cm across and maroon inside, are borne single along the rhizomes in early summer. Fruit is one seeded berry.

**Distribution**

**Global** : Himalayas, China and Japan

**Local** : Dachigam. Alt. 1829 m

***Aster alpines* L.**

Spreading clump forming perennial with short-stalked, spoon shaped to narrowly lance shaped mid green leaves, to 9 cm long. Bears solitary



*Bergenia ciliata*



*Muscari armeniacum*



*Bellis Perennis*



*Thymus serpyllum*

violet flower heads, to 5 cm across, with deep yellow disc florets, on erect stems in early and mid summer. Fruit an achene.

**Distribution**

**Global** : North America, Himalayas

**Local** : Srinagar, Gulmarg. Alt. 1585-2730 m

***Aubrieta deltoide* L. (D.C)**

Stems spreading and rooting. Flowers 2-3 cm blue or purple, in few flowered racemes, petals long clawed. Fruit 2 cm with a long beak.

**Distribution**

**Global** : South Europe

**Local** : Srinagar. Alt. 1585 m

***Begonia evansiana* Andr.**

Tuberous, winter dormant perennial with pointed glossy bright to dark green leaves and reddish on the lower surface. The flowers are borne in small clusters consisting of two small female flowers and one showy, frequently double male flower. The stem is branched and succulent. Fruit is a capsule.

**Distribution**

**Global** : England

**Local** : Gupkar, Cheshmashi. Alt. 1585-1676 m

### ***Begonia x Semperflorens* Link & Otto**

These hybrids have a glossy foliage which accounts for the name wax begonias by which the group is sometimes known. Flowers white, slightly tinged pink flowers and pale green shiny foliage. The colour range too, has become quite wide, both in ranged to leaves and to flowers. There are some sorts with almost variegated leaves and atleast one with yellowish leaves. Others have bronze-red or dark red foliage, while there are a few which have white leaves of a shape which have caused them to be described as the calla leaved begonias.

Stem glabrous and leaves glossy green with reddish ribs. Flowers 2.5 cm, pink or white. Fruit green, with prominent red ringed wings.

#### **Distribution**

**Global** : Brazil

**Local** : Gupkar, Cheshmashahi. Alt. 1585-1676 m

### ***Begonia x tuberhybrida* Voss.**

The group comprises, numerous hybrid tuberous begonias of complex derivation, and are variable in habit, size and colour. They are very popular flowering plants upto 60 cm tall. The stems are short, reddish green and the leaves alternate, irregular, rough and fleshy. The flowers

come in a wide range of colours except blue and mauve. Separate male and female flowers appear on the same plant. Fruit is a capsule.

### **Distribution**

**Global** : Brazil

**Local** : Gupkar, Cheshmashi. Alt. 1585-1676 m.

### ***Belamcanda chinensis* DC**

Tuberous rooted herbaceous perennial, with sword-shaped mid to deep green leaves, 20 cm long closely resembling those of Iris leaves. In summer, bears a succession of upto 12 loosely arranged clusters of wide opening flowers, 4 cm across, bright yellow to orange red with maroon spots, followed by large black seeds. Fruit is a capsule.

### **Distribution**

**Global** : China, Japan, E. former LISSR

**Local** : Shalimar. Alt. 1585 m

### ***Bellis perennis* L.**

Stoloniferous perennial with narrowly obovate or obovate-spathulate leaves in a basal rosette, bright-green 1 to 6 cm long. Inflorescence a solitary head, 15 to 25 cm in diameter. Ray florets white or rarely pink in a single row, female; disc florets yellow, hermaphrodite. Achenes compressed

without ribs, 1.5 to 2 mm long, without pappus. From late winter to late summer produce flower heads.

**Distribution**

**Global** : Europe, Turkey

**Local** : Srinagar. Alt. 1585 m

***Bergenia ciliata* (How) Sternb**

Clump forming perennial with very broadly obovate, hairy mid green leaves, to 35 cm long. In early spring flower stems bear more or less erect flowers, that are pink or white fading to pinkish white, with rose pink calyces usually 2 cm across on short branched often red or purple flower stems. In frost-prone areas, foliage dies back in winter. Bears fruit stalks.

**Distribution**

**Global** : Himalayas

**Local** : Srinagar. Alt. 1585 m

***Caltha palustris* L.**

A robust aquatic perennial, with kidney shaped leaves, glabrous, with usually finely toothed margins, long petiolated. Flowers white, 2-5 cm diameter, terminal with usually 5 or 6, petiolated sepals, many stamens, carpels free with no petals. Fruit a head of narrow flattened follicles.

**Distribution**

**Global** : Himalaya, Europe, Asia, North America, Nepal

**Local** : Gulmarg. Alt. 2730 m

***Campanula latifolia* L.**

Vigorous, upright perennial with stout unbranched stems arising from basal clumps of ovate oblong, long-stalked, rough-textured toothed mid green leaf, 7 to 12 cm long. Stem leaves are similar but stalkless and sharply pointed, decreasing in size towards the tops of the stems. In summer, flowers are produced single or in twos or threes from the axils of the upper leaves, forming narrow leafy spike-like racemes. The flowers are broadly tubular-bell shaped, 4 to 6 cm long, pale to deep violet and have wide spreading corolla lobes. Fruit a capsule ½ in glabrous or nearly so.

**Distribution**

**Global** : Cacasus, Turkey, Iran, W. Asia

**Local** : Cheshmashahi. Alt. 1585-1676

***Campanula medium* L.**

Slow growing, clump-forming, downy biennial producing lance-shaped to elliptic, toothed mid green basal leaves 12 to 15 cm long and smaller stem leaves. Lax racemes of single or double, bell shaped whit pink or blue flowers 2.5 to 4 cm long, open from spring to summer. Fruit is an ovoid capsule.

**Distribution**

**Global** : South Europe

**Local** : Rajbagh, Cheshmashahi. Alt. 1585-1676 m

***Canna indica* L.**

Stately, erect, strong rhizomatous perennial with ovate-lance-shaped to oblong, dark green, often bronze-tinted leaves, to 50 cm long. The inflorescence is a terminal raceme or a panicle. The colourful petals (staminodes) are really the petaloid stamens. The real petals are insignificant : seplid, light yellow-green in colour, hardly bigger than the sepals. One of these showy stamens is narrower and reflexed, forming the 'lip' of the flower. Fruit is a 3-angle bristly capsule.

**Distribution**

**Global** : Tropical and subtropical South America

**Local** : Nishat, Shalimar, Kokernag. Alt.1585-2012 m

***Centaurea montana* L.**

Rhizomatous, mat forming perennial with ovate to broadly lance shaped, entire to pinnatifid, some times slightly toothed, mid green leaves, 6 cm long, wooly beneath with densely wooly stems. Blue flower heads 5 cm across, with reddish violet florets. Fruit is a compressed achene.

**Distribution**

**Global** : Europe, Poland

**Local** : Sonamarg, Gulmarg. Alt. 2439-2730 m

***Cerastium tomentosum* L.**

Rampant, carpet or mat forming perennial producing linear or linear lance shaped, white or silver woolly leaves, 1 to 3 cm long. Profuse cymes of star-shaped white flowers to 2.5 cm across are borne in late spring and summer. Fruit is a capsule opening at the top.

**Distribution**

**Global** : Italy, Europe

**Local** : Nishat, Shalimar, Gupkar, Boulevard. Alt. 1585 m

***Cheiranthus cheiri* L.**

A perennial of longer duration and more woody than the common stock more branched and less hoary, the hairs forked at the base and closely pressed on the surface, or often quite green and nearly glabrous. Leaves narrow, pointed quite entire. Flowers rather large, generally sweet scented pods 2.5 inches long, the valves with a slightly prominent midrib pod siliquose

**Distribution**

**Global** : USA, North Mexico

**Local** : Nishat, Shalimar, Hazratbal, Telbal. Alt. 1585 m

***Chrysanthemum leucanthemum* L.**

Extremely variable rhizomatous perennial with the lowest leaves in a rosette, sub circular to obovate – spatulate, pedicelled; the upper ones oblong, sessile. Inflorescence a solitary head, 2.5 – 4 cm in diameter. Involucralbracts with papery, narrow, purplish edges. Ray florets white, female. Disk florets yellow tubular, hermaphrodite. Fruit an achene. Ribbed 3 mm long, cylindrical without pappus.

**Distribution**

**Global** : Europe, temperate Asia

**Local** : Cheshmashahi, Kokernag. Alt. 1676-2012 m

***Clivia miniata* Regel**

Evergreen perennial with strap shaped leaves, to 60 cm long. Bears large umbels of up to 20 semipendent, open tubular to funnel shaped, yellow, red, or orange flowers 5 to 7 cm long, from spring to summer. Fruit is a globose red berry.

**Distribution**

**Global** : South Africa

**Local** : Harwan. Alt. 1585 m

### ***Colchicum luteum* Baker**

A small perennial with the base of the stem below ground thickened into a solid thick, fleshy ovoid body termed as corm. Leaves are radical appearing with the flowers and becoming much elongated after the flowering season is passed, linear, obtuse. Flowers 2.5-4 cm in diameter, erect, golden yellow with very short flowering stem or scape, bearing 1 or 2 flowers. Fruit a capsule 3-4 cm in length, the valves with long recurved beaks.

#### **Distribution**

**Global** : Afghanistan, North India, Tibet

**Local** : SKUAST, Zabarwan hills. Alt. 1585-2743 m

### ***Convallaria majalis* L.**

Rhizomatous herbaceous perennial producing tough, slender, creeping branching rhizomes bearing pairs of ovate-lance-shaped to elliptic, stalked, hairless basal leaves, 4 to 20 cm long. Arching racemes of pendent, spherical-bell-shaped, strongly scented, waxy white flowers 1 cm across are produced on leafless stems in late spring. Fruit a berry, red, globose, poisonous.

#### **Distribution**

**Global** : North temperate region

**Local** : Bagat, Barzulla, SKUAST-K. Alt. 1585 m.

***Coreopsis grandiflora* Hogg.**

Clump forming almost hairless, perennial, often growth as an annual, with simple lance shaped or palmately lobed lower leaves to 10 cm long. Flowering stems produce 3 – 5 pinnate leaves with linear leaflets. From late spring to late summer, produces solitary flower heads to 6 cm across, consisting of golden yellow ray florets, with evenly cut outer margins and darker yellow disc florets. Fruit an achene.

**Distribution**

**Global** : Central and South East USA

**Local** : Nishat, Shalimar, Kokernag. Alt. 1585-2012 m

***Coreopsis lanceolata* L.**

Clump forming hairless perennial with usually entire, lance-shaped to inversely lance-shaped, mid green leaves, to 15 cm long. Flowering stems, with leaves only at the bases, produce solitary yellow flower heads, 4-6 cm across, from late spring to mid summer. Fruit an achene.

**Distribution**

**Global** : Central and South USA

**Local** : Nishat, Shalimar, Hazratbal, Naseembagh, Telbal. Alt. 1585 m

***Crococsmia masonorum* N.E.Br**

Robust cormous perennial bearing pleated, mid-green leaves 60 to 100 cm long. In mid summer bears upward-facing, orange red flowers 5 cm long, in arching, usually unbranched spikes. Fruit is a capsule.

**Distribution**

**Global** : South Africa

**Local** : Nishat, Shalimar, Hazratbal, Telbal. Alt. 1585 m

***Crocus chrysanthus* Herb.**

Late winter and early spring flowering crocus with dull green leaves and upto 4 rounded, scented flowers, 1.5 to 4 cm long, which vary from cream to deep golden yellow, often suffused or veined bronze-maroon outside. Fruit is a capsule buried among the leaves.

**Distribution**

**Global** : Yugoslavia, Greece, Albania, Bulgaria

**Local** : Barzulla. Alt. 1585 m

***Crocus sativus* L.**

Autumn flowering crocus producing 1 to 5 widely open rich lilac flowers, to 5 cm in long, with dark purple veins. Dull green leaves are borne with or shortly after the flowers. Saffron is obtained from the long,

conspicuous, 3-branched deep red style. Sterile, increasing only by division.

Fruit is a capsule buried among the leaves.

**Distribution**

**Global** : Asia minor

**Local** : Pampore. Alt. 1585 m

***Cynara cardunculus* L.**

Clump forming perennial with pinnatifid or 2 – pinnatifid, usually spiny. Silvery grey leaves to 50 cm long, with ovate to linear – lance shaped segments and deep basal leaves. From early summer to early autumn, purple flower heads 4-8 cm across, are produced on grey-woody stems. Branched leaf stalks and midribs are edible. Fruit an achene.

**Distribution**

**Global** : SouthWest Mediterranean, Morocco

**Local** : SKUAST-K, Shalimar. Alt. 1585 m

***Dahlia variabilis* L.**

Root tuberous, flower 6-8 cm, horizontal or nodding. Bears pompon flower head of various colours. Pinnate, toothed, oval leaflets having rounded tips. Fruit is an oblong achene.

**Distribution**

**Global** : Mexico

**Local** : Nishat, Shalimar, Cheshmashi. Alt. 1585-1676 m

***Delphinium elatum* L.**

Clump forming perennials with fleshy crowns producing flowering spikes. The spikes bear numerous double flowers with 5 large outer sepals and an 'eye' formed by 8 inner sepals. The flowers at least 6 cm across are usually larger at the base of spike. Each stem also bears lateral shoots flowering after the main spike with slightly smaller flower.

**Distribution**

**Global** : Temperate Himalaya

**Local** : Sonmarg, Gulmarg. Alt. 2439-2730 m

***Dendranthema x grandiflorum* Kitam**

Rhizomatous, sometimes invasive herbaceous perennial with vigorous erect stems, reddish green when young. Lance shaped to linear oblong, dark green leaves 12 cm long, with red midribs, turn red and yellow in autumn. In early summer, bears terminal cymes, 10 cm across, of yellow cyathia cupped within orange – red to red involucres. Fruit is an achene, cylindrical in shape.

**Distribution**

**Global** : Bhutan, Tibet, South West China

**Local** : Kokernag, Gulmarg. Alt. 2012-2730 m

***Dianthus barbatus* L.**

Bushy short lived perennial, grown as a biennial, with light to mid-green leaves, to 10 cm long, sometimes deep bronze green. In late spring and early summer, leafy bracts surround dense flat terminal clusters, of small 8-12 cm across, single, sweet scented, purple – red, pink, salmon – pink, or white flowers, sometimes bicoloured, each petal bearded and dotted with a paler colour at the base. Fruit is a capsule.

**Distribution**

**Global** : South Europe

**Local** : Zabarwan hills. Alt. 2743 m

***Dianthus caryophyllus* L.**

Loosely tufted, woody perennial with flattened, soft mid-green leaves to 15 cm long, with conspicuous sheaths. Bears loose cymes, 5 cm across, of 1-5 strongly fragrant single, toothed, bright pink-purple flowers to 1.5 cm across, on stiff stems in summer. Fruit is a capsule.

**Distribution**

**Global** : Mediterranean

**Local** : Zabarwan hills. Alt. 2743 m

***Dianthus chinensis* L.**

Bushy, short lived, hairy perennial or biennial, usually grown annually from seed leaves are pale to mid-green up to 8 cm long. In summer bears loose, terminal cymes to pink, red or white flowers often with purple eyes, fringed to nearly half their lengths and often intricately patterned. Fruit is a capsule.

**Distribution**

**Global** : China

**Local** : Barzulla, Gupkar, Nishat, Shalimar, Naseembagh. Alt. 1585 m

***Digitalis lanata* Ehrh**

Clump forming perennial or biennial with oblong. Lance – shaped or inversely lance – shaped, mid green leaves, to 12 cm long, hairless beneath or with toothed margins. Dense, racemes of pale cream or fawn flowers 3 cm long, each with brown or violet - brown veins and a lighter cream lower lip, are produced from mid to late summer. Fruit is a capsule.

**Distribution**

**Global** : Italy, Balkans, Hungary, Turkey

**Local** : Cheshmashahi, Gulmarg. Alt. 1676-2730 m

***Digitalis purpurea* L.**

Hairy perennial with leaves ovate to lanceolate or lanceolate – oblong, 22 cm long, greyish – tomentose beneath; petiole winged. Stem erect, stout simple or rarely branched. Inflorescence a terminal, many – flowered raceme. Flowers zygomorphic, hypogynous, hermaphrodite, rather showy. Calyx deeply 5-lobed, green; the lobes ovate, overlapping. Fruit an ovoid septicidal capsule, exceeding the calyx.

**Distribution**

**Global** : Southern, Western and Central Europe

**Local** : Cheshmashahi, Gulmarg. Alt. 1676-2730 m

***Echinacea purpurea* Moench**

Erect perennial with smooth, sometimes rough – hairy, red – tinted green stems, ovate, toothed, rough-hairy basal leaves, 15 cm long, and ovate – lance shaped, toothed stem leaves. From mid summer to early autumn, bears flower heads to 12 cm across, with golden brown, cone shaped discs and partly reflexed, purplish red ray – florets, 3 – 8 cm long. Fruit is an achene.

**Distribution**

**Global** : USA, Virginia

**Local** : Cheshmashahi. Alt. 1676 m

***Eranthis hyemalis* Salisb**

Clump-forming, tuberous perennial producing bright yellow flowers, 3 cm across, each above a ruff of dissected, bright green leaves, in late winter and early spring. Quickly forms large colonies particularly in alkaline soil. Fruit of 5-8 stalked follicles.

**Distribution**

**Global** : Southern France to Bulgaria

**Local** : Residency Road. Alt. 1585-1676 m

***Eremurus himalaicus* Baker**

Tufted perennial with strap – shaped, bright green leaves, 30 cm long. Bears white flowers 2.5 cm across in racemes to 90 cm long in late spring and early summer. Fruit is a capsule.

**Distribution**

**Global** : Kashmir, North West Himalayas

**Local** : SKUAST-K, Cheshmashahi. Alt. 1585-1676 m

***Eryngium biebersteinianum* Nevski ex. Bobrov**

Stiff, hard herbs, usually perennial, and with prickly leaves and involucre. Flowers in a compact spike or head, with a scale or bract on the common receptacle under each flower. Petals erect, with a long inflected

pointed or prickly teeth of the calyx. Fruit ovoid, without vitas, crowned by the pointed or prickly teeth of the calyx.

**Distribution**

**Global** : Spain

**Local** : Gulmarg. Alt. 2730 m

***Euphorbia stracheyi* Bioss**

Rhizomatous, sometimes invasive herbaceous perennial with vigorous, erect stems, reddish green when young. Lance shaped to linear oblong, dark green leaves 12 cm long, with red midribs, turn red and yellow in autumn. In early summer bears terminal cymes, 10 cm across, of yellow cyathia cupped within orange-red to red involucres. Fruit of 3 carpels, each with a single seed.

**Distribution**

**Global** : Bhutan, Tibet, South West China

**Local** : Srinagar, Kokernag, Gulmarg. Alt. 1585-2730m.

***Fressia x hybrida* Bailey**

Cormous perennial bearing mauve coloured, funnel shaped, usually scented flowers, held erect in dense racemes at the end of arching,

frequently branched stems. Narrowly sword-shaped leaves. Fruit is a capsule.

### **Distribution**

**Global** : South Africa

**Local** : Cheshmashahi. Alt. 1676 m

### ***Fritillaria imperialis* Linn**

A tall handsome, robust perennial with lanceolate, sessile leaves, the lower ones opposite and the upper ones longer and in whorls. Flowers are about 2-3 cm in length, brownish orange colour in a terminal umbel of about 5 to 8 pedicelled and pendulous flowers. Fruit, a capsule 5 cm long, obovoid almost 6 winged.

### **Distribution**

**Global** : Temperate regions

**Local** : Telbal, Gupkar. Alt. 1585 m

### ***Gagea elegans* Wallich-ex.D.Don**

Leaves up to 40 cm, long 8 mm broad, with parallel venation, hooded at the apex. Inflorescence subtended by large leaf like bracts, umbel like, 1-5-flowered, loose. Flowers actinomorphic, erect. Perianth of 6 segments in two whorls; the segments spreading 1.5 cm long, lanceolate-

oblong, yellow with a green stripe underneath. Another 6 stem leafless (Except for the large leaf like bracts). Fruit a capsule, nearly globose.

**Distribution**

**Global** : Europe, North Africa

**Local** : Zabarwan hills. Alt. 2743 m

***Galanthus nivalis* L.**

Bulbous perennial with narrow, glaucous leaves having parallel veination, linear, bluish – green 20cm long. Flowers solitary, actinomorphic, always nodding, enclosed in a papery spathe before flowering free, spreading (white); the inner 3 only half as long, deeply emarginated white with a green spot at the middle near the apex. Fruit a capsule, ovoid in shape.

**Distribution**

**Global** : Pyrenees to Ukraine

**Local** : Sonwar, Bagat. Alt. 1585 m

***Gazania nivea* DC**

Herbaceous perennial with mound forming habit having dark green pubescent lanceolate basal leaves with daisy like orange flower heads 9cm across. Achenes are angled.

**Distribution**

Global : Tropical Africa

Local : Nishat, Shalimar, Hazatbal. Alt. 1585m

***Gazania x splendis* Moore**

Vigorous, spreading, evergreen perennial with glossy leaves 15 cm long, dark green above, covered with silky white hairs beneath. Bears

solitary flower heads in a mix of bronze, orange, rose-pink. Fruit is as achene.

**Distribution**

**Global** : Tropical Africa

**Local** : Nishat, Shalimar. Alt. 1585 m

**64) *Geranium rectum* Traut**

Herbaceous perennial, with erect branched, glandular, pubescent leaves 6-9 partite, segments acute, incised; pedicels densely hairy; petals large, spreading. Larger bluish – purple flowers loosely paniced on longer peduncles; the pedicels always more or less spreading or reflexed after flowering. Fruit is a capsule seprating into 5, 1-seeded carpels which cure upwards and glabrous inside.

**Distribution**

**Global** : Europe

**Local** : Sonmarg. Alt. 2439 m

***Geranium wallichianum*, D.Don**

Herbaceous perennials with forked, stems often swollen at the nodes, opposite palmately divided leaves and purplish flowers, solitary on axillary peduncles. Stamens 10, of which five shorter, but generally with anthers. Ovary 5 – lobed, terminating in long beak with five stigmas on the top, the

lobes being all whorled – beaked receptacle. Fruit is a capsule. Capsule separating into 5-1 seeded carpels which curve upwards, with a long elastic awn, detached from the beak, and glabrous inside.

**Distribution**

**Global** : North East Afghanistan

**Local** : Gulmarg. Alt. 2730 m

***Gerbera jamesonii* Bol. ex. Adlam**

Clump forming, deep rooting perennial with inversely lance shaped, deeply lobed to pinnatifid leaves, 40 cm long, dark green above, paler and sparsely to densely woolly beneath. Solitary daisy like, orange – scarlet flower heads, 10 cm across, with yellow centres. Fruit is a capsule.

**Distribution**

**Global** : Africa

**Local** : Cheshmashahi. Alt. 1676 m

***Gladiolus byzanthus* Mill.**

Vigorous perennial producing linear leaves, 60 cm long. From late spring to early summer bears, deep magenta flowers, 5 cm across, with paler marks on the lip tepals. Fruit is a capsule.

**Distribution**

**Global** : Spain, North West Africa.

**Local** : Chanapora. Alt. 1585 m

***Gloriosa rothschildiana* O'Brein**

Climbing perennial with ovate-lance-shaped to oblong glossy, bright green leaves, 6 cm long which narrow to form terminal tendrils, 4 cm long. Nooding flowers, 8 cm across are borne from the upper leaf axils. Flowers have 6 reflexed, wavy – margined, sometimes entirely yellow, with long, protruding stamens.

**Distribution**

**Global** : Africa, India

**Local** : Nishat, Shalimar, Brein. Alt. 1585 m

***Gyposphila paniculata* L.**

Tap rooted herbaceous perennial with branching stems forming an airy mound of linear – lance – shaped, usually hairless, glaucous leaves, 6 cm loose, many flowered panicles of shallowly trumpet – shaped white flowers to 8 mm across, forming mounds to 45 cm or more across. Fruit is a capsule.

**Distribution**

**Global** : Central and East Europe

**Local** : Cheshmashahi. Alt. 1676 m

***Hedychium gardnerianum* Wall.**

Upright, rhizomatous perennial with lance-shaped, greyish green leaves, 35 cm long. Butterfly like fragrant, lemon–yellow flowers, with bright red stamens, are borne in dense, broadly cylindrical, terminal racemes, 30 cm long. Fruit is a capsule.

**Distribution**

**Global** : Himalayas

**Local** : Sonamarg. Alt. 2439 m

***Helenium autumnale* L.**

Upright clump forming perennial-shaped toothed leaves 15 cm long. From late summer to mid autumn, bears flower heads to 5 cm long with yellow ray florets that reflex as the brown disc florets open. Fruit is a 4-angled achene.

**Distribution**

**Global** : Canada, Eastern USA

**Local** : Gupkar, Nishat, Shalimar. Alt. 1585 m

***Helianthus autumnale* Nutt**

Tall, coarse plant with large simple bristly, alternate leaves, the

showy daisy – like flower heads with sterile ray florets are borne in loose corymbs and have yellow disc florets. Fruit is a obovate achene.

**Distribution**

**Global** : North America, Central America, Peru

**Local** : Gupkar, Nishat, Shalimar. Alt. 1585 m

***Helianthus x multiflorus***

Clump forming perennial with lance-shaped to ovate, slightly hairy, dark green leaves to 20 cm long. Flower heads to 12cm across, with domed, yellow ray florets, open from late summer to mid-autumn. Fruit is an obovate achene.

**Distribution**

**Global** : North, Central America, Peru, Chile

**Local** : Kokernag. Alt. 2012 m

***Helleborus niger L.***

Clump forming, hairless perennial with over – wintering, pedate , leathery, dark green, basal leaves 15 cm long comprising 7-9 oblong to inversely lance-shaped leaflets, toothed towards the apexes. From early winter to early spring stout, purple-marked stems bear shallowly saucer-shaped flowers 6 cm across, single or occasionally in cymes of 2 to 3

blooms; the flowers are white, sometimes strongly pink – flushed, with greenish white centres, ageing to pinkish white. Fruit is a follicle. Follicle is many seeded.

**Distribution**

**Global** : Germany, Australia, Italy

**Local** : Barzulla, Gupkar, Cheshmashahi. Alt. 1585-1676 m

***Hemerocallis flava* L.**

Semi evergreen, rhizomatous perennial with wide; dark bluish green leaves, 75 cm long. Branched scapes bear trumpet-shaped, orange-brown flowers 7 cm across, with recurved tepals, in mid and late summer. Fruit is a capsule.

**Distribution**

**Global** : China, Japan

**Local** : Shalimar, Cheshmashahi. Alt. 1585-1676 m

***Hesperis matronalis* L.**

Leaves shortly stalked, or tapering at the base, ovate-lanceolate or lanceolate 3 inches long, or the upper ones smaller. Flowers usually fragrant in the evening stems 3 feet high, usually slightly branched nearly cylindrical, but much contracted between the seeds. Pods 3 inches long.

**Distribution**

**Global** : Europe, Russia, Central Asia

**Local** : Residency road. Alt. 1585 m

***Hippeastrum puniceum* Urban**

Bulbous perennial with bright green leaves emerging just after the flowers. Bears umbel of upto 3-funnel shaped scarlet flowers. Fruit is a globose capsule.

**Distribution**

**Global** : Central and South America

**Local** : Harwan. Alt. 1585 m

**78) *Hosta lancifolia* Engler**

Perennial forming a dense mound of arching, narrowly lanceolate, thin glossy, dark green leaves 15 cm long. In late summer, slender very leafy, red dotted scapes 60 cm long, bear narrowly funnel shaped, deep purple flowers. Fruit is a capsule.

**Distribution**

**Global** : Korea, Japan

**Local** : Barzulla, Sheikhabagh, Nishat. Alt. 1585 m

***Hosta plantaginea* Aschers**

Clump – forming perennial producing ovate to heart shaped, slightly wavy, glossy, light green leaves, 20 cm long with prominent, widely spaced, raised veins. Trumpet-shaped long tubed, very fragrant white flowers 10 cm long are borne on leafy, bright green scapes 70 cm long, in late summer and early autumn. Fruit is a capsule.

**Distribution**

**Global** : China

**Local** : Barzulla, Sheikhabagh, Nishat. Alt. 1585 m.

***Hyacinthus orientalis* L.**

Bulbous perennial with linear to lance – shaped, channelled, bright green leaves, 30 cm long. In early, spring, bears erect racemes of up to 40 tubular – bell shaped, waxy, very fragrant, single flowers 30 cm long pale violet – blue at the bases and almost white above, with spreading, then recurved lobes. Fruit is a 3-angled capsule.

**Distribution**

**Global** : South Turkey, North West Syria Lebanon

**Local** : Nishat, Shalimar, Brein. Alt. 1585 m

***Inula royleana* C.B. Clarke**

An erect, robust perennial with simple. Exstipulate, alternate, sessile, oblong or elliptic lanceolate, acute or obtuse, glandular-serrate sparingly hairy leaves. Flowers are bright yellow, in a solitary, terminal radiate head 8 cm diameter, receptacle naked. Fruit is small achene.

Distribution :

Global : West Himalayas

Local : Sonmarg, Gulmarg. Alt. 2439-2730 m

***Iris ensata* Thunb**

Rhizomatous, beardless laevigatae irises with single occasionally branched stems. Leaves are with prominent mid ribs. Each stem bears 3-4 blue flowers. Standards are erect and smaller than the falls. Fruit is a capsule.

**Distribution**

Global : North China, Japan, East Russia

Local : Nishat, Shalimar, Pampore. Alt. 1585 m

***Iris germanica* L.**

The most commonly found garden iris is the bearded *Iris germanica*. The rhizomatous species with 3-10 basal sword shaped leaves. The inflorescence are fan shaped and contain one or more symmetrical six-lobed flowers. The fruit is a capsule containing numerous seeds within.

**Distribution**

**Global** : North temperate zone.

**Local** : Pampore. Alt. 1585 m

***Iris 'Gingerbread Man'***

Rhizomatous standard dwarf bearded iris with evergreen stiff glossy dark green leaves. In late spring bears deep brown flowers with blue-purple beards in mid and late spring. Fruit is a capsule.

**Distribution**

**Global** : China.

**Local** : Nishat, Shalimar, Telbal, Hazratbal. Alt. 1585 m

***Iris japonica* Thunb**

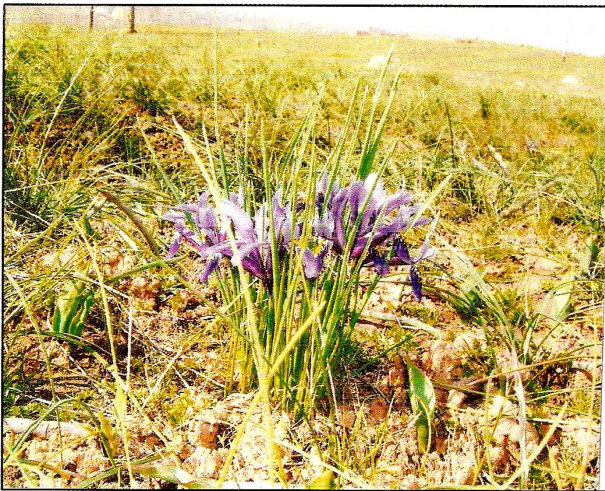
Rhizomatous crested irises which spreads by surface rhizomes with fans of strap-shaped evergreen glossy dark green leaves to 45 cm long. In



*Iris kashmeriana*



*Iris ensata*



*Iris reticulata*



*Iris japonica*

Plate – 4 Iris species

spring each branched stem bears 3 or 4 flattened and frilly white or pale lavender-blue flowers. Falls have purple patches and orange crests. Fruit is a capsule.

**Distribution**

**Global** : Central China, Japan

**Local** : Nishat, Shalimar. Alt. 1585 m

***Iris kashmiriana* Baker**

Flowers large, usually mauvish-blue; falls 5.5-9 cm and 4-6 cm broad with yellow beard; standards broadly elliptic, 4.5-6 cm broad. Spathes with a green base, and a papery apex. Leaves 2-3.5 cm broad. Stems 40-90 cm. Fruit is a capsule.

**Distribution**

**Global** : Temperate Eurasia. Common on groves in the Kashmir valley

**Local** : Srinagar. Alt. 1585 m

***Iris reticulata* M. Bieb**

Bulbous reticulate irises with square sectioned leaves. Bears a solitary fragrant flower varying from pale to deep violet-blue or reddish purple with a yellow central ridge on each fall. Bulbs often split after blooming and may take some years to reach maturity. Fruit is a capsule.

**Distribution**

**Global** : Caucasus, East and Northern Turkey

**Local** : Pampore. Alt. 1585 m

***Iris tectorum Maxim***

Rhizomatous crested iris with fans of broad, ribbed, glossy, dark green leaves. Each branched stem bears 2 to 3 lilac flowers with darker veins and a white crest on each fall. Fruit is a capsule.

**Distribution**

**Global** : Central, South and Southwest China

**Local** : Nishat, Shalimar, Gupkar, Boulevard, Telbal, Naseembagh. Alt. 1585 m

***Iris unguicularis Poir***

Rhizomatous crested irises with fans of strap shaped evergreen dark green grass like leaves. Pale lavender to deep violet with contrasting veins and a central band of yellow on the fall and with perianth tube. They are borne singly on very short stem arising from a branching rhizome.

**Distribution**

**Global** : Greece, Turkey, Syria

**Local** : Nishat, Shalimar, Brein. Alt. 1585 m

***Ixiolirion karateginum* Lipsky**

Linear, lance shaped leaves in basal rosettes with racemes or umbels of funnel shaped usually deep blue or violet flower. Fruit is a capsule.

**Distribution**

**Global** : Israel, Lebnon, Syria

**Local** : Sonmarg. Alt. 2439 m

***Kalanchoe blossfeldiana* V. Poellnitz**

Bushy perennial succulent with oval to oblong-ovate-softly toothed, glossy dark green leaves, 8 cm long on long stalks tubular scarlet flowers, 1.5 cm long, are produced in early spring, mostly in crowded corymb – like panicles. Fruit is a follicle.

**Distribution**

**Global** : South West Madagascar

**Local** : Nishat, Shalimar, Hazratbal. Alt. 1585 m

***Kniphofia uvaria* Hook.**

Evergreen perennial with lax, linear, keeled finely toothed, coarse leaves, to 60 cm long. Flowers 3 – 4 cm long, red in bud, opening to

orange, and fading to yellow, are borne in slender, oblongovoid racemes in early autumn.

**Distribution**

**Global** : South African

**Local** : Chanapora, Nishat, Shalimar. Alt. 1585 m

***Lathyrus latifolius* L.**

Herbaceous perennials with weak stems, sometimes climbing with sagittate stipules; the leaves usually pinnate mid green in colour usually consisting of one pair of ovate to elliptic leaflets to 5 cm long. Flowers pink purple and red flowers. Petals usually broad, especially the standard upper stamen free style flattened below the stigma, quite glabrous on the outer side. Fruit a pod. Pod cylindrical with several seeds.

**Distribution**

**Global** : South East Europe

**Local** : Gupkar, Boulevard. Alt. 1585 m

***Lavendula angustifolia* Mill.**

Compact, bushy shrub with linear, grey-green leaves, to 5 cm long. unbranched stalks produce fragrant, pale to deep purple flowers in dense spikes, to 8 cm long. Nutlets are smooth.

**Distribution**

**Global** : W. Mediterranean

**Local** : Nishat, Shalimar, Brein, Telbal. Alt. 1585 m

***Leucojum aestivum* L.**

Robust, bulbous perennial with erect strap – shaped, glossy, dark green leaves, to 40 cm long. In spring, leafless stems bear up to 8 bell shaped, faintly chocolate scented white flowers, 2 cm long, with green tips. Fruit is a capsule.

**Distribution**

**Global** : Ireland, U.K., France

**Local** : Bagat, Chanapora, Sonwar. Alt. 1585 m

***Liatris spicata* Willd**

Perennial with hairless stems and linear-lance shaped basal leaves, stem leaves are smaller and linear. Long lasting, purple flower heads, to 1 cm across, are borne in dense spikes 60 cm long. Fruit is a capsule.

**Distribution**

**Global** : East and South USA

**Local** : Nishat, Shalimar, Cheshmashahi. Alt. 1585 m

***Lilium auratum* Lindl**

Stem glaucous. Leaves many, strongly nerved. Flowers 20 cm, horizontal or drooping crimson; each segment with a longitudinal yellow band. Fruit is a capsule.

**Distribution**

**Global** : Japan

**Local** : Kokernag. Alt. 2010 m

***Lilium candidum* L.**

This splendid lily, known since antiquity and often depicted as the symbol of purity has upright, cylindrical, glabrous stem; linear leaves up to 25 cm long, tending to become smaller above; and racemes of 5 – 10 scented flowers (7.6 cm) across, with pure white petals revolute at the tip. Fruit is a capsule.

**Distribution**

**Global** : South and East Europe

**Local** : Kokernag. Alt. 2012 m

***Lilium longiflorum* Thunb.**

Stem 1.5 to 3 ft., smooth, green and unspotted, reddish toward base.

Leaves many, scattered, long narrow-lanceolate, acuminate, 4-7 inch long, smooth, finely nerved. Flowers few to several, horizontal on somewhat inclined or declined, clear waxy-white, green-tinged towards base, long tubular, 4-7 inch long, the upper part flaring like a trumpet and 4-5 inch across, very fragrant.

**Distribution**

**Global** : Japan

**Local** : Kokernag (Altitude 2012 m)

***Limonium latifolium* Kuntze**

Rosette forming perennial with elliptic to spoon shaped, mid to dark green leaves, usually to 30 cm long, occasionally to 60 cm. in late summer, branched, wiry stems bear panicles of spikelets that consist of shortly tubular deep lavender blue flowers 6mm long, with white calyces. Fruit is a capsule.

**Distribution**

**Global** : Bulgaria, Russia

**Local** : Gulmarg. Alt. 2730 m

***Lunaria annua* L.**

Annual or biennial with ovate or heart shaped, coarsely toothed, light

to mid-green leaves to 15 cm long. Cross shaped light purple flowers to 1 cm across are borne in broad leafy racemes to 18 cm long. Flat seed pods 6 cm long are rounded and silvery.

**Distribution**

**Global** : Europe

**Local** : Nishat, Shalimar, Telbal. Alt. 1585 m

***Lupinus polyphyllus* Lindl.**

Per. stout and erect, 3-5 ft., glabrate, or sparsely hairy-pubescent above. Leaves very long-stalked, the petioles 6-12 inch long or the upper ones shorter; leaflets 9-16, lanceolate to oblanceolate, 2-6 inch long, acute, glabrous above and sparsely hairy beneath; stipules pointed, adnate to petiole for one-third or one-half their length. Flowers with purplish standard, blue wings and mostly dark-tipped point to keel ½ inch long, many and alternate on slender pedicels in a rather dense terminal raceme 1-2 ft long. Pod 1-1½ inch long, wooly hairy; seed about 6; oblong, brown-black and glossy.

**Distribution**

**Global** : California

**Local** : Gulmarg. Alt. 2730 m

***Lycoris radiata* Herb**

Bulbous perennial with wavy-margined rose-red or deep red flowers, 4 cm long with strength reflexed tepals and conspicuous, protruding stamens, borne in umbels, leaves semi-erect strap shaped and dark green appear after the flowers. Fruit is a capsule.

**Distribution**

**Global** : Japan

**Local** : Harwan. Alt. 1585 m

***Lythrum salicaria* L.**

Clump forming perennial, usually in damp situations with erect stiff, branched stems bearing lance-shaped downy leaves. In spike like racemes bears star shaped bright purple-pink flowers. Fruit is a capsule.

**Distribution**

**Global** : Europe, Temperature Asia

**Local** : Sonmarg. Alt. 2439 m

***Matthiola incana*, Br.**

Erect, usually perennial and more or less woody at the base, but not of long duration; leaves oblong-linear, obtuse, quite, entire, soft and hairy

on both sides with short crisped hairs. Flowers purple or reddish, rather large, the petals obovate, fruit a pod, pod 5 inches long, crowned by short stigmas, which are rather thickened at the base.

**Distribution**

**Global** : Europe, Spain, Turkey

**Local** : Boulevard, Gupkar, Nishat, Shalimar. Alt. 1585 m

***Mimulus nepalensis* Benth**

Flowers yellow, tubular, weakly two-lipped, the upper lip erect, two lobed. The lower spreading, three lobed. Flowers solitary, axillary, borne on stalks usually longer than the leaf. Erect leafy stems 15-20 cm opposite, elliptic, coarsely toothed, stalked leaves, mostly 2-2.5 cm. Calyx inflated in fruit. Fruit is a capsule.

**Distribution**

**Global** : Southwest China, Burma

**Local** : Babareshi, Tangmarg. Alt. 2730 m.

***Mirabilis jalapa* L.**

Bushy perennial with ovate leaves 8 cm long. Fragrant, red pink, magenta, yellow or white flowers to 5 cm long, some striped, and often

with several colours present on the same plant, are borne. Individual plants open in late afternoon and die by morning. Fruit is a dry capsule.

**Distribution**

**Global** : Peru, tropical, North, South America

**Local** : Barzulla, Gupkar, Rajbagh. Alt. 1585 m

***Muscari armeniacum* Leicht**

Bulbous perennial producing semi-erect narrowly linear to linear inversely lanceolate, mid green leaves, 12 inches long in autumn. Tubular bright blue flowers with distinct, constricted white mouths are borne in dense racemes 2 to 8 cm long, in spring. Fruit is a 3-angled capsule.

**Distribution**

**Global** : South East Europe to Caucasus

**Local** : Baghat, Residency road, Brein. Alt. 1585 m.

***Narcissus pseudonarcissus* L.**

Single flowered, wild daffodils with leaves linear, erect having parallel veining, bluish green. Flowers actinomorphic, solitary, drooping or horizontal, showy 4.5 cm in diameter. Corolla a perianth, with a corona (paracorolla) inserted between segments and stamens. Fruit a capsule, globose, often obtusely-trigonal.

**Distribution**

**Global** : Portugal, Spain

**Local** : Nishat, Shalimar, Telbal, Hazratbal. Alt. 1585 m

***Narcissus tazetta* L.**

Very variable wild species daffodil with erect, broad, twisted, keeled, glaucous, mid-green leaves 40 cm long. Bears upto 20 sweetly scented flowers 4 cm across, with white perianth segments and yellow cups. Fruit is a globose capsule.

**Distribution**

**Global** : France, Spain

**Local** : Nishat, Shalimar, Hazratbal, Telbal. Alt. 1585 m

***Nelumbo nucifera* Gaertn.**

An aquatic plant, with a whitish creeping rhizome from which sprout long, upright stalks that emerge from the water the leaves are downy (50 cm) in diameter with their blades borne slightly above the water surface, and the stalk. Sometimes 1 cm long, in the center. The flowers, on peduncles of 1 m are large, pinkish-white, reversed cone. Fruit is a spongy nut.

**Distribution**

**Global** : Iran, Japan, Australia

**Local** : Dal lake. Alt. 1585 m

***Nepeta nervosa* Royle ex-benth**

Bushy perennial bearing erect, unbranched stems with narrowly lance shaped, entire to slightly toothed, conspicuously veined, hairly faintly aromatic, mid to gray green leaves, to 10 cm long. Dense, cylindrical, spike like whorled cymes of purplish blue flowers to 12 mm long, are borne. Fruit is a nutlet.

**Distribution**

**Global** : India (Kashmir)

**Local** : Kokernag. Alt. 2012 m

***Nerine bowdenii* Watson**

Robust bulbous perennial with broad, strap – shaped leaves, to 30 cm long. Bears open umbels of upto 7 or more funnel – shaped faintly scented pink flowers, to 8 cm across, with recurved, wavy-margined tepals. Fruit is a loculicidal capsule.

**Distribution**

**Global :** South Africa (East Cape)

**Local :** Gupkar, Boulevard, Cheshmashahi. Alt. 1585-1676 m

***Nymphae stellata Willd***

A perennial aquatic plant with very beautiful star liker flowers with rounded, cordate, glossy leaves floating on the surface of water at the end of long, stout flexible stems. Flowers solitary. Fruit is a spongy berry ripening under water, seeds buried in the pulp and each covered with a fleshy aril.

**Distribution**

**Global :** Siberia

**Local :** Dal lake Srinagar. Alt. 1585 m

***Oenothera biennis L.***

A Biennial with stems almost simple and more or less hairy; ovate lanceolate or lanceolate, slightly toothed hoary or downy. Flowers yellow large and fragrant, in a long terminal spike often leafy at the base. Ovary sessile about 7 inches long, the tube of the calyx at least an inch longer, the petals broad and spreading. Fruit a capsule. Capsule oblong.

**Distribution**

**Global** : North America

**Local** : Boulevard, Gupkar. Alt. 1585 m

***Ornithogalum umbellatum* L.**

Bulbous perennial with linear leaves having parallel veination 30 cm long each with a central silver stripe above; the leaves wither as the flowers open in early summer. Inflorescence a raceme, corymbose 8-10 flowered flower actinomorphic, erect with a perigon petals white, with a green band at the back. Fruit a hexagonal capsule 1-1.5 cm in diameter.

**Distribution**

**Global** : Europe, Turkey, and North Aferica

**Local** : Nishat, Shalimar, Kokernag. Alt. 1585-2012 m.

***Paeonia emodi*, Wall. ex Royle**

A stout, shrubby perennial, 1 to 2½" in height with exstipulate, alternate, glabrous, 15 cm leaves, petiolated, divided in to distinct leaflets or deeply cut into segments. Flowers 3 to 4" diameter, white, usually solitary (or sometimes 2 or 3) flower bud globuse, bracts 2 or 3 leafy, lying close against the calyx, sepals 5, persistant, outer ones with a leafy point, petals 5

to 10, stamens many, carpels 1 to 5, surrounded below by a fleshy disk fruit a single follicle (rarely 2) about 3 cm long.

**Distribution**

**Global** : North Western Himalaya, Kumaon

**Local** : Brein, Kokernag, Gulmarg. Alt. 2730-1585 m

***Paeonia lactiflora* Pall.**

Herbaceous perennial with erect, red-mottled stems and dark green leaves each with a elliptic or lance – shaped rough margined leaflets, paler and slight hairy beneath. Bears bowl shaped fragrant, white to pale pink flowers. Fruit is an oblong follicle.

**Distribution**

**Global** : Russia, Mongolia, China

**Local** : Babareshi, Gulmarg. Alt. 2730 m

***Papaver orientale* L**

A perennial hairy plant. All the leaves arising from the base, pinnately lobed hairy. Flowering stems several. Flowers orange red. Sepals densely hairy. Fruit is a capsule. Capsule covered with bristles.

**Distribution**

**Global** : Central and North Europe, Afghanistan

**Local** : Gulmarg. Alt. 2730 m

***Penstemon barbatus (Cav)Roth***

Erect perennial with semi – evergreen basal rosettes and deciduous stems bearing lance-shaped to linear, entire, sometimes glaucous, mid green leaves to 20 cm long. Bears long panicles of pendent, tubular red flowers tinged pink to carmine red 4 cm long, the reflexed lower lips with yellow beards the upper ones projecting over them. Fruit is a capsule.

**Distribution**

**Global** : USA to Mexico

**Local** : Kokernag. Alt. 2012 m

***Phlox paniculata L.***

Erect herbaceous perennial with ovate or lance-shaped to elliptic, toothed, thin leaves 11 cm long. Panicle like cymes of salver-form, fragrant, dark lilac 2.5 cm across are borne from summer to early autumn. Fruit is an ovoid capsule.

### **Distribution**

**Global** : USA

**Local** : Nishat, Shalimar, Telbal, Hazratbal, Naseembagh. Alt. 1585 m.

### ***Physalis alkengi* L.**

Vigorous, spreading, rhizomatous perennial with trigonous-ovate to diamond shaped leaves to 12cm long. Nodding, Bell shaped cream flowers 2cm long, with star-shaped mouths, reproduced from the leaf axils, followed by large, bright orange-scarlet berries and closed in a papery red calyxes to 5cm across.

### **Distribution**

Global : Europe, West Asia, Japan

Local : Nishat, Shalimar, Kokernag Alt 1585-2012m

### ***Platycodon grandiflorum* A.DC.**

Compact-clump forming perennial with ovate to ovate-lanceolate, toothed, bluish green leaves, to 5 cm long, borne in whorls on the lower stem alternately higher up. Large balloon like buds open to shallow bell shaped, 5-petalled purple-blue flower to 5 cm across, with darker blue veins and pointed tips to the petals. Fruit is a capsule.

### **Distribution**

**Global** : Russia, China

**Local** : Nishat, Shalimar, Chesmashahi, Shalimar. Alt. 1585-1676 m

### ***Primula denticulata* Smith**

The commonest of the primulas and one of the earliest flowers to bloom at elevations above 7000". It is a perennial with radical, simple, ovate, spatulate, sessile, or the base narrowed in to a short winged petiole. The lower surface sparingly covered with a yellowish powder. At the time of flowering the leaves are small, but subsequently become much elongated. Flowers 2.5-3.5 cm in diameter, yellow, in compact rounded

clusters of shortly pedicelled flowers, the clusters about 3-6 cm in diameter.

Fruit is a capsule.

### **Distribution**

**Global** : Afghanistan, South East Tibet, Burma, China

**Local** : Gulmarg. Alt. 2730 m

### ***Primula rosea* Royle**

A beautiful primula with simple, radical, elliptic or ob-ovate, spatulate leaves with the base narrowed in to a winged petiole, green and glabrous on both surfaces. Flowers 2.5 cm in diameter, bright or pale rose-pink with a yellow centre, in lax umbels of 3 to 10 pedicelled flowers on a scape of 8-20 cm in length. Fruit, a capsule, globose sunk in the calyx.

### **Distribution**

**Global** : Europe, Asia

**Local** : Gulmarg. Alt. 2730 m

### ***Primula vulgaris* Huds.**

Leaves oblong or obovate-oblong about 2 inch long, obtuse, narrowed into petiole shorter than blades, crenulate, more or less pilose or glabrescent, wrinkled. Flowers solitary on pubescent pedicels to 6 inch long, pale yellow, purple or blue, becoming green in drying, 1-1.5 inch

across, calyx pubescent, the narrow lanceolate-acuminate lobes several times shorter than tube; throat of corolla slightly contracted and with scale-like folds.

**Distribution**

**Global** : Europe

**Local** : Gulmarg. Alt. 2730 m

***Ranunculus falcatus* L.**

An erect perennial covered with long, closely appressed hairs, stem 1-2 ft without runners, usually much branched many flowered, hairs white. Radical leaves 2-4 in and more across, long stalked, deeply 3 – lobed; segments deeply cut, nearly equal in length. Flowers long stalked, bright yellow. Fruit a globose head of many smooth, flattened, not dotted achenes, margins of achenes thickened.

**Distribution**

**Global** : Europe, South and West Asia

**Local** : Gulmarg. Alt. 2730 m.

***Rheum austrade* D.Don**

Stem stout, streaked green and brown, 1.5-2 m, with rounded leaves, and with dense branches clusters of small dark reddish-purple flowers borne

in an inflorescence 20-30 cm long, which enlarges greatly in fruit. Flowers 3 mm across. Leaves with a very stout leaf-stalk 30-45 cm, and with rounded to broadly ovate blade with a heart-shaped base having beneath, the basal leaves up to 60 cm across. Nutlets purple, 12 mm long, with narrow wings, and with a rounded heart shaped base and notched apex.

### **Distribution**

**Global** : Temperate to subtropical Asia to East Nepal

**Local** : Cheshmashahi. Alt. 1676 m

### ***Rudbeckia fulgida* Ait.**

Hairy per. 1-2 ft high. Leaves mostly entire, narrowly to oblong-lanceolate, the lowest and basal spatulate-lanceolate. Petiolate, 2-4 inch long. Foliaceous bracts of involucre often wide, ½-1 inch long; rays 12-14 golden-yellow or with orange base, as long as the bracts; disk black-purple, over ½ inch diameter; style-branches short and obtuse : Pappus a minute crown.

### **Distribution**

**Global** : North America, Pakistan, Mongolia and Texas

**Local** : Jawaharnagar. Alt. 1585 m

***Rudbeckia laciniata* L.**

Branching per. 2-12 ft high, smooth and glabrous or more or less roughened with short stiff hairs. Leaves broad, the basal pinnately divided into 5-7 after 2-3 cleft segms; straight leaves 3-5 parted or cleft those of the branches few-toothed or entire. Heads solitary or few, long-peduncled; involucral brackets loose and irregular, foliaceous; rays yellow, few or several, oblanceolate, 1-1½ inch long, soon dropping; disk greenish yellow; style-branches short and obtuse; pappus a short crown.

**Distribution**

**Global** : Queba to Florida and Arizon

**Local** : Gulmarg. Alt. 2730 m

***Salvia sclarea* L.**

Erect, many branched, glandular hairy perennial or biennial with ovate to oblong, notched to irregularly toothed, wrinkled, mid green leaves to 23 cm long with heart-shaped or perfoliate bases. Bears many flowered, terminal panicles or racemes of blue flowers to 3 cm with prominent lilac bracts. Fruit is of 4 round nutlets.

**Distribution**

**Global** : Europe to Central Asia

**Local** : Tangmarg, Gulmarg. Alt. 2730 m

***Santolina chamaecyparissus* L.**

Compact, rounded perennial producing white woolly young shoots, densely covered with slender, narrowly oblong, toothed to pinnatisect, grey white leaves to 4 cm long, with very fine, toothed divisions. Bright yellow flower heads to 1 cm across are borne on slender stems.

**Distribution**

**Global** : W and C. Mediterranean

**Local** : SKUAST-K. Alt. 1585 m

***Saxifraga stonilfera* Curtis**

Mat forming, producing a web of long, slender, much-branched, red stolens bearing numerous plantlets; leaves in rosettes, long-stalked, the blade to 10 cm wide, orbicular, coarsely toothed, silvery-veined above reddish beneath; panicles 30 to 60 cm tall, flowers about 2 cm wide with 1 or 2 petals longer than the rest, white.

**Distribution**

**Global** : East Asia

**Local** : Gulmarg. Alt. 2730 m

***Scilla bifolia* L.**

Bulbous perennial with upright stem, generally one per bulb; 2 – 3 linear lanceolate leaves sprouting from ground in late winter or early spring; and a raceme of 6-10 stellate flowers with violet – blue, sometimes pink or white petals. Fruit is a 3-loculicidal capsule.

**Distribution**

**Global** : Central and South Europe, Turkey

**Local** : Barzulla, Sheikhabagh, Nishat, Shalimar. Alt. 1585 m

***Scilla siberica* Haw**

Bulbous perennials with 2 to 4 semi-erect, broadly linear, basal leaves, 10 to 15 cm long produced in spring at the same time as loose racemes of up to 4 or 5 pendent bowl shaped bright blue flowers 1.5 cm across stems gradually elongate. Fruit is a loculicidal capsule.

**Distribution**

**Global** : Caucasus, Turkey

**Local** : Barzulla, Sheikhabagh, Nishat, Shalimar. Alt. 1585 m

***Sedum spectabile* Boreau**

Clump forming deciduous perennial, upright, unbranched green

stems bear opposite or whorled, ovate to elliptic or obovate, slightly scalloped, toothed grey-green leaves, to 8 cm long. In late summer, star shaped pink flowers to 1 cm across, with prominent stamens are borne in dense, flat cymes to 15 cm across, often causing the stems to bend. Attractive to bees. Fruit is a cluster of erect follicles.

**Distribution**

**Global** : China, Korea

**Local** : Kokernag. Alt. 2012 m

***Senecio cineraria* D.C**

Mound-forming evergreen with ovate to lanceolate, shallowly to deeply pinnatisect silvery grey leaves to 15 cm long. Loose corymbs of mustard- yellow flower heads to 2.5 cm across. Fruit is a cylindrical achene.

**Distribution**

**Global** : West and Central Mediterranean

**Local** : Kokernag. Alt. 2012 m

***Sisyrrinchium stratum* Smith.**

Clump – forming evergreen perennial with linear to lanceolate, iris – like but 2-ranked stiff, grayish green leaves, to 40 cm long. Bears stalk less

clusters of open-cup shaped, pale yellow flowers 2.5 cm across with tepal black striped purple-brown. Fruit is a loculicidal capsule.

**Distribution**

**Global** : Chile, Argentina

**Local** : Kokernag. Alt. 2012 m

***Solidago canadensis* L.**

A tall, graceful, perennial herb, with few branches, with angular edges, rather rough. Stems erect, stout. Leaves lance - shaped, basal ones short-stalked, elliptic, coarsely toothed, sharp – pointed or blunt, upper leaves smaller, narrower entire. Head 1-4 on short axillary stalks, gathered on a long leafy panicle. Ray-flowers (outer flowers) 10-12, central flower 12 – 20, all golden yellow. Fruit (achene) hairless or slightly hairy, ribbed.

**Distribution**

**Global** : China, Europe, America

**Local** : Babareshi, Gulmarg. Alt. 2730 m

***Sprekelia formosissima* Herb.**

Bulbous perennial with linear leaves 30 cm long and one (rarely two) pink flower-scape bearing a single funnel shaped flower 10 cm long, bright red with the three upper petals broader. Fruit is a loculicidal capsule.

**Distribution**

**Global** : Mexico and Guatemala

**Local** : Bagat, Barzulla, Gupkar, Boulevard. Alt. 1585 m

***Stachys byzantina* K.Koch**

Mat forming, densely white woolly perennial with rosettes of entire, oblong elliptic to lance shaped, thick, wrinkled, veined, grey green leaves to 10 cm long. Erect stems bear interrupted spikes of woolly, pink purple flowers, 1.5 cm long. Nutlets are ovoid.

**Distribution**

**Global** : Caucasus to Iran

**Local** : Kangan, Sonamarg. Alt. 2439 m

***Sternbergia lutea* Roem and Schult**

Bulbous perennial with upright trigonal stem, grooved linear leaves, and single flower, yellow with perianth composed of a 2 cm tube and spatulate segments. Fruit is an achene.

**Distribution**

**Global** : Mediterranean region

**Local** : Nishat, Shalimar, Telbal, Hazratbal. Alt. 1585 m.

***Thymus serpyllum* L.**

Mat forming perennial with finely hairy, trailing stems and linear to elliptic or elliptic ovate, mid green leaves. Purple flowers are brown in congested whorls. Bears ovoid nutlets.

**Distribution**

**Global** : Eurasia, China, Japan

**Local** : Kokernag, Gulmarg. Alt. 2012-2730 m

***Tradescantia sillamontana* Matuda**

Trailing perennial with upright, later spreading silky hairy stems and ovate, fleshy, silky hairy, grey green leaves 5 cm long. Magenta pink flowers are borne in paired, terminal cymes. Fruit is a capsule.

**Distribution**

**Global** : North Mexico

**Local** : Nishat, Shalimar, Barzulla. Alt. 1585 m

***Tradescantia virginiana* L.**

A showy herbaceous perennial used for ground covers in shaded gardens. The leaves are alternate, usually fleshy, lance shaped, hairless.

Short lived, spreading, usually saucer shaped flowers up to 7.5 cm in diameter. Fruit is a capsule.

**Distribution**

**Global** : North America

**Local** : Shalimar, Chesmashahi. Alt. 1585-1676 m

***Tragopogon pratensis dublins Scop.***

Stems erect, slightly branched, 2 feet high, radical and lower leaves 5-8 inches long shortly dilated at the base, glabrous and slightly glaucous upper leaves shorter with the dilated base longer in proportion disk flowers absent. Ray florets ligulate, golden yellow. Peducles long, thickened at the summit, each with a single head of yellow flowers. Fruit an achene, cylindrical 2 cm long with a beak of the same length, the hairs of the pappus long and very feathery.

**Distribution**

**Global** : Europe, Asia

**Local** : Babareshi, Tangmarg, Gulmarg. Alt. 2730 m

***Tulipa clusiana D.C***

Tulip with 2-5 linear, hairless, glaucous, grey green leaves, to 15 cm long, bowl shaped, later star shaped flowers, to 10 cm across, with rounded

bases, are produced singly or in pairs. Flowers are white, striped pink outside with purple marks and purple stamens. Fruit is a capsule oblong in shape.

### **Distribution**

**Global** : Iran

**Local** : Nishat, Shalimar, Chesmashahi. Alt. 1585-1676 m

### ***Tulipa lanata* Rgl**

Tulips with 15-60 cm stems, downy. Leaves 4 or 5, glaucous, downy, margin waxy, red, ciliate; flower solitary; perianth-segments red, somewhat silvery on the back and downy on the upper half, basal blotch olive green with a yellow border.

### **Distribution**

**Global** : Northeast Iran, USSR, Afghanistan

**Local** : Sagan, Kokernag. Alt. 2012 m

### **149) *Typha angustifolia* Bory and Chaub.**

Aquatic perennial with linear leaves, to 1.5 m long, sheathed at the bases. Brown flower spikes, 20 cm long are borne in mid-summer. Male and female flowers are 7 cm apart, the females with dark reddish brown scales. Fruit is a nutlet.

**Distribution**

**Global** : Europe, North and Central Asia

**Local** : Gupkar, Nishat, Shalimar, Telbal. Alt. 1585 m

***Verbascum thapsus* L.**

A stout erect biennial, simple or branched clothed with soft woolly hairs. Leaves oblong, pointed, slightly toothed, narrowed at the base in to 2 wings running a long way down the stem; the lower ones often stalked. Inflorescence a terminal spike like raceme, many flowered, dense. Flowers zygomorphic, hypogynous showy, 2.5 cm in diameter. Fruit a capsule, septicidal, exceeding the calyx.

**Distribution**

**Global** : Europe, North Africa

**Local** : Sonamarg, Gulmarg. Alt. 2439-2730 m

***Viola odorata* L.**

Perennial stock short, but sometimes branched, knotted with the remains of the old leaf stalks and stipules, and usually emitting creeping runners or scions. Leaves in radical (or rather terminal) tufts, broadly cordate, rounded at the top, and crenate, downy or shortly hairy with longer stalks. Stipules narrow lanceolate or linear, and entire. Peduncles about as

long as the leaf stalks with a pair of small bracts. Stigma pointed horizontal or turned downwards. Fruit a capsule.

**Distribution**

**Global** : Western and Southern Europe

**Local** : Brein. Alt. 1585 m

***Zantedeschia aethiopica* Spreng**

Clump forming rhizomatous perennial, ever green in mild areas, with semi-erect, arrow shaped, glossy, bright green leaves, to 40 cm long. Bears a succession of large, pure white spathes to 25 long with creamy yellow spadices. Bears baccate, red tinged wings.

**Distribution**

**Global** : South Africa, Lesotho

**Local** : Gupkar. Alt. 1585 m

***Zantedeschia elliottiana* Engler**

Rhizomatous perennial with erect, heart shaped, dark green, basal leaves to 45 cm long, covered with translucent white spots. In summer bears golden yellow spadices. Bears baccate, red tinged wings.

## **Distribution**

**Global** : East Africa

**Local** : Gupkar. Alt. 1585 m

## **4.2 Habit, Habitat and mode of propagation**

### **4.2.1 Herbaceous Perennials:**

#### **4.2.1.1 Habit of growth**

The growth habit of herbaceous perennials is an important feature. There are two basic shapes recognizable in Herbaceous Perennials that is vertical growth or upright habit and the horizontal or spreading habit. In vertical growth, the height dominates over spread and in horizontal growth, the spread is more than height. However, number of recognizable shapes coming under these categories are identifiable. In the present studies on the basis of shape the herbaceous perennial has been grouped into seven categories (Table 2.1).

Out of eighty two herbaceous perennials studied, forty one had erect shape (*Aconitum napellus*, *Achillea filependulina*, *Alcea rosea*), twenty had spreading shape (*Dianthus barbatus*, *Limonium latifolium*, *Helenium autumnale*). Mound forming habit was observed in ten herbaceous perennials (*Paeonia emodi*, *P. lactiflora*, *Stachys byzantina*). Seven herbaceous perennials had clump



*Caltha palustris*



*Primula rosea*



*Typha angustifolia*



*Zantedeschia aethiopica*

forming habit (*Lythrum salicari*, *Lunaria annua*). Rosette type of habit was found in *Primula rosea* and *P. vulgaris* with climbing habit in *Lathyrus latifolius* and arching habit in *Arundo donax*.

#### **4.2.1.2 Rate of growth**

On the basis of rate of growth, the herbaceous perennials under study were classified into three categories with forty under rapid growth rate, thirty eight and four herbaceous perennials under medium and slow growth rate respectively.

#### **4.2.1.3 Habitat preference**

Perusal of Table 2.1 reveals that forty three herbaceous perennials prefers full sun (*Agapanthus praecox*, *Achillea millifolium*) while as semi shade was preferred by fifteen herbaceous perennials (*Aconitum napellus*, *Alcea rosea*) and twenty four preferred full sun/semi-shade (*Aquilegia canadensis*, *Coreopsis lanceolata*). Further perusal of Table 2.1 depicts that forty herbaceous perennials are adaptable to grow in fertile well drained soil (*Adiantum capillusveneris*, *Cheiranthus cheiri*) and thirty eight prefers fertile moist but well drained soil (*Euphorbia stracheyi*, *Helianthus multiflorus*) while as *Nelumbo nucifera* and *Nymphae stellata* prefers undisturbed water. *Arundo donax* and *Typha angustifolia* needs moist soil.

#### **4.2.1.4 Mode of propagation**

The propagation of plants have been a fundamental occupation of mankind since civilization began. It deals with multiplication and production of plants using propagules representing a specific genotype. A propagule is any plant part used to produce a new plant or a population of plants. Specific propagule include seeds, cuttings, buds, scions, explants and various kinds of specialized structures. In the present investigation, the commonly used methods of propagation of the flora under study have been recorded and have been presented in Table 2.

Out of eighty two herbaceous perennials, thirty one species are propagated by means of seed/cutting/division (*Gypsophila paniculata* , *Kniphofia uvaria*). Twenty nine by way of seed/division (*Helleborus niger*, *Liatris spicata*). Nine with seed/cutting (*Klanchoe blossfeldiana*, *Hesperis matronalis*). Six by means of seed (*Aquilegia vulgaris*, *Digitalis lanata*). *Solidago canadensis*, *Typha angustifolia* with division. *Adiantum capillus Veneris* by means of spores and *Arundo donax* with seed/division/sucker while as *Tradescandia virginiana* with cutting/division.

#### **4.2.2 Bulbous plants**

##### **4.2.2.1 Habit of growth**

Perusal of Table 2.2 reveals that thirty nine bulbous plants had erect

habit with *Alstroemeria aurantiaca* having leafy erect stems, *Amaryllis belladonna* and *Clivia miniata* having leafless erect stems. Four herbaceous perennials had mound forming habit (*Anemone biflora*, *Begonia* × *tuber hybrida*). Four having clump forming habit (*Belamcanda chinensis*, *Crocasmia masoniorum*) while as three species (*Fressia* x *hybrida* and *Hemerocallis flava*) and *Ornithogalum umbellatum* had spreading habit. Two species of crocus (*Crocus sativus* and *Crocus chrysanthus*) had mat forming habit. Climbing type of habit was observed in *Gloriosa rothschildiana*.

#### **4.2.2.2 Rate of growth**

The bulbous plants were grouped on the basis of growth rate and listed in Table 2.2 which revealed twenty four bulbous plants had rapid growth rate, twenty seven medium and two species (*Clivia miniata* and *Colchicum luteum*) had slow growth rate.

#### **4.2.2.3 Habitat Preference**

It is clear from Table 2.2 that twelve Bulbous plants prefer full sun/semi-shade (*Iris reticulata*, *Scilla bifolia*). Thirty three bulbous plants prefer full sun (*Dahlia variabilis*, *Fritillaria imperialis*). Eight Bulbous species prefer semi-shade (*Lilium candidum*, *L.longiflorum*).Thirty Bulbous plants were adaptable to grow in fertile well drained soil (*Sprekelia*

*formosissima*, *Tulipa lanata*). Seventeen bulbous species were adapted to fertile moist but well drained soil (*Iris germanica*, *Zantedeschia elliottiana*).

#### **4.2.2.4 Mode of propagation**

Out of fifty-three bulbous plants, fifteen are propagated with seeds/division (*Nerine bowdenii*, *Scilla siberica*). Sixteen with seeds/bulb (*Tulipa lanata*, *T.clusiana*). Six with seed/division/bulb (*Iris germanica*, *I. reticulata*). Five with seed/division/rhizomes (*Iris ensata*, *I. japonica*). Four with seed (*Ixiolirion karateginum*). Three with seed/cutting/division (*Dahlia variabilis*) *Begonia x tuberhybrida* with seed/cutting/division/ bulb, *Sprekelia formossisima* with division. *Gladiolus byzanthus* with seed/corm and *Hyacinthus orientalis* with bulb.

#### **4.2.3 Ground covers**

##### **4.2.3.1 Habit of growth**

Out of twenty nine species studied under this group, ten ground covers (*Aubrieta deltoide*, *Bellis perennis*) had mound forming habit, four spreading (*Geranium rectum*, *G.wallichianum*), six are erect growing (*Colchicum luteum*, *Leucojum aestivum*) and three had clump forming (*Eranthis hyemalis*, *Bergenia ciliata*) habit.

Two Ground covers (*Aspidistra elatior*, *Hosta lancifolia*) were found to have arching habit (*Primula rosea* and *P. vulgaris*) had rosette forming habit while as *Ajuga reptans* had creeping and *Cerastium tomentosum* had mat forming habit.

#### **4.2.3.2 Rate of growth**

The ground covers were grouped on the basis of growth rate and listed in Table 2.3 which revealed that eight ground covers were having rapid growth rate, seventeen medium and four ground covers slow growth rate.

#### **4.2.3.3 Habitat preference**

It is clear from Table 2.3 that twelve ground covers prefer full sun (*Colchicum luteum*, *Cerastium tomentosum*). Six species preferred semi-shade (*Ajuga reptans*, *Bellis perennis*). Full sun/semi-shade was preferred by eleven species (*Aptenia cordifolia*, *Viola odorata*). Sixteen ground covers are adaptable to grow in fertile, moist but well drained soil (*Muscari armeniacum*, *Leucojum aestivum*). Thirteen ground covers are adaptable to grow in practically fertile well drained soil (*Ornithogalum umbellatum*, *Thymus serpyllum*).

**Table-2 : Habit, habitat and mode of propagation**

**2.1 Herbaceous Perennials**

<b>S. No.</b>	<b>Name of the taxa</b>	<b>Habit of growth</b>	<b>Rate of growth</b>	<b>Habitat preference</b>	<b>Mode of propagation</b>
<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>	<b>(5)</b>	<b>(6)</b>
1.	<i>Achillea filipendulina</i>	Erect	M	FS/FWDS	Seed, Division
2.	<i>Achillea millifolium</i>	Mound forming	M	FS/FWDS	Seed, Division
3.	<i>Achillea ptarmica</i>	Erect	M	FS/FWDS	Seed, Division
4.	<i>Aconitum heterophyllum</i>	Erect	M	SS/FMWDS	Seed, Division
5.	<i>Aconitum napellus</i>	Erect	R	SS/FMWDS	Seed, Division
6.	<i>Adiantum-capillus Veneris</i>	Mound forming	M	SS/FWDS	Spores
7.	<i>Agapanthus africanus</i>	Erect	M	FS/FWDS	Seed, Division
8.	<i>Alcea rosea</i>	Erect	R	SS/FMWDS	Seed, Division
9.	<i>Aquilegia canadensis</i>	Erect	R	FS/SS/FMWDS	Seed, Division
10.	<i>Aquilegia vulgaris</i>	Erect	R	FS/SS/FMWDS	Seed

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)
11.	<i>Arundo donax</i>	Clump forming with arching leaves	M	FS/Moist conditions/muddy soil	Seed, Division, Sucker
12.	<i>Asparagus officinalis</i>	Erect	M	SS/FMWDS	Seed, Division
13.	<i>Aster alpinus</i>	Erect	R	SS/FWDS	Seed, Cutting, Division
14.	<i>Caltha palustris</i>	Mound forming	M	FS/FMWDS	Seed, Division
15.	<i>Campanula latifolia</i>	Erect	R	FS/FMWDS	Seed, Cutting, Division
16.	<i>Campanula medium</i>	Erect	M	FS/FMWDS	Seed, Division
17.	<i>Centaurea montana</i>	Mound forming	M	FS/FWDS	Seed, Cutting, Division
18.	<i>Cheiranthus cheiri</i>	Erect	R	FS/FWDS	Seed, Cutting, Division
19.	<i>Chrysanthemum leucanthemum</i>	Erect	M	FS/SS/FWDS	Seed, Cutting, Division
20.	<i>Coreopsis grandiflora</i>	Erect	M	FS/FWDS	Seed, Cutting, Division
21.	<i>Coreopsis lanceolata</i>	Erect	M	FS/SS/FWDS	Seed, Cutting, Division
22.	<i>Cynara cardunculus</i>	Erect	M	FS/FWDS	Seed, Division
23.	<i>Delphinium elatum</i>	Clump forming	M	FS/FWDS	Seed, Cutting

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)
24.	<i>Dendranthema x grandiflorum</i>	Erect	R	FS/FWDS	Seed, Cutting, Division
25.	<i>Dianthus barbatus</i>	Spreading	R	FS/FWDS	Seed, Cutting, Division
26.	<i>Dianthus caryophyllus</i>	Spreading	R	FS/FWDS	Seed, Cutting
27.	<i>Dianthus chinensis</i>	Spreading	R	FS/FWDS	Seed, Cutting
28.	<i>Digitalis lanata</i>	Clump forming	R	SS/FWDS	Seed
29.	<i>Digitalis purpurea</i>	Erect	R	SS/FWDS	Seed
30.	<i>Echinacea purpurea</i>	Erect	R	FS/FWDS	Seed, Cutting, Division
31.	<i>Eryngium biebersteinianum</i>	Clump forming	R	FS/FMWDS	Seed, Cutting, Division
32.	<i>Euphorbia stracheyi</i>	Erect	M	FS/SS/FMWDS	Seed, Cutting, Division
33.	<i>Gazania niveae</i>	Mound forming	R	FS/FWDS	Seed, Cutting, Division
34.	<i>Gazania x splendens</i>	Mound forming	R	FS/FWDS	Seed, Cutting
35.	<i>Gerbera jamesonii</i>	Erect	M	SS/FMWDS	Seed, Cutting, Division

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)
36.	<i>Gypsophila paniculata</i>	Spreading	M	FS/FWDS	Seed, Cutting, Division
37.	<i>Hedychium gardnerianum</i>	Erect	M	SS/FS/FMWDS	Seed, Division
38.	<i>Helenium autumnale</i>	Spreading	R	FS/FMWDS	Seed, Cutting
39.	<i>Helianthus autumnale</i>	Erect	R	FS/FMWDS	Seed, Cutting, Division
40.	<i>Helianthus x multiflorus</i>	Erect	R	FS/FMWDS	Seed, Cutting, Division
41.	<i>Helleborus niger</i>	Clump forming	R	SS/FS/FWDS	Seed, Division
42.	<i>Hesperis matronalis</i>	Spreading	S	SS/FS/FMWDS	Seed, Cutting
43.	<i>Inula royleana</i>	Erect	M	FS/FMWDS	Seed, Division
44.	<i>Kalanchoe blossfeldiana</i>	Spreading	M	SS/FMWDS	Seed, Cutting
45.	<i>Kniphofia uvaria</i>	Erect	R	SS/FMWDS	Seed, Cutting, Division
46.	<i>Lathyrus latifolius</i>	Climbing	R	SS/FS/FWDS	Seed
47.	<i>Lavendula angustifolia</i>	Spreading	R	FS/FWDS	Seed, Cutting
48.	<i>Liatris spicata</i>	Erect	R	FS/FMWDS	Seed, Division

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)
49.	<i>Limonium latifolium</i>	Spreading	M	FS/FWDS	Seed, Division
50.	<i>Lunaria annua</i>	Clump forming	M	SS/FS/FMWDS	Seed, Division
51.	<i>Lupinus polyphyllus</i>	Erect	R	SS/FWDS	Seed, Cutting
52.	<i>Lythrum salicaria</i>	Clump forming	M	FS/FWDS	Seed, Cutting, Division
53.	<i>Matthiola incana</i>	Spreading	M	FS/FMWDS	Seed
54.	<i>Mimulus nepalensis</i>	Erect	M	FS/SS/FMWDS	Seed, Cutting, Division
55.	<i>Mirabilis jalapa</i>	Spreading	M	FS/FWDS	Seed, Division
56.	<i>Nelumbo nucifera</i>	Spreading	R	FS/UW	Seed, Division
57.	<i>Nepeta nervosa</i>	Spreading	M	SS/FS/FWDS	Seed, Cutting, Division
58.	<i>Nymphae stellata</i>	Spreading	R	FS/UW	Seed, Division
59.	<i>Oenothera biennis</i>	Erect	R	FS/FWDS	Seed, Cutting, Division
60.	<i>Paeonia emodi</i>	Mound forming	R	SS/FMWDS	Seed, Cutting, Division
61.	<i>Paeonia lactiflora</i>	Mound forming	R	SS/FMWDS	Seed, Cutting, Division
62.	<i>Papaver orientale</i>	Clump forming	R	FS/FWDS	Seed, Cutting, Division

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)
63.	<i>Penstemon barbatus</i>	Spreading	R	SS/FS/FWDS	Seed, Division
64.	<i>Phlox paniculata</i>	Erect	R	SS/FS/FMWDS	Seed, Cutting, Division
65.	<i>Physalis alkekengi</i>	Spreading	R	SS/FS/FWDS	Seed, Division
66.	<i>Platycodon grandiflorum</i>	Erect	M	SS/FS/FMWDS	Seed, Division
67.	<i>Primula denticulata</i>	Erect	M	SS/FS/FMWDS	Seed, Cutting, Division
68.	<i>Primula rosea</i>	Rosette forming	M	FS/SS/FMWDS	Seed, Cutting, Division
69.	<i>Primula vulgaris</i>	Rosette forming	M	FS/SS/FMWDS	Seed, Cutting, Division
70.	<i>Ranunculus falcatus</i>	Spreading	R	SS/FS/FMWDS	Seed, Division
71.	<i>Rheum australe</i>	Erect	M	SS/FS/FMWDS	Seed, Division
72.	<i>Rudbeckia fulgida</i>	Spreading	R	SS/FS/FMWDS	Seed, Division
73.	<i>Rudbeckia laciniata</i>	Spreading	M	SS/FS/FMWDS	Seed, Division
74.	<i>Salvia sclarea</i>	Erect	R	SS/FS/FMWDS	Seed, Cutting, Division
75.	<i>Senecio cineraria</i>	Erect	M	FS/FWDS	Seed, Cutting, Division

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)
76.	<i>Sisyrinchium striatum</i>	Erect	S	FS/FWDS	Seed, Division
77.	<i>Solidago canadensis</i>	Erect	R	FS/FWDS	Division
78.	<i>Stachys byzantina</i>	Mound forming	M	FS/FWDS	Seed, Cutting, Division
79.	<i>Tradescantia virginiana</i>	Spreading	R	SS/FS/FMWDS	Cutting, Division
80.	<i>Tragopogon pratensis</i>	Mound forming	S	FS/FWDS	Seed
81.	<i>Typha angustifolia</i>	Erect	M	FS/DMS	Division
82.	<i>Verbascum thapsus</i>	Erect	S	FS/FWDS	Seed, Cutting, Division

## 2.2 Bulbous Plants

1.	<i>Alstroemeria aurantiaca</i>	Leafy, Erect, Stems	R	FS/FWDS	Seed, Division
2.	<i>Amaryllis belladonna</i>	Erect	M	SS/FWDS	Seed, Bulb
3.	<i>Anemone biflora</i>	Cushion or mound forming	R	SS/FMWDS	Seed, Division
4.	<i>Anemone x hybrida</i>	Erect	M	FS/FMWDS	Seed, Division

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)
5.	<i>Begonia evansiana</i>	Erect	R	SS/FWDS	Seed, Cutting, Division
6.	<i>Begonia x semperflorens</i>	Cushion or mound forming	M	FS/FWDS	Seed, Cutting, Division
7.	<i>Begonia x tuberhybrida</i>	Cushion or mound forming	M	SS/FWDS	Seed, Cutting, Division, Bulb
8.	<i>Belamcanda chinensis</i>	Clump forming	M	FS/FMWDS	Seed, Division
9.	<i>Canna indica</i>	Erect	R	FS/FWDS	Seed, Division
10.	<i>Clivia miniata</i>	Stemless	S	SS/FWDS	Seed, Division
11.	<i>Colchicum luteum</i>	Erect	S	FS/FWDS	Seed, Bulb
12.	<i>Crococsmia masoniorum</i>	Clump forming	R	FS/SS/FMWDS	Seed, Division
13.	<i>Crocus chrysanthus</i>	Mat forming	R	FS/FWDS	Seed, Bulb
14.	<i>Crocus sativus</i>	Mat forming	R	FS/FWDS	Seed, Bulb
15.	<i>Dahlia variabilis</i>	Erect	M	FS/FWDS	Seed, Cutting, Division
16.	<i>Eranthis hyemalis</i>	Clump forming	M	FS/SS/FMWDS	Seed, Bulb, Division

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)
17.	<i>Eremurus himalaicus</i>	Clump forming	M	FS/FWDS	Seed, Division, Bulb
18.	<i>Fressia x hybrida</i>	Spreading	M	FS/FMWDS	Seed
19.	<i>Fritillaria imperialis</i>	Erect	R	FS/FWDS	Seed, Division, Bulb
20.	<i>Gagea elegans</i>	Erect	R	FS/FWDS	Seed, Bulb
21.	<i>Galanthus nivalis</i>	Mound forming	M	SS/FMWDS	Seed, Division
22.	<i>Gladiolus byzanthus</i>	Erect	R	FS/FWDS	Seed, Corm
23.	<i>Gloriosa rothschildiana</i>	Climbing	M	FS/FWDS	Seed
24.	<i>Hemerocallis flava</i>	Spreading	R	FS/FMWDS	Seed, Division
25.	<i>Hippeastrum puniceum</i>	Erect	M	SS/FS/FWDS	Seed
26.	<i>Hyacinthus orientalis</i>	Erect	R	SS/FS/FWDS	Bulb
27.	<i>Iris ensata</i>	Erect	M	FS/SS/FMWDS	Seed, Division, Rhizomes
28.	<i>Iris germanica</i>	Erect	M	FS/SS/FMWDS	Seed, Division, Bulb

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)
29.	<i>Iris 'Gingerbread Man'</i>	Erect	M	FS/SS/FMWDS	Seed, Division, Rhizomes
30.	<i>Iris japonica</i>	Erect	M	FS/SS/FMWDS	Seed, Division, Rhizomes
31.	<i>Iris kashmeriana</i>	Erect	M	FS/FWDS	Seed, Division, Bulb
32.	<i>Iris reticulata</i>	Erect	M	FS/SS/FMWDS	Seed, Division, Bulb
33.	<i>Iris tectorum</i>	Erect	M	FS/FWDS	Seed, Division, Rhizomes
34.	<i>Iris unguicularis</i>	Erect	M	FS/SS/FMWDS	Seed, Division, Rhizomes
35.	<i>Ixiolirion karateginum</i>	Erect	M	FS/FWDS	Seed
36.	<i>Leucojum aestivum</i>	Erect	R	FS/FMWDS	Seed, Bulb
37.	<i>Lilium auratum</i>	Erect	R	FS/FWDS	Seed, Bulb
38.	<i>Lilium candidum</i>	Erect	R	SS/FWDS	Seed, Bulb
39.	<i>Lilium longiflorum</i>	Erect	R	SS/FWDS	Seed, Bulb

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)
40.	<i>Lycoris radiata</i>	Erect	M	FS/FWDS	Seed, Bulb
41.	<i>Muscari armeniacum</i>	Erect	R	FS/FMWDS	Seed, Bulb
42.	<i>Narcissus pseudonarcissus</i>	Erect	R	FS/FMWDS	Seed, Bulb
43.	<i>Narcissus tazetta</i>	Erect	R	FS/FMWDS	Seed, Bulb
44.	<i>Nerine bowdenii</i>	Erect	M	FS/FWDS	Seed, Division
45.	<i>Ornithogalum umbellatum</i>	Spreading	M	FS/FWDS	Seed, Bulb
46.	<i>Scilla bifolia</i>	Erect	M	SS/FS/FWDS	Seed, Division
47.	<i>Scilla siberica</i>	Erect	M	SS/FS/FWDS	Seed, Division
48.	<i>Sprekelia formosissima</i>	Erect	M	FS/FWDS	Division
49.	<i>Sternbergia lutea</i>	Erect	R	FS/FWDS	Seed, Division
50.	<i>Tulipa Clusiana</i>	Erect	R	FS/FWDS	Seed, Bulb
51.	<i>Tulipa lanata</i>	Erect	R	FS/FWDS	Seed, Bulb
52.	<i>Zantedeschia aethiopica</i>	Erect	R	FS/FMWDS	Seed, Division
53.	<i>Zantedeschia elliottiana</i>	Erect	R	FS/FMWDS	Seed, Division

Continued .....

### 2.3 Ground Covers

(1)	(2)	(3)	(4)	(5)	(6)
1.	<i>Ajuga reptans</i>	Creeping	M	SS/FMWDS	Seed, Sucker
2.	<i>Aptenia cordifolia</i>	Mound-forming	R	FS/SS/FWDS	Seed, Cutting, Grafting
3.	<i>Aspidistra elatior</i>	Arching	M	SS/FMWDS	Division
4.	<i>Aubrieta deltoide</i>	Mound forming	R	FS/FWDS	Seed, Cutting, Division
5.	<i>Bellis perennis</i>	Mound forming	M	SS/FWDS	Seed, Division
6.	<i>Bergenia ciliata</i>	Clump forming	S	SS/FMWDS	Seed, Division
7.	<i>Caltha palustris</i>	Mound forming	M	FS/FMWDS	Seed, Division
8.	<i>Cerastium tomentosum</i>	Mat forming	M	FS/FWDS	Seed, Cutting, Division
9.	<i>Colchicum luteum</i>	Erect	S	FS/FWDS	Seed, Bulb
10.	<i>Convallaria majalis</i>	Mound forming	S	FS/SS/FMWDS	Seed, Sucker
11.	<i>Eranthis hyemalis</i>	Clump forming	M	SS/FS/FMWDS	Seed, Division
12.	<i>Geranium rectum</i>	Spreading	R	SS/FS/FWDS	Seed, Cutting, Division

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)
13.	<i>Geranium wallichianum</i>	Spreading	R	SS/FS/FWDS	Seed, Cutting, Division
14.	<i>Hosta lancifolia</i>	Arching	M	SS/FS/FMWDS	Seed, Division
15.	<i>Hosta plantaginea</i>	Clump forming	R	SS/FS/FMWDS	Seed, Division
16.	<i>Leucojum aestivum</i>	Upright	R	FS/FMWDS	Seed, Bulb
17.	<i>Lycoris radiata</i>	Erect	M	FS/FWDS	Seed, Bulb
18.	<i>Muscari armeniacum</i>	Erect	R	FS/FMWDS	Seed, Bulb
19.	<i>Nerine bowdenii</i>	Erect	M	FS/FWDS	Seed, Division
20.	<i>Ornithogalum umbellatum</i>	Spreading	M	FS/FWDS	Seed
21.	<i>Primula denticulata</i>	Erect	M	FS/SS/FMWDS	Seed, Cutting, Division
22.	<i>Primula rasea</i>	Rosette forming	M	FS/SS/FMWDS	Seed, Cutting, Division
23.	<i>Primula vulgaris</i>	Rosette forming	M	FS/SS/FMWDS	Seed, Cutting, Division

Continued .....



#### **4.2.3.4 Mode of propagation**

The commonly used method of propagation of twenty nine ground covers presented in Table 2.3 revealed that eleven species are propagated with seed/cutting/division (*Thymus serpyllum*, *Viola odorata*). Six with seed/Division (*Hosta lancifolia*, *H. plantaginea*). Four with seed/bulb (*Leucojum aestivum*, *Muscari armeniacum*). *Ajuga reptans* and *Convallaria majalis* with seed/sucker. One with seed (*Ornithogalum umbellatum*), one with seed/cutting (*Santolina chamaecyparissus*), one with cutting/division (*Aspidistra elatior*) and one with seed/cutting/grafting (*Aptenia cordifolia*). One with division (*Aspidistra elatior*), one with seed/bulb/division (*Eranthis hyemalis*).

### **4.3 Mature Height and Spread:**

#### **4.3.1 Herbaceous perennials**

##### **4.3.1.1 Height**

The height of eighty two herbaceous perennials was recorded and the data has been presented in Table 3.1. On the basis of height , the species have been divided into four main groups; small upto 30 cm, medium 31-60 cm, large 61-90 cm and very large >90 cm. Ten herbaceous perennials falled under small group (*Aconitum heterophyllum*, *Adiantum capillus Veneris*). Twenty-six species were of medium height (*Centaurea Montana*, *Coreopsis lanceolata*). Twenty species were of large height (*Coreopsis*

*grandiflora*, *Delphinium elatum*). Twenty six herbaceous perennials were found to be of very large height (*Helianthus autumnale*, *Matthiola incana*).

#### **4.3.1.2 Spread**

On the basis of spread, the species have been divided into four groups small upto 30 cm, medium 31-45 cm, large 46-75 cm and very large >75 cm. Perusal of Table 3.1 reveals that out of eighty two herbaceous perennials, three falled in the range of small spread (*Aquilegia canadensis*, *Centaurea montana*). Twenty-eight species falled in the medium category (*Cheiranthus cheiri*, *Gazania niveae*). Eighteen species in the range of large spread (*Chrysanthemum leucanthemum*, *Digitalis purpurea*). Thirteen species were having very large spread (*Euphorbia stracheyi*, *Kniphofia uvaria*).

#### **4.3.2 Bulbous Plants**

##### **4.3.2.1 Height**

Persual of Table 3.2 reveals that out of fifty-three species, twenty species were of small height (*Anemone biflora*, *Crocus chrysanthus*). Sixteen species of medium height (*Civia miniata*, *Fressia × hybrida*). Six species of large height (*Gladiolus byzanthus*, *Lilium longiflorum*) and eleven species were of very large height (*Dahlia variablis*, *Eremurus himalaicus*).

#### **4.3.2.2 Spread**

Out of fifty-three species, thirty-four species were having average spread of upto 15 cm (*Crocus sativus*, *Iris reticulata*). Thirteen species (*Clivia miniata*, *Narcissus tazetta*) fell in the range of 16-30 cm and six bulbous plants were having large spread of >30 cm (*Lilium auratum*, *Zantedeschia aethiopica*).

#### **4.3.3 Ground Covers**

##### **4.3.3.1 Height**

The height of twenty-nine ground covers were recorded and the data has been presented in the Table 3.1. On the basis of height, the species have been divided into three groups; small upto 15 cm, medium 16-30 cm and large > 90 cm.

Among twenty-nine species, eight species were having height upto 15 cm (*Bellis perennis*, *Colchicum luteum*). Ten species were of medium height falling in the range of 16-30 cm (*Bergenia ciliata*, *Convallaria majalis*). Eleven ground covers were of large height >30 cm (*Hosta lancifolia*, *H. plantaginea*).

##### **4.3.3.2 Spread**

On the basis of spread, the species have been divided into three classes; small upto 15 cm, medium 16-30 cm and large >30 cm.

**Table-3 : Height and spread at flowering**

**3.1 Herbaceous Perennials**

S. No.	Name of the species	Height (cm)				Spread (cm)			
		Upto 30	31-60	61-90	>90	Upto 30	31-45	46-75	>75
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1.	<i>Achillea filipendulina</i>	-	-	-	100	-	35	-	-
2.	<i>Achillea millifolium</i>	-	-	75	-	-	-	60	-
3.	<i>Achillea ptarmica</i>	-	-	78	-	-	-	60	-
4.	<i>Aconitum heterophyllum</i>	25	-	-	-	15	-	-	-
5.	<i>Aconitum napellus</i>	-	-	85	-	30	-	-	-
6.	<i>Adiantum-capillus Veneris</i>	30	-	-	-	-	40	-	-
7.	<i>Agapanthus africanus</i>	-	-	86	-	-	-	55	-
8.	<i>Alcea rosea</i>	-	-	-	180	-	-	60	-
9.	<i>Aquilegia canadensis</i>	-	-	80	-	30	-	-	-
10.	<i>Aquilegia vulgaris</i>	-	45	-	-	-	32	-	-

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
11.	<i>Arundo donax</i>	-	-	-	400	-	-	-	140
12.	<i>Asparagus officinalis</i>	-	-	-	120	-	-	-	80
13.	<i>Aster alpinus</i>	-	35	-	-	-	45	-	-
14.	<i>Caltha palustris</i>	19	-	-	-	-	45	-	-
15.	<i>Campanula latifolia</i>	-	-	-	100	-	-	58	-
16.	<i>Campanula medium</i>	-	-	-	102	-	-	60	-
17.	<i>Centaurea montana</i>	-	45	-	-	30	-	-	-
18.	<i>Cheiranthus cheiri</i>	30	-	-	-	-	40	-	-
19.	<i>Chrysanthemum leucanthemum</i>	-	-	85	-	-	-	60	-
20.	<i>Coreopsis grandiflora</i>	-	-	80	-	-	45	-	-
21.	<i>Coreopsis lanceolata</i>	-	60	-	-	-	42	-	-
22.	<i>Cynara cardunculus</i>	-	-	-	100	-	-	-	98
23.	<i>Delphinium elatum</i>	-	50	-	-	30	-	-	-

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
24.	<i>Dendranthema x grandiflorum</i>	-	50	-	-	-	32	-	-
25.	<i>Dianthus barbatus</i>	-	-	70	-	30	-	-	-
26.	<i>Dianthus caryophyllus</i>	-	-	80	-	20	-	-	-
27.	<i>Dianthus chinensis</i>	-	-	70	-	22	-	-	-
28.	<i>Digitalis lanata</i>	-	-	62	-	30	-	-	-
29.	<i>Digitalis purpurea</i>	-	-	-	150	-	-	60	-
30.	<i>Echinacea purpurea</i>	-	-	-	145	-	45	-	-
31.	<i>Eryngium biebersteinianum</i>	-	40	-	-	30	-	-	-
32.	<i>Euphorbia stracheyi</i>	-	-	75	-	-	-	-	95
33.	<i>Gazania niveae</i>	22	-	-	-	-	32	-	-
34.	<i>Gazania x splendens</i>	20	-	-	-	25	-	-	-
35.	<i>Gerbera jamesonii</i>	-	38	-	-	-	-	55	-
36.	<i>Gypsophila paniculata</i>	-	40	-	-	-	-	50	-
37.	<i>Hedychium gardnerianum</i>	-	-	-	200	-	-	-	100

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
38.	<i>Helenium autumnale</i>	-	-	-	190	-	45	-	-
39.	<i>Helianthus autumnale</i>	-	-	-	190	-	-	-	90
40.	<i>Helianthus x multiflorus</i>	-	-	-	195	-	-	-	90
41.	<i>Helleborus niger</i>	-	38	-	-	-	35	-	-
42.	<i>Hesperis matronalis</i>	-	-	90	-	-	45	-	-
43.	<i>Inula royleana</i>	-	50	-	-	-	45	-	-
44.	<i>Kalanchoe blossfeldiana</i>	-	40	-	-	-	40	-	-
45.	<i>Kniphofia uvaria</i>	-	60	-	-	30	-	-	102
46.	<i>Lathyrus latifolius</i>	-	-	-	103	20	-	-	-
47.	<i>Lavendula angustifolia</i>	-	-	-	95	-	-	-	110
48.	<i>Liatris spicata</i>	-	-	80	-	-	45	-	-
49.	<i>Limonium latifolium</i>	-	60	-	-	-	45	-	-
50.	<i>Lunaria annua</i>	-	-	90	-	30	-	-	-
51.	<i>Lupinus polyphyllus</i>	-	35	-	-	30	-	-	-

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
52.	<i>Lythrum salicaria</i>	-	-	-	102	-	45	-	-
53.	<i>Matthiola incana</i>	-	-	-	120	10	-	-	-
54.	<i>Mimulus nepalensis</i>	20	-	-	-	10	-	-	-
55.	<i>Mirabilis jalapa</i>	-	60	-	-	-	-	60	-
56.	<i>Nelumbo nucifera</i>	-	-	-	120	30	-	-	-
57.	<i>Nepeta nervosa</i>	-	50	-	-	30	-	-	-
58.	<i>Nymphae stellata</i>	-	60	-	-	30	-	-	-
59.	<i>Oenothera biennis</i>	-	-	-	120	-	-	50	-
60.	<i>Paeonia emodi</i>	-	-	70	-	-	-	-	76
61.	<i>Paeonia lactiflora</i>	-	60	-	-	-	-	65	-
62.	<i>Papaver orientale</i>	-	-	65	-	-	-	75	-
63.	<i>Penstemon barbatus</i>	-	-	-	94	-	38	-	-
64.	<i>Phlox paniculata</i>	-	-	-	115	-	45	-	-
65.	<i>Physalis alkekengi</i>	-	60	-	-	-	-	74	-
66.	<i>Platycodon grandiflorum</i>	-	60	-	-	30	-	-	-

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
67.	<i>Primula denticulata</i>	-	45	-	-	-	45	-	-
68.	<i>Primula rosea</i>	18	-	-	-	15	-	-	-
69.	<i>Primula vulgaris</i>	15	-	-	-	-	35	-	-
70.	<i>Ranunculus falcatus</i>	20	-	-	-	15	-	-	-
71.	<i>Rheum australe</i>	-	-	-	202	-	-	-	104
72.	<i>Rudbeckia fulgida</i>	-	-	90	-	-	45	-	-
73.	<i>Rudbeckia laciniata</i>	-	-	-	200	-	-	-	100
74.	<i>Salvia sclarea</i>	-	32	-	-	-	-	-	90
75.	<i>Senecio cineraria</i>	-	60	-	-	-	-	60	-
76.	<i>Sisyrinchium striatum</i>	-	-	90	-	25	-	-	-
77.	<i>Solidago canadensis</i>	-	-	-	140	-	45	-	-
78.	<i>Stachys byzantina</i>	-	45	-	-	-	-	60	-
79.	<i>Tradescantia virginiana</i>	-	60	-	-	-	50	-	-
80.	<i>Tragopogon pratensis</i>	-	-	75	-	-	45	-	-
81.	<i>Typha angustifolia</i>	-	-	-	105	-	-	75	-
82.	<i>Verbascum thapsus</i>	-	-	-	100	-	45	-	-

Continued .....

### 3.2 Bulbous Plants

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1.	<i>Alstroemeria aurantiaca</i>	-	-	-	92	-	45	-
2.	<i>Amaryllis belladonna</i>	-	52	-	-	9	-	-
3.	<i>Anemone biflora</i>	5	-	-	-	8	-	-
4.	<i>Anemone x hybrida</i>	-	-	-	120	-	25	-
5.	<i>Begonia evansiana</i>	25	-	-	-	15	-	-
6.	<i>Begonia x semperflorens</i>	8	-	-	-	15	-	-
7.	<i>Begonia x tuberhybrida</i>	8	-	-	-	15	-	-
8.	<i>Belamcanda chinensis</i>	-	-	80	-	-	20	-
9.	<i>Canna indica</i>	-	-	-	150	-	-	50
10.	<i>Clivia miniata</i>	-	45	-	-	-	30	-
11.	<i>Colchicum luteum</i>	10	-	-	8	-	-	-
12.	<i>Crocsmia masoniorum</i>	-	-	-	130	8	-	-

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
13.	<i>Crocus chrysanthus</i>	5	-	-	-	4	-	-
14.	<i>Crocus sativus</i>	4	-	-	-	5	-	-
15.	<i>Dahlia variabilis</i>	-	-	-	105	-	-	60
16.	<i>Eranthis heymalis</i>	8	-	-	7	-	-	-
17.	<i>Eremurus himalaicus</i>	-	-	-	125	-	-	50
18.	<i>Fressia x hybrida</i>	-	40	-	-	10	-	-
19.	<i>Fritillaria imperialis</i>	-	-	-	120	-	30	-
20.	<i>Gagea elegans</i>	5	-	-	-	30	-	-
21.	<i>Galanthus nivalis</i>	10	-	-	-	10	-	-
22.	<i>Gladiolus byzanthus</i>	-	-	80	-	10	-	-
23.	<i>Gloriosa rothschildiana</i>	-	50	-	-	6	-	-
24.	<i>Hemerocallis flava</i>	-	-	-	98	-	-	100
25.	<i>Hippeastrum puniceum</i>	-	45	-	-	-	30	-

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
26.	<i>Hyacinthus orientalis</i>	27	-	-	-	9	-	-
27.	<i>Iris ensata</i>	-	-	90	-	16	-	-
28.	<i>Iris germanica</i>	-	-	-	92	-	18	-
29.	<i>Iris 'Gingerbread Man'</i> ,	-	25	-	-	14	-	-
30.	<i>Iris japonica</i>	-	45	-	-	10	-	-
31.	<i>Iris kashmeriana</i>	-	45	-	-	12	-	-
32.	<i>Iris reticulata</i>	20	-	-	-	10	-	-
33.	<i>Iris tectorum</i>	-	35	-	-	10	-	-
34.	<i>Iris unguicularis</i>	-	30	-	-	11	-	-
35.	<i>Ixiolirion karateginum</i>	2	-	-	-	10	-	-
36.	<i>Leucojum aestivum</i>	1	50	1	1	8	1	1
37.	<i>Lilium auratum</i>	-	-	-	102	-	-	40
38.	<i>Lilium candidum</i>	-	-	-	105	-	30	-

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
39.	<i>Lilium longiflorum</i>	-	-	80	-	-	30	-
40.	<i>Lycoris radiata</i>	-	40	-	-	-	20	-
41.	<i>Muscari armeniacum</i>	20	-	-	-	5	-	-
42.	<i>Narcissus pseudonarcissus</i>	23	-	-	-	-	20	-
43.	<i>Narcissus tazetta</i>	20	-	-	-	-	20	-
44.	<i>Nerine bowdenii</i>	-	42	-	-	8	-	-
45.	<i>Ornithogalum umbellatum</i>	28	-	-	-	10	-	-
46.	<i>Scilla bifolia</i>	13	-	-	-	5	-	-
47.	<i>Scilla siberica</i>	17	-	-	-	5	-	-
48.	<i>Sprekelia formosissima</i>	-	30	-	-	15	-	-
49.	<i>Sternbergia lutea</i>	15	-	-	-	8	-	-
50.	<i>Tulipa Clusiana</i>	-	45	-	-	3	-	-
51.	<i>Tulipa Lanata</i>	-	60	-	-	3	-	-
52.	<i>Zantedeschia aethiopica</i>	-	-	90	-	-	-	60
53.	<i>Zantedeschia elliottiana</i> Engler	-	-	80	-	-	20	-

Continued .....

### 3.3 Ground Covers

S. No.	Name of the taxa	Height (cm)			Spread (cm)		
		Upto 15	16-30	>30	Upto 15	16-30	>30
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.	<i>Ajuga reptans</i>	15	-	-	-	-	75
2.	<i>Aptenia cordifolia</i>	5	-	-	7.5	-	-
3.	<i>Aspidistra elatior</i>	-	60	-	-	-	60
4.	<i>Aubrieta deltoide</i>	5	-	-	8	-	-
5.	<i>Bellis perennis</i>	13	-	-	15	-	-
6.	<i>Bergenia ciliata</i>	-	27	-	-	-	42
7.	<i>Caltha palustris</i>	-	19	-	-	-	45
8.	<i>Cerastium tomentosum</i>	8	-	-	8	-	-
9.	<i>Colchicum luteum</i>	10	-	-	8	-	-

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
10.	<i>Convallaria majalis</i>	-	23	-	-	30	-
11.	<i>Eranthis hyemalis</i>	8	-	-	7	-	-
12.	<i>Geranium rectum</i>	-	-	35	-	-	100
13.	<i>Geranium wallichianum</i>	-	30	-	-	-	110
14.	<i>Hosta lancifolia</i>	-	-	45	-	-	75
15.	<i>Hosta plantaginea</i>	-	-	60	-	-	100
16.	<i>Leucojum aestivum</i>	-	-	50	8	-	-
17.	<i>Lycoris radiata</i>	-	-	40	-	20	-
18.	<i>Muscari armeniacum</i>	-	20	-	5	-	-
19.	<i>Nerine bowdenii</i>	-	-	42	8	-	-
20.	<i>Ornithogalum umbellatum</i>	-	28	-	10	-	-
21.	<i>Primula denticulata</i>	-	-	45	-	-	45

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
22.	<i>Primula rosea</i>	-	18	-	15	-	-
23.	<i>Primula vulgaris</i>	15	-	-	-	-	35
24.	<i>Santolina chamaecyparissus</i>	-	-	50	-	-	75
25.	<i>Saxifraga stonilfera</i>	-	-	31	-	-	32
26.	<i>Sedum spectabile</i>	-	-	45	-	-	45
27.	<i>Thymus serpyllum</i>	-	25	-	-	-	45
28.	<i>Tradescantia sillamontana</i>	-	30	-	-	-	45
29.	<i>Viola odorata</i>	-	20	-	-	-	30

Persual of Table 3.2 reveals that out of twenty-nine species, eleven ground covers were having small spread upto 15 cm (*Leucojam aestivum*, *Ornithogalum umbellatum*). Three species falled in the range of medium spread 16-30 cm (*Convallaria majalis*, *Viola odorata* and *Lycoris radiata*) and fifteen species were having large spread of > 30 cm (*Ajuga reptans*, *Aspidistra elatior*).

#### **4.4 Foliage colour and texture**

##### **4.4.1 Herbaceous perennials**

###### **4.4.1.1 Foliage colour**

Colour in plants is normally thought of as flower or fruit colour because those are the most striking, foliage likewise have colour of considerable range. In foliage this ranges from grey, blue-grey and brown-grey though grey-green, light, medium and dark green to various purple and red shades and variegations of silver, yellow and red. In the present investigation, the foliage colour of species was recorded and has been depicted in Table 4.1.

The foliage colour was recorded in eighty-two herbaceous perennials, out of these thirty-two species produced mid green leaves like *Alcea rosea*, *Arundo donax*. Thirty two species produced dark green leaves as in *Aster alpinus*, *Caltha palustris*. Light green leaves were observed in eight herbaceous perennials like *Adiantum capillus Veneris*, *Tragopogon*



*Tradescantia sillamontana*



*Senecio cineraria*



*Cynara carduncules*



*Santolina chamaecyparissus*

Plate-6 Plants with silvery Grey foliage

*pratensis*. Five herbaceous perennials were having grey green leaves like *Digitalis purpurea*, *Hedychium gardnerianum*. Two species namely *Aquilegia canadensis* and *Platycodon grandiflorum* produced bluish green foliage. *Cynara cardunculus* and *Senecio cineraria* produced silvery grey foliage whereas Crimson purple colored foliage was noticed in *Rudbeckia laciniata*.

#### **4.4.1.2 Texture**

The foliage texture refers to the surface structure. Appreciable differences in foliage texture was noticed in herbaceous perennial species. Various texture such as soft, smooth, rough, pubescent, tomentose, glossy, fleshy and prickly were recorded.

Out of eighty-two herbaceous perennials, Twenty-nine species were having pubescent texture with *Echinacea purpurea* and *Primula vulgaris* having roughly pubescent texture. Fifteen herbaceous perennials species are valued for their smooth texture as in *Agapanthus praecox*, *Asparagus officinalis*. Fourteen species are valued for their soft texture as in *Dianthus caryophyllus*, *D.chinensis*. Rough texture was noticed in ten species as in *Physalis alkekengi*, *Campanula latifolia*. Six species are valued for their glossy texture as in *Adiantum capillus Veneris*. Fleshy texture was noticed in four species as in *Lavendula angustifolia*, *Nelumbo nucifera*. *Gerbera*

*jamesonii*, *Digitalis purpurea* and *Centaurea montana* are valued for their tomentose texture whereas *Eryngium beibersteinianum* is valued for its prickly foliage.

#### **4.4.2 Bulbous plants**

##### **4.4.2.1 Foliage colour**

The foliage colour of fifty-three bulbous species has been recorded and presented in Table 4.2. In twenty-two species dark green colour was noticed with *Begonia evansiana* having dark green colour above and reddish on lower surface. Twenty-one species were having mid green leaves (*Anemone biflora*, *A × hybrida*). Three species namely *Alstroemeria aurantiaca*, *Iris germanica* and *Tulipa lanata* produced grey green leaves. Pale green coloured foliage was noticed in *Begonia semperflorens*, *Crocus sativus* and *Crocus chrysanthus*. Bluish green foliage was produced by three species viz *Galanthus nivalis*, *Narcissus pseudonarcissus*, with *Hemerocallis flava* having dark bluish green foliage. Reddish green foliage was observed in only one species namely *Begonia x tuberhybrida*.

##### **4.4.2.2 Texture**

Out of fifty-three bulbous plants species, twenty-four plants are valued for their smooth texture such as *Alstroemeria aurantiaca*, *Belamcanda chinensis*, *Canna indica*; ten plants are valued for their glossy

texture like *Iris japonica*, *Zantedeschia aethiopica*; eight plants are valued for their soft texture such as *Anemone x hybrida*, *Anemone biflora* and *Galanthus nivalis*. Six species are valued for their rough texture with *Begonia x tuberhybrida* having rough, fleshy texture. Four species namely *Amaryllis belladonna*, *Clivia miniata* and *Hyacinthus orientalis* are valued for their thick and fleshy foliage. Pubescent foliage was noticed in one specie namely *Dahlia variabilis*.

#### **4.4.3 Ground covers**

##### **4.4.3.1 Foliage colour**

Appreciable variation in foliage colour was noticed in the species under study. Eleven ground covers present mid green colour foliage, thirteen ground covers produced dark green foliage. Greyish white foliage was noticed in two species viz. *Cerastium tomentosum* and *Santolina chamaecyparissus*. Light green foliage was produced by *Hosta plantaginea* and grayish green by *Tradescantia sillamontana* and *Sedum spectabile*.

##### **4.4.3.2 Texture**

Similar to foliage colour, lot of variation was noticed in texture of foliage. Out of twenty-nine species, nine ground covers had pubescent foliage with *Aspidistra elatior* and *Geranium wallichianum* having roughly pubescent foliage. Soft foliage was noticed in six ground covers like

**Table-4 : Characteristics of foliage****4.1 : Herbaceous perennials**

S. No.	Scientific name	Colour	Texture	Shape
(1)	(2)	(3)	(4)	(5)
1.	<i>Achillea filipendulina</i>	Dark green	Pubescent	2-3- pinnate, laceolate leaves, the lower being petiolate
2.	<i>Achillea millifolium</i>	Dark green	Pubescent	Simple, linear-lanceolate sessile finely toothed leaves
3.	<i>Achillea ptarmica</i>	Light green	Roughly Pubescent	Rounded 3.5 cm long cut in to 3-7 shallow lobes
4.	<i>Aconitum heterophyllum</i>	Dark green	Pubescent	Broad strap shaped 60 cm long leaves
5.	<i>Aconitum napellus</i>	Dark green	Pubescent	Rounded, deeply 5-7 lobed leaves, the lobes toothed or further divided
6.	<i>Adiantum-capillus Veneris</i>	Light green	Glossy	Segments obovate or fan shaped, 4-8 lines broad, all narrowed at the base into a short slender stalk divided into wedge shaped obtuse lobes, thin without any mid-rib
7.	<i>Agapanthus africanus</i>	Grey green	Smooth	Rosettes of oblong, 1-or 2-pinnate leaves
8.	<i>Alcea rosea</i>	Mid green	Roughly Pubescent	Decussate leaves, obovate to oblong margins usually crenate
9.	<i>Aquilegia canadensis</i>	Bluish green	Smooth	Finely divided ternate or 2-ternate leaves divided into leaflets

Continued .....

(1)	(2)	(3)	(4)	(5)
10.	<i>Aquilegia vulgaris</i>	Dark green	Smooth	2-ternate fern like leaves divided into leaflets
11.	<i>Arundo donax</i>	Mid green	Soft	Arching, broadly linear leaves
12.	<i>Asparagus officinalis</i>	Light green	Smooth	Lower leaves stalked, round, heart shaped at base, more or less 5-lobed and toothed, upper leaves stem-clasping, lanceolate, sharply toothed
13.	<i>Aster alpinus</i>	Dark green	Glossy	Ovate to lanceolate leaves produced singly at short intervals along the rhizomes
14.	<i>Caltha palustris</i>	Dark green	Soft	Kidney shaped with finely toothed margins, long petiolated radical leaves
15.	<i>Campanula latifolia</i>	Mid green	Rough	Basal clumps of ovate oblong, long stalked leaves, stem leaves are similar but stalkless and sharply pointed decreasing in size towards the tops of the stems
16.	<i>Campanula medium</i>	Mid green	Rough	Lance shaped to elliptic, toothed basal leaves and smaller stem leaves
17.	<i>Centaurea montana</i>	Mid green	Tomentose	Ovate to broadly lanceolate, entire to pinnatifid, sometimes slightly toothed leaves
18.	<i>Cheiranthus cheiri</i>	Dark green	Smooth	Narrow, pointed quite entire leaves
19.	<i>Chrysanthemum leucanthemum</i>	Mid green	Smooth	Lowest leaves in a rosette, subcircular to obovate spatulate, pedicelled; the upper ones oblong, sessile.

Continued .....

(1)	(2)	(3)	(4)	(5)
20.	<i>Coreopsis grandiflora</i>	Mid green	Smooth	Simple lanceolate or palmately lobed lower leaves. Flowering stems produce 3-5 pinnate leaves with linear leaflets
21.	<i>Coreopsis lanceolata</i>	Mid green	Smooth	Lanceolate to inversely lanceolate leaves
22.	<i>Cynara cardunculus</i>	Silvery grey	Roughly pubescent	Pinnatifid or 2-pinnatifid leaves with ovate to linear lanceolate segments and deep basal leaves
23.	<i>Delphinium elatum</i>	Dark green	Pubescent	Radical leaves long petioled, the lobes broadly cuneate, more or less 3-lobed and serrate cauline leaves similar to the radical leaves but shorter petioled
24.	<i>Dendranthema x grandiflorum</i>	Dark green	Soft	Alternate, oval to lanceolate leaves, deeply lobed
25.	<i>Dianthus barbatus</i>	Mid green leaves	Soft	Linear to lanceolate mostly pointed
26.	<i>Dianthus caryophyllus</i>	Mid green	Soft	Linear to lanceolate, pointed with conspicuous sheaths
27.	<i>Dianthus chinensis</i>	Mid green	Soft	Linear to lanceolate, pointed
28.	<i>Digitalis lanata</i>	Mid green	Pubescent	Oblong lanceolate or inversely lanceolate
29.	<i>Digitalis purpurea</i>	Greyish green	Tomentose beneath	Ovate to lanceolate or lanceolate oblong with winged petiole
30.	<i>Echinacea purpurea</i>	Dark green	Roughly pubescent	Ovate, toothed basal leaves and ovate lanceolate toothed stem leaves

Continued .....

(1)	(2)	(3)	(4)	(5)
31.	<i>Eryngium biebersteinianum</i>	Mid green	Prickly	Basal leaves long stalked, stem leaves stalkless, palmately divided
32.	<i>Euphorbia stracheyi</i>	Dark green	Smooth	Lanceolate to linear oblong, leaves with red midribs, turn red and yellow in autumn
33.	<i>Gazania niveae</i>	Dark green	Pubescent	Lanceolate, basal leaves
34.	<i>Gazania x splendens</i>	Dark green	Pubescent	Lanceolate, basal leaves, covered with grey felted hairs, lobed
35.	<i>Gerbera jamesonii</i>	Dark green	Densely tomentose	Inversely lanceolate, deeply lobed to pinnatifid leaves, dark green above and sparsely to densely woolly beneath
36.	<i>Gypsophila paniculata</i>	Dark green	Rough	An airy mound of linear lanceolate, usually hairless leaves
37.	<i>Hedychium gardnerianum</i>	Greyish green	Pubescent	Lanceolate leaves, borne in 2 parallel ranks on unbranched, reed like stems
38.	<i>Helenium autumnale</i>	Mid green	Slightly pubescent	Ovate to inversely lanceolate leaves
39.	<i>Helianthus autumnale</i>	Dark green	Slightly pubescent	Large simple, bristly, alternate leaves
40.	<i>Helianthus x multiflorus</i>	Dark green	Slightly pubescent	Lanceolate to ovate leaves
41.	<i>Helleborus niger</i>	Dark green	Fleshy	Over wintering, pedate basal leaves comprising 7-9 oblong to inversely lanceolate leaflets toothed towards the apex

Continued .....

(1)	(2)	(3)	(4)	(5)
42.	<i>Hesperis matronalis</i>	Light green	Rough	Leave shortly stalked or tapering at the base, ovate lanceolate, the upper ones smaller
43.	<i>Inula royleana</i>	Dark green	Glossy	Strap shaped leaves
44.	<i>Kalanchoe blossfeldiana</i>	Dark green	Glossy	Oval oblong ovate, softly toothed leaves
45.	<i>Kniphofia uvaria</i>	Mid green	Rough	Lax, linear, keeled, finely toothed leaves
46.	<i>Lathyrus latifolius</i>	Mid green	Smooth	The leaves usually pinnate consisting of one pair of ovate to elliptic leaflets
47.	<i>Lavendula angustifolia</i>	Grey green	Fleshy	Linear, opposite, toothed with the margins usually rolled under
48.	<i>Liatris spicata</i>	Mid green	Rough	Alternately arranged linear, lanceolate basal leaves
49.	<i>Limonium latifolium</i>	Dark green	Glossy	Basal rosettes of elliptic to spoon shaped leaves
50.	<i>Lunaria annua</i>	Mid green	Rough	Ovate to heart shaped, coarsely toothed leaves
51.	<i>Lupinus polyphyllus</i>	Mid green	Pubescent above	Stout, erect, very long stalked leaved
52.	<i>Lythrum salicaria</i>	Dark green	Smooth	Opposite, lanceolate stalkless leaves
53.	<i>Matthiola incana</i>	Dark green	Pubescent	Oblong, linear, obtuse, entire, soft, hairy on both sides with short crisped hairs
54.	<i>Mimulus nepalensis</i>	Light green	Soft	Opposite, entire, linear coarsely toothed stalked leaves
55.	<i>Mirabilis jalapa</i> L.	Mid green	Soft	Opposite, ovate, simple leaves

Continued .....

(1)	(2)	(3)	(4)	(5)
56.	<i>Nelumbo nucifera</i>	Dark green	Fleshy	The leaves are downy with their blades borne slightly above the water surface.
57.	<i>Nepeta nervosa</i>	Mid green	Pubescent	Narrowly, lanceolate, slightly toothed conspicuously veined leaves
58.	<i>Nymphae stellata</i>	Dark green	Glossy	Rounded, cordate floating leaves, each cleft into 2 lobes, with basal sinus and a long leaf stalk.
59.	<i>Oenothera biennis</i>	Light Green	Soft	Ovate, lanceolate, slightly toothed, hoary or downy.
60.	<i>Paeonia emodi</i>	Dark green	Soft	Exstipulate, alternate, petiolated leaves divided into distinct leaflets
61.	<i>Paeonia lactiflora</i>	Dark green	Slightly pubescent beneath	Each leaf with 9 elliptic or lanceolate rough margined leaflets
62.	<i>Papaver orientale</i>	Dark green	Pubescent	All the leaves arising from the base alternate, pinnately lobed
63.	<i>Penstemon barbatus</i>	Mid green	Soft	Lanceolate to linear, entire sometimes glaucous leaves
64.	<i>Phlox paniculata</i>	Mid green	Soft	Ovate or lanceolate to elliptic, toothed thin leaves.
65.	<i>Physalis alkekengi</i>	Mid green	Rough	Triangular ovate to diamond shaped leaves.
66.	<i>Platycodon grandiflorum</i>	Bluish green	Smooth	Ovate lanceolate, toothed leaves borne in whorls on the lower stem, alternately higher up

Continued .....

(1)	(2)	(3)	(4)	(5)
67.	<i>Primula denticulata</i>	Mid green	Roughly pubescent	Radical, simple, obovate, spatulate, sessile or the base narrowed in to a short winged petiole. The lower surface covered with yellowish powder.
68.	<i>Primula rosea</i>	Dark green	Soft	Simple, radical, elliptic, spatulate leaves with the base narrowed into a winged petiole
69.	<i>Primula vulgaris</i>	Dark green	Roughly pubescent	Inversely lanceolate to obovate, toothed to scalloped, deeply veined leaves.
70.	<i>Ranunculus falcatus</i>	Mid green	Pubescent	Radical leaves, long stalked, deeply 3-lobed, segments, deeply cut, nearly equal in length
71.	<i>Rheum australe</i>	Mid green	Roughly pubescent	Basal leaves pinnate with deeply 3-lobed, toothed leaflets with prominent veins; stem leaves become less deeply lobed up the stems
72.	<i>Rudbeckia fulgida</i>	Light green	Pubescent	Oblong to lanceolate entire leaves and lanceolate toothed stem leaves.
73.	<i>Rudbeckia laciniata</i>	Crimson purple	Pubescent	Rounded, entire to palmately lobed leaves with coarse teeth and conspicuous veins and midribs.
74.	<i>Salvia sclarea</i>	Mid green	Roughly pubescent	Ovate to oblong, notched to irregularly toothed, wrinkled leaves
75.	<i>Senecio cineraria</i>	Silvery grey	Smooth and Glossy	Lanceolate, deeply pinnatisect leaves.

Continued .....

(1)	(2)	(3)	(4)	(5)
76.	<i>Sisyrinchium striatum</i>	Greyish green	Pubescent	Linear to lanceolate, Iris like but 2-ranked stiff leaves.
77.	<i>Solidago canadensis</i>	Mid green	Rough	Basal leaves short stalked, elliptic, coarsely toothed, sharp pointed. Upper leaves smaller, narrower and entire.
78.	<i>Stachys byzantina</i>	Mid green	Rough	Rosettes of entire, oblong-elliptic to lanceolate, thick wrinkled veined leaves.
79.	<i>Tradescantia virginiana</i>	Mid green	Fleshy	Leaves are alternate, usually lanceolate hairless leaves.
80.	<i>Tragopogon pratensis</i>	Light green	Smooth	Radical and lower leaves, shortly dilated at the base, glabrous and slightly glaucous; upper leaves shorter with the dilated base
81.	<i>Typha angustifolia</i>	Dark green	Smooth	Linear leaves, sheathed at the bases
82.	<i>Verbascum thapsus</i>	Mid green	Soft	Leaves oblong, pointed, slightly toothed narrowed at the base into 2 wings running a long way down the stem.

#### 4.2 Bulbous Plants

1.	<i>Alstroemeria aurantiaca</i>	Grey green	Smooth	Leave lanceolate, soft, grassy
2.	<i>Amaryllis belladonna</i>	Mid green	Fleshy	Strap shaped leaves produced after flowering
3.	<i>Anemone biflora</i>	Mid green	Soft	Radical leaves 1-2" in diameter, long petioled, 3-partite or 3-foliolate, leaf segments rounded or cuneate

Continued .....

(1)	(2)	(3)	(4)	(5)
4.	<i>Anemone x hybrida</i>	Mid green	Soft	Oval, usually 3-palmate toothed leaves
5.	<i>Begonia evansiana</i>	Dark green above and reddish on lower surface	Glossy	Pointed leaves, alternate and irregular
6.	<i>Begonia x semperflorens</i>	Pale green	Glossy	There are some sorts with almost variegated leaves, while there are a few which have white leaves of a shape which have caused them to be described as calla leaved begonias
7.	<i>Begonia x tuberhybrida</i>	Reddish green	Rough and fleshy	The leaves are alternate and irregular
8.	<i>Belamcanda chinensis</i>	Mid green	Smooth	Sword shaped leaves closely resembling those of Iris leaves
9.	<i>Canna indica</i>	Dark green often bronze tinted	Smooth	Ovate lanceolate to oblong leaves
10.	<i>Clivia miniata</i>	Mid green	Fleshy	Strap shaped leaves
11.	<i>Colchicum luteum</i>	Mid green	Fleshy	Leaves are radical appearing with the flowers and becoming much elongated after the flowering season is passed, linear, obtuse
12.	<i>Crocasmia masoniorum</i>	Mid green	Rough	Bears pleated 95 cm long leaves
13.	<i>Crocus chrysanthus</i>	Pale green with pale silvery green central stripes	Smooth	Semi-erect, linear to lanceolate leaves and elongate markedly as the flowers fade

Continued .....

(1)	(2)	(3)	(4)	(5)
14.	<i>Crocus sativus</i>	Pale green	Smooth	Lanceolate leaves are borne with or shortly after the flowers
15.	<i>Dahlia variabilis</i>	Green	Pubescent	Pinnate, toothed, oval leaflets having rounded tips
16.	<i>Eranthis hyemalis</i>	Dark green	Rough	A ruff of dissected leaves
17.	<i>Eremurus himalaicus</i>	Dark green	Smooth	Strap shaped leaves
18.	<i>Fressia x hybrida</i>	Mid green	Smooth	Narrowly sword shaped leaves develop in basal fans
19.	<i>Fritillaria imperialis</i>	Mid green	Smooth	Lanceolate, sessile leaves, the lower ones opposite and the upper ones longer and in whorls
20.	<i>Gagea elegans</i>	Mid green	Smooth	Leaves with parallel venation, hooded at the apex
21.	<i>Galanthus nivalis</i>	Bluish green	Soft	Narrow, glaucous leaves having parallel venation, linear
22.	<i>Gladiolus byzanthus</i>	Dark green	Smooth	Erect leaves, borne in basal fans, are narrow linear and sword shaped
23.	<i>Gloriosa rothschildiana</i>	Dark green	Glossy	Ovate lanceolate to oblong leaves, which narrow to form terminal tendrils
24.	<i>Hemerocallis flava</i>	Dark bluish green	Smooth	Arching strap shaped leaves
25.	<i>Hippeastrum puniceum</i>	Mid green	Smooth	Semi-erect, strap shaped basal leaves develop with or just after flowers

Continued .....

(1)	(2)	(3)	(4)	(5)
26.	<i>Hyacinthus orientalis</i>	Dark green	Fleshy	Linear to lanceolate channelled bright green leaves
27.	<i>Iris ensata</i>	Mid green	Smooth	Leaves with prominent, midribs
28.	<i>Iris germanica</i>	Grey green	Smooth	Bearded Iris with fans of sometimes evergreen leaves
29.	<i>Iris 'Gingerbread Man'</i>	Dark green	Glossy	Evergreen, stiff leaves
30.	<i>Iris japonica</i>	Dark green	Glossy	Fans of strap shaped, evergreen leaves
31.	<i>Iris kashmeriana</i>	Dark green	Smooth	Narrow, linear leaves
32.	<i>Iris reticulata</i>	Mid green	Smooth	Grassy leaves with square sections
33.	<i>Iris tectorum</i>	Dark green	Glossy	Crested Iris with fans of broad, ribbed leaves
34.	<i>Iris unguicularis</i>	Mid green	Rough	Tough, grass like evergreen leaves
35.	<i>Ixiolirion karateginum</i>	Mid green	Smooth	Linear, lanceolate leaves in basal rosettes
36.	<i>Leucojum aestivum</i>	Dark green	Glossy	Erect, strap shaped leaves
37.	<i>Lilium auratum</i>	Dark green	Glossy	Scattered lanceolate leaves
38.	<i>Lilium candidum</i>	Dark green	Glossy	Broad, inversely lanceolate basal leaves
39.	<i>Lilium longiflorum</i>	Mid green	Smooth	Sessile, alternate, or nearly opposite or whorled, narrowly lanceolate or linear leaves
40.	<i>Lycoris radiata</i>	Dark green	Smooth & Fleshy	Semierect strap shaped leaves appearing after the flowers

Continued .....

(1)	(2)	(3)	(4)	(5)
41.	<i>Muscari armeniacum</i>	Mid green	Rough	Semi-erect, narrowly spoon shaped leaves
42.	<i>Narcissus pseudonarcissus</i>	Bluish green	Soft	Linear, erect having parallel veining
43.	<i>Narcissus tazetta</i>	Mid green	Soft	Erect, broad, twisted, keeled leaves
44.	<i>Nerine bowdenii</i>	Dark green	Smooth & Fleshy	Broad, strap shaped leaves
45.	<i>Ornithogalum umbellatum</i>	Mid green	Soft	Linear leaves having parallel veination with a central silver stripe above
46.	<i>Scilla bifolia</i>	Dark green	Smooth	2-3, linear, lanceolate leaves sprouting from ground
47.	<i>Scilla siberica</i>	Dark green	Smooth	Linear leaves
48.	<i>Sprekelia formosissima</i>	Dark green	Smooth	Lanceolate leaves
49.	<i>Sternbergia lutea</i>	Mid green	Smooth	Grooved, linear leaves
50.	<i>Tulipa Clusiana</i>	Mid green	Soft	Linear to broadly ovate leaves
51.	<i>Tulipa lanata</i>	Gery green	Soft	Linear, hairless leaves
52.	<i>Zantedeschia aethiopica</i>	Dark green	Glossy	Semierect arrow shaped leaves
53.	<i>Zantedeschia elliottiana</i>	Dark green	Rough	Erect, heart shaped, basal leaves covered with translucent white spots

Continued .....

### 4.3 Ground Covers

(1)	(2)	(3)	(4)	(5)
1.	<i>Ajuga reptans</i>	Mid green	Pubescent	Small, obovate, entire or toothed leaves
2.	<i>Aptenia cordifolia</i>	Mid green	Fleshy	Stems bear scale like true leaves with spines
3.	<i>Aspidistra elatior</i>	Mid green	Roughly Pubescent	Short stalked, spoon shaped to narrowly lanceolate leaves
4.	<i>Aubrieta deltoide</i>	Dark green	Fleshy	Broadly ovate 2.5 cm long leaves
5.	<i>Bellis perennis</i>	Dark green	Smooth	Narrowly obovate or obovate spatulate leaves in a basal rosette
6.	<i>Bergenia ciliata</i>	Mid green	Pubescent	Very broadly ovate leaves
7.	<i>Caltha palustris</i>	Dark green	Soft	Kidney shaped with finely toothed margins, long petiolated radical leaves
8.	<i>Cerastium tomentosum</i>	White or greyish	Tomentose	Linear or lanceolate shaped leaves
9.	<i>Colchicum luteum</i>	Mid green	Fleshy	Leaves are radical appearing with the flowers and becoming much elongated after the flowering season is passed, linear, obtuse.
10.	<i>Convallaria majalis</i>	Dark green	Smooth	Pairs of ovate lanceolate to elliptic, stalked hairless basal leaves

Continued .....

(1)	(2)	(3)	(4)	(5)
11.	<i>Eranthis hyemalis</i>	Dark green	Rough	A ruff of dissected leaves
12.	<i>Geranium rectum</i>	Dark green	Pubescent	Erect, branched, glandular leaves 6-9 partite, segments acute, incised, pedicles densely hairy
13.	<i>Geranium wallichianum</i>	Dark green	Roughly Pubescent	The leaves usually 5 pointed are palmately lobed, the divisions further lobed and toothed the basal leaves are arranged in loose rosettes, the stem leaves are usually smaller with fewer lobes
14.	<i>Hosta lancifolia</i>	Dark green	Glossy	Dense mound of arching, narrowly lanceolate thin leaves
15.	<i>Hosta plantaginea</i>	Light green	Glossy	Ovate to heart shaped, slightly wavy leaves
16.	<i>Leucojum aestivum</i>	Dark green	Glossy	Erect, strap shaped leaves
17.	<i>Lycoris radiata</i>	Dark green	Smooth and fleshy	Semi erect strap shaped leaves appearing after the flowers
18.	<i>Muscari armeniacum</i>	Mid green	Rough	Semi-erect, narrowly spoon shaped leaves
19.	<i>Nerine bowdenii</i>	Dark green	Smooth and fleshy	Broad, strap shaped leaves
20.	<i>Ornithogalum umbellatum</i>	Mid green	Soft	Linear leaves having parallel veination with a central silver stripe above

Continued .....

(1)	(2)	(3)	(4)	(5)
21.	<i>Primula denticulata</i>	Mid green	Roughly pubescent	Radical, simple, obovate, spatulata, sessile or the base narrowed into a short winged petiole. The lower surface covered with yellowish powder
22.	<i>Primula rosea</i>	Dark green	Soft	Simple, radical, elliptic, spatulate leaves with the base narrowed into a winged petiole
23.	<i>Primula vulgaris</i>	Dark green	Roughly pubescent	Inversely lanceolate to obovate, toothed to scalloped, deeply veined leaves
24.	<i>Santolina chamaecyparissus</i>	Greyish white	Soft	Slender, narrowly, oblong, toothed to pinnatisect leaves with very fine toothed divisions
25.	<i>Saxifraga stonilfera</i>	Mid green	Roughly pubescent	Radical leaves, acute, upper cauline leaves usually simple, entire and ovate.
26.	<i>Sedum spectabile</i>	Grey green	Fleshy	Opposite, ovate, slightly scalloped toothed leaves
27.	<i>Thymus serpyllum</i>	Mid green	Soft	Linear to elliptic or elliptic ovate leaves
28.	<i>Tradescantia sillamontana</i>	Greyish green	Pubescent	Ovate, fleshy, silky leaves
29.	<i>Viola odorata</i>	Mid green	Soft	Leaves in radical tufts, broadly cordate, rounded at the top and crenate, downy or shortly hairy with longer stalks.

*Ornithogalum umbellatum*, *Santolina chamaecyparissus*, *Thymus serpyllum* and *Viola odorata*. Fleshy texture was observed in four species namely *Aubrietia deltoide*, *Aptenia cordifolia* and *Colchicum luteum*. Glossy texture was found in *Hosta plantaginea*, *Hosta lancifolia* and *Leucojum aestivum* smooth texture was observed in four species and rough texture in two species, whereas tomentose texture was observed only in *Cerastium tomentosum*.

## **4.5 Flowering phenology**

### **4.5.1 Herbaceous perennials**

Studies on flowering phenology were conducted during three consecutive years (2006-07 through 2008-09). However data of two years are only presented (2007-08 as 1-year and 2008-09 as 11- year). The year 2006-07 was utilized for preliminary survey and assessment in the natural habitats.

From the perusal of data presented in Table 5.1 it is quite evident that none of the herbaceous perennials species showed any flower emergence in January and February. In March during 1-year flower emergence of four herbaceous perennial species were recorded, out of which flower emergence of *Helleborus niger* was recorded in 1<sup>st</sup> week of March and of *Primula rosea* and *P.denticulata* in 2<sup>nd</sup> week and of



*Colchicum luteum*



*Eranthis hyemalis*



*Gagea elegans*



*Sternbergia lutea*

*Kalanchoe blossfeldiana* and *Ixiolirion karateginum* in 3<sup>rd</sup> week of March. Similar results were obtained in 11- year, except in *Ixiolirion karateginum* in which flower emergence was recorded in 4<sup>th</sup> week of March.

During both years *Primula rosea* remained presentable for maximum days and *Ixiolirion karateginum* for minimum days. On an average *Primula rosea* remained presentable for (55 days) and *Ixiolirion karateginum* for (29.5 days). During both years span of maximum peak flowering period was observed in *Primula rosea* and *Helleborus niger* (18 days), whereas *Kalanchoe blossfeldinea* remained for minimum duration of (10 days) during both the years.

In April, during 1- year emergence of 14 herbaceous perennial species were recorded. Flower emergence of *Paeonia emodi*, *Lunaria annua*, *Dianthus barbatus* were observed in 1<sup>st</sup> week of April and those of *Caltha palustris*, *Hesperis matronalis*, *Mimulus nepalensis*, *Aquilegia canadensis*, *Limonium latifolium* in 2<sup>nd</sup> week of April. Flower emergence of *Aquilegia vulgaris*, *Cheiranthus cheiri*, *Ranunculus falcatus*, *Tradescantia virginiana* were recorded in 3<sup>rd</sup> week and that of *Salvia sclarea* and *Matthiola incana* in 4<sup>th</sup> week of April respectively. Similar results were noticed in 11- year except in *Limonium latifolium* in which flowering was recorded in 3<sup>rd</sup> week of April.

In both years *Dianthus barbatus* remained presentable for maximum days and *Cheiranthus cheiri* for minimum days. On an average *Dianthus barbatus* remained in bloom for the longest period (69.5 days) and *Cheiranthus cheiri* for minimum period (33 days). During both years, span of maximum peak flowering period of (18 days) was recorded in *Aquilegia vulgaris* and minimum in *Lunaria annua*(6 days).

In May during 1- year flower emergence was recorded in twenty herbaceous perennial species out of which *Centaurea montana*, *Gypsophila paniculata*, *Gerbera jamesonii*, *Kniphofia uvaria*, *Paeonia lactiflora*, *Papaver orientale*, *Penstemon barbatus*, *Stachys byzantina* and *Thypha angustifolia* were recorded in 1<sup>st</sup> week of May and those of *Campanula medium*, *Digitalis purpurea*, *Euphorbia stracheyi*, *Echinacea purpurea*, *Lupinus polyphyllus*, *Sisyrinchium striatum* in 2<sup>nd</sup> week of May. Flower emergence in *Coreopsis lanceolata*, *C. grandiflora*, *Dianthus cayophyllus*, *Physalis alkekengi* were recorded in 3<sup>rd</sup> week of May and that of *Nymphaea stellata* in 4<sup>th</sup> week of May. In 11- year flower emergence in *Kniphofia uvaria*, *Papaver orientale* and *Stachys byzantina* were observed in 2<sup>nd</sup> week of May and that of *Coreopsis grandiflora* in 4<sup>th</sup> week of May.

In 1- year, *Penstemon barbatus* remained presentable for maximum duration and minimum presentable duration was noticed in *Centaurea*

*montana*. Similar sequence of flowering was noticed in 11- year of flowering. On an average *Penstemon barbatus* remained in bloom for the longest period (82 days) and *Centaurea montana* for minimum period of (37 days). During 1- year span of peak flowering period was maximum in *Echinacea purpurea* and *Gerbera jamsonii* and minimum in *Centaurea montana*. During 11-year span of peak flowering period was maximum in *Echinacea purpurea* and *Gerbera jamsonii* and minimum in *Centaurea montana* and *Lupinus polyphyllus*. On an average maximum span was recorded in *Echinacea purpurea* and *Gerbera jamsonii* (25 days each) and minimum in *Centaurea montana* (8.5 days)

In June during 1- year, flower emergence was recorded in twenty-one herbaceous perennial species, out of which flower emergence of *Achillea filipendulina*, *Alcea rosea*, *Aster alpinus*, *Dianthus chinensis*, *Senecia cineraria* and *Tragopogon pratensis* was observed in 1<sup>st</sup> week of June and those of *Aconitum napellus*, *Campanula latifolia*, *Delphinium elatum*, *Eryngium biebersteinianum*, *Helenium autumnale*, *Lathyrus latifolius*, *Lavendula angustifolia*, *Nepeta nervosa* and *Phlox paniculata* in 2<sup>nd</sup> week of June. Flower emergence of *Chrysanthemum leucanthemum* and *Nelumbo nucifera* was observed in 3<sup>rd</sup> week of June and those of *Achillea millefolium*, *Asparagus officinalis*, *Cynara cardunculus*, *Liatris spicata* in

the 4<sup>th</sup> week of June. Similar results were obtained in 11- year except in *Achillea filpendulina*, *Aster alpinus* in which flower emergence was recorded in 2<sup>nd</sup> week of June. In *Cynara cardunculus*, *Helenium autumnale* and *Lavendula angustifolia* flower emergence was recorded in 2<sup>nd</sup> week of June.

During both the years *Phlox paniculata* remained presentable for maximum period (78 days) whereas *Aconitum napellus* remained presentable for minimum period (40 days). During both the years, maximum span of peak flowering period was recorded in *Lavendula angustifolia* (25 days) and minimum period was noticed in *Tragopogon pratensis*.

In July during 1- year flower emergence was recorded in seventeen herbaceous perennial species, out of which flower emergence in *Achillea ptarmica*, *Inula rouleana*, *Primula vulgaris*, *Rudbeckia laciniata* was recorded in 1<sup>st</sup> week of July and those of *Aconitum heterophyllum*, *Agapanthus praecox* and *Oenothera biennis* in 2<sup>nd</sup> week of July. Flower emergence of *Digitalis lanata*, *Dendranthema × grandiflora*, *Gazania × splendis*, *Helianthus autumnale*, *Lythrum salicaria*, *Platycodon grandiflorum* and *Mirabilis jalapa* in 3<sup>rd</sup> week of July and those of *Gazania nivea*, *Rheum australe* and *Solidago canadensis* in 4<sup>th</sup> week of July. During

11-year flower emergence in *Digitalis lanata* was recorded in 1<sup>st</sup> week of July and those of *Agapanthus praecox*, *Oenothera biennis* in 3<sup>rd</sup> week of July. Flower emergence in *Lythrum salicaria*, *Mirabilis jalapa* was recorded in 4<sup>th</sup> week of July.

During both the years *Gazania nivea* remained presentable for maximum duration (75.5 days) whereas *Agapanthus africanus* for minimum duration (51.5 days). During both the years span of maximum peak flowering period was recorded in *Gazania nivea*. During both the years minimum peak flowering period (11 days) was recorded in *Inula royleana* than *Agapanthus africanus*. Thus on an average maximum peak flowering period was recorded in *Gazania nivea* (26 days) and minimum in *Inula royleana*.

In August during 1- year flower emergence was recorded in five species, out of which flower emergence in *Helianthus multiflorus* and *Rudbeckia fulgida* was recorded in 1<sup>st</sup> week of August *Arundo donax*, *Hedychium gardnerianum* and *Verbascum thapsus* was recorded in 3<sup>rd</sup> week of August. Similar results were obtained in 11- year.

During both the years *Rudbeckia fulgida* remained presentable for maximum duration (68 days) whereas *Hedychium gardnerianum* for minimum duration (49 days). During both the years maximum peak

flowering period was recorded in *Arundo donax* and *Rudbeckia fulgida* (21 days each). Minimum peak flowering period was recorded in *Helianthus multiflorus* (14.5 days).

#### **4.5.2 Bulbous plants**

Flowering periodicity of bulbous plants is presented in table 5.1. From the perusal of data its evident that during both the years flower emergence was recorded in two species namely *Sternbergia lutea* and *Colchicum luteum* in the month of January. Flower emergence was recorded in 1<sup>st</sup> week of January and remained presentable for (46 days) during 1-year and for (47 days) during 11- year in case of *Sternbergia lutea*. On an average the specie remained presentable for (46.5 days) with peak flowering period for 14 days during both the years. *Colchicum luteum* remained presentable for 52 days during both the years and on an average peak flowering period was observed to be 20.5 days.

In February during 1- year flower emergence was recorded in seven bulbous species, out of which flower emergence in *Anemone biflora*, *Eranthis hyemalis*, *Gagea elegans* and *Narcissus pseudonarcissus* was observed in 2<sup>nd</sup> week of February and those of *Galanthus nivalis*, *Leucojum aestivum*, *Narcissus tazetta* in 3<sup>rd</sup> week of February. Similar results were obtained in 11- year.

During both the years, *Narcissus pseudonarcissus* remained presentable for maximum days. During 1- year *Galanthus nivalis* remained presentable for minimum days and during 11- year *Eranthis hyemalis* remained presentable for minimum days. On an average *Narcissus pseudonarcissus* remained presentable for maximum (58 days) whereas *Galanthus nivalis*, *Leucojum aestivum* and *Eranthis hyemalis* remained presentable for minimum (31 days) each. During both the years, span of peak flowering period was observed maximum in *Narcissus pseudonarcissus* (20.5 days) and minimum in *Eranthis hyemalis* (7.5 days).

In March during 1- year flower emergence was recorded in ten bulbous plants, out of which flower emergence in *Fritillaria imperialis*, *Hyacinthus orientalis* was recorded in 1<sup>st</sup> week of March and those of *Iris reticulata*, *I. unguicularis* and *Tulipa clusiana* in 2<sup>nd</sup> week of March. Flower emergence in *Crocus chrysanthus*, *Tulipa lanata* was recorded in 3<sup>rd</sup> week of March and that of *Iris germanica* and *Muscari armeniacum* in the 4<sup>th</sup> week of March. During 11- year flower emergence in *Tulipa clusiana* was observed in 3<sup>rd</sup> week of March.

In both the years *Crocus chrysanthus* remained presentable for maximum (41 days) and *Tulipa clusiana* for minimum (26.5 days). During 1- year peak flowering period was maximum in *Iris reticulata* and

minimum in *Fritillaria imperialis*, *Hyacinthus orientalis*, *Iris germanica* and *Tulipa clusiana*, whereas during 11- year span of peak flowering period was maximum in *Iris unguicularis* and minimum in *Tulipa clusiana*. On an average peak flowering period was maximum in *Iris reticulata* and *I. unguicularis* (14 days) each and minimum in *Tulipa clusiana* (9.5 days).

In April during 1- year, flower emergence in *Eremurus himalaicus*, *Iris japonica*, *I. tectorum*, *Scilla bifolia* was recorded in 1<sup>st</sup> week of April and those of *Clivia miniata*, *Iris ensata*, *I. 'Gingerbreadman'* *I. kashmeriana* and *Ornithogalum umbellatum* in 2<sup>nd</sup> week of April. The flower emergence in *Begonia evansiana*, *Fressia × hybrida*, *Gladiolus byzanthus*, *Scilla siberica* and *Zantedeschia elliottiana* in 3<sup>rd</sup> week of April and those of *Alstroemeria aurantiaca* and *Begonia × semperflorens* in last week of April. During 11- year flower emergence in *Iris japonica* was recorded in 2<sup>nd</sup> week of April and that of *I. kashmerina* in 3<sup>rd</sup> week of April. Flower emergence in *Begonia × semperflorens* and *Gladiolus byzanthus* was recorded in 4<sup>th</sup> week of April.

During both the years *Zantedeschia elliottiana* remained in bloom for maximum period. During both the years *Ornithogalum umbellatum* remained presentable for minimum period. On an average *Zantedeschia elliottiana* remained presentable for maximum (66 days) and *Ornithogalum*

*umbellatum* for minimum (24.5 days). During 1- year peak flowering period was maximum in *Begonia evansiana*, *Begonia* × *semperflorens* and *Zantedeschia elliottiana* and minimum in *Clivia miniata* and *Iris ensata*. During 11- year peak flowering period was maximum in *Iris* ‘*Gingerbreadman*’ and minimum in *Clivia miniata* and *Iris ensata*. On an average peak flowering period was maximum in 4 species (13 days) each and minimum in 2 species (7 days) each.

In May during 1- year flower emergence was recorded in 4 bulbous species out of which flower emergence in *Begonia* × *tuberhybrida* was recorded in 1<sup>st</sup> week of May and that of *Hippeastrum puniceum* in 2<sup>nd</sup> week of May. In *Sprekelia formosissima* flower emergence was recorded in 3<sup>rd</sup> week and that of *Lycoris radiata* in 4<sup>th</sup> week of May. Similar pattern of flower emergence was observed in 11- year .

During both the years *Hippeastrum puniceum* remained presentable for maximum (58 days) and *Sprekalia formosissima* for minimum (41.5 days). Span of peak flowering period was recorded for maximum (19 days) in *Hippeastrum puniceum* and minimum in *Sprekelia formosissima* (7 days) during both the years.

In June during 1- year flower emergence was recorded in ten bulbous plant species out of which flower emergence in *Amaryllis*

*belladonna*, *Hemerocallis flava*, *Lilium candidum* and *Zantedeschia aethiopica* was observed in 1<sup>st</sup> week of June and those of *Belamcanda chinensis*, *Crocasmia masoniorum*, *Dahlia variables*, *Lilium auratum*, *L. longiflorum* in 2<sup>nd</sup> week of June. Flower emergence in *Nerine bowdenii* was recorded in 3<sup>rd</sup> week of June. Similar results were recorded in 11- year except in *Amaryllis belladonna* in which flower emergence was recorded in 2<sup>nd</sup> week of June.

During both the years *Dahlia variabilis* remained presentable for maximum (72 days) and *Amaryllis belladonna* for minimum of (34 days). During both the years span of peak flowering period was found to be maximum (25 days) in dahlia variabilis and minimum (10.5 days) in *Amaryllis belladonna*.

In July during both years flower emergence was recorded in only one specie namely *Gloriosa rothschildiana*. Flower emergence was recorded in 1<sup>st</sup> week of July and remained presentable for (56 days) during 1- year and for (55 days) during 11- year. On an average it remained presentable for (55.5 days). Peak flowering period was found to be (19 days) during 1- year and (17 days) during 11- year. On an average peak flowering period was recorded to be (18 days).

In August during both the years flower emergence was recorded in two bulbous species out of which flower emergence in *Anemone × hybrida* was recorded in 2<sup>nd</sup> week of August and that of *Canna indica* in 3<sup>rd</sup> week of August.

On an average *Canna indica* remained presentable for (54 days) and *Anemone hybrida* for (53.5 days). Peak flowering period was (21 days) in case of *Canna indica* and (15 days) in case of *Anemone × hybrida*.

In October during both the years flower emergence was recorded in one specie namely *Crocus sativus*. The specie remained presentable for (43 days) during 1- year and for (41 days) during 11- year. On an average *Crocus sativus* remained presentable for (42 days). Peak flowering period was reported to be (15 days) for 1- year and (16 days) for 11- year. On an average peak flowering period was found to be (15.5 days).

#### **4.5.3 Ground covers**

Flowering periodicity of the ground covers during two years is recorded in table 5.3. It is quite evident that during both the years flower emergence was recorded only in *Colchicum luteum* in January. During both the years flower emergence was recorded in 1<sup>st</sup> week of January and remained presentable for (52 days)

During 1- year peak flowering period was recorded to be (19 days)

and (22 days) for 11- year. Thus on an average peak flowering period was observed to be (20.5 days).

In February during both the years flower emergence was recorded in two species. Flowering in *Eranthis hyemalis* was recorded in 2<sup>nd</sup> week of February and remained presentable for (31 days). In *Leucojum aestivum* flowering was recorded in 2<sup>nd</sup> week of February and remaining presentable for (31 days).

On an average peak flowering period was observed to be (14 days) maximum in *Leucojum aestivum* and minimum in *Eranthis hyemalis* (7.5 days).

In March during 1- year flower emergence was recorded in five ground covers out of which flower emergence in *Bergenia ciliata*, *Viola odorata* was recorded in 1<sup>st</sup> week of March. Flower emergence in *Primula denticulata* and *Primula rosea* was recorded in 2<sup>nd</sup> week of March and that of *Muscari armeniacum* in 4<sup>th</sup> week of March. Similar results were obtained in 11- year except for *Bergenia ciliata* in which flower emergence was recorded in 2<sup>nd</sup> week of March. On an average *Primula rosea* remained presentable for maximum (38.5 days) and *Muscari armeniacum* for minimum (33 days)

During both the years peak flowering period was found to be

maximum (18 days) in *Primula rosea* and minimum in *Bergenia ciliata* (10 days).

In April during 1<sup>st</sup> year flower emergence was recorded in six ground cover species, out of which flower emergence in *Ajuga reptans*, *Bellis perennis* was recorded in 1<sup>st</sup> week of april and that of *Convallaria majalis*, *Caltha palustris* and *Ornithogalum umbellatum* in 2<sup>nd</sup> week of April. Flower emergence in *Aubrieta deltoide* was recorded in 3<sup>rd</sup> week of April. Similar results were recorded in 11- year except for *Ornithogalum umbellatum* in which flower emergence was recorded in 3<sup>rd</sup> week of April. During both the years *Caltha palustris* remained presentable for maximum (43.5 days) and *Ornithogalum umbellatum* for minimum (24.5 days)

Peak flowering period was observed to be maximum (13 days) in *Convallaria majalis* and minimum (6 days) in *Bellis perennis* during both the years.

In May, during 1- year flower emergence in *Aspidistra elatior* was observed in 1<sup>st</sup> week of May and that of *Thymus serpyllum* in 3<sup>rd</sup> week of May. Flower emergence in *Geranium wallichianum* and *Lycoris radiata* was recorded in 4<sup>th</sup> week of May. Similar results were obtained in 11- year except for *Thymus serpyllum* in which flower was recorded in 4<sup>th</sup> week of

May. During both the years *Geranium wallichianum* remained presentable for maximum (72 days) and *Aspidistra elatior* for minimum (53 days).

During both the years span of peak flowering period was observed to be maximum in *Geranium wallichianum* (22.5 days) and minimum in *Lycoris radiata* (14 days).

In June during both the years flower emergence was recorded in four ground cover species out of which flower emergence in *Cerastium tomentosum* was recorded in 1<sup>st</sup> week of June and that of *Geranium rectum* in 2<sup>nd</sup> week of June. During both the years *Cerastium tomentosum* was presentable for maximum (55.5 days) and *Geranium rectum* for minimum (30 days).

Span of peak flowering period was found to be (15.5 days) in *Cerastium tomentosum* and (15 days) in case of *Geranium rectum*.

In July during 1- year flower emergence in *Primula vulgaris* was observed in first week of July and that of *Tradescantia sillamontana* in 3<sup>rd</sup> week of July. Flower emergence in *Santolina chamaecyparissus* was recorded in 4<sup>th</sup> week of July. In 11- year flower emergence in *Tradescantia sillamontana* was observed in 4<sup>th</sup> week of July. On an average *Primula vulgaris* and *Tradescantia sillamontana* remained presentable for (55 days) and *Santolina chamaecyparissus* for (11.5 days).

**Table-5 : Phenology**

**5.1 Herbaceous Perenials**

S. No.	Name of the species	Flowering period				Duration (days)			Peak flowering period				Duration (days)		
		2007		2008		2007	2008	Av.	2007		2008		2007	2008	Av.
		From	To	From	To				From	To	From	To			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
<b>March</b>															
1.	<i>Helleborus niger</i>	5.3.07	20.4.07	8.3.08	24.4.08	45	45	45	22.3.07	9.4.07	25.3.08	12.4.08	18	18	18
2.	<i>Kalanchoe blossfeldiana</i>	16.3.07	28.4.07	18.3.08	29.4.08	43	42	42.5	2.4.07	12.4.07	3.4.08	13.4.08	10	10	10
3.	<i>Primula denticulata</i>	10.3.07	30.4.07	11.3.08	30.4.07	50	49	49.5	30.3.07	10.4.07	31.3.08	11.4.08	11	11	11
4.	<i>Primula rosea</i>	8.3.07	2.5.07	10.3.08	4.5.08	55	55	55	24.3.07	11.4.07	25.3.08	12.4.08	18	18	18
<b>April</b>															
1.	<i>Aquilegia canadensis</i>	12.4.07	18.5.07	14.4.08	20.5.08	36	36	36	25.4.07	3.5.07	27.4.08	5.5.08	8	8	8
2.	<i>Aquilegia vulgaris</i>	18.04.07	05.06.07	20.04.08	8.06.08	48	49	48.5	2.05.07	20.05.07	4.05.08	22.05.08	18	18	18
3.	<i>Cheiranthus cheiri</i>	17.4.07	20.5.07	20.4.08	23.5.08	33	33	33	1.5.07	8.5.07	3.5.08	10.5.08	7	7	7
4.	<i>Caltha palustris</i>	8.04.07	20.5.07	9.4.08	23.5.08	42	44	43.5	29.4.07	6.5.07	1.5.08	7.5.08	7	6	6.5
5.	<i>Dianthus barbatus</i>	5.4.07	14.6.07	7.4.08	15.6.08	70	69	69.5	2.5.07	19.5.07	3.5.08	20.5.08	17	17	17
6.	<i>Hesperis matronalis</i>	10.4.07	15.5.07	12.4.08	17.5.08	35	35	35	20.4.07	29.4.07	21.4.08	3.5.08	9	12	10.5

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
7.	<i>Limonium latifolium</i>	12.4.07	20.5.07	15.4.08	23.5.08	38	38	38	25.4.07	7.5.07	27.4.08	9.5.08	12	12	12
8.	<i>Lunaria annua</i>	4.4.07	9.5.07	7.4.08	12.5.08	35	35	35	16.4.07	22.4.07	18.4.08	24.4.08	6	6	6
9.	<i>Mimulus nepalensis</i>	10.4.07	19.5.07	11.4.08	20.5.08	39	39	39	30.4.07	9.5.07	1.5.08	10.5.08	9	9	9
10.	<i>Matthiola incana</i>	22.4.07	15.6.07	23.4.08	16.6.08	55	54	54.5	9.5.07	24.5.07	10.5.08	26.5.08	15	16	15.5
11.	<i>Paeonia emodi</i>	2.4.07	9.5.07	5.4.08	11.5.08	37	36	36.5	19.4.07	28.4.07	20.4.08	29.4.08	9	9	9
12.	<i>Ranunculus falcatus</i>	18.4.07	23.6.07	19.4.08	24.6.08	66	66	66	10.5.07	26.5.07	11.5.08	27.5.08	16	16	16
13.	<i>Salvia sclarea</i>	27.4.07	18.6.07	29.4.08	29.4.08	52	51	51.5	15.5.07	28.5.07	16.5.08	29.5.08	13	13	13
14.	<i>Tradescantia virginiana</i>	15.4.07	20.5.07	16.4.08	21.5.08	35	35	35	24.4.07	1.5.07	25.4.08	2.5.08	7	7	7
<b>May</b>															
1.	<i>Centaurea montana</i>	2.5.07	8.6.07	3.5.08	9.6.08	37	37	37	20.5.07	28.5.07	21.5.08	30.5.08	8	9	8.5
2.	<i>Campanula medium</i>	10.5.07	30.6.07	9.5.08	29.6.08	51	51	51	1.6.07	14.6.07	1.6.08	13.6.08	13	12	12.5
3.	<i>Coreopsis lanceolata</i>	18.5.07	14.7.07	19.5.08	15.7.08	57	57	57	8.6.07	26.6.07	9.6.08	27.6.08	18	18	18
4.	<i>Coreopsis grandiflora</i>	21.5.07	20.7.07	23.5.08	22.7.08	60	60	60	15.6.07	2.7.07	16.6.08	3.7.08	17	17	17
5.	<i>Dianthus caryophyllus</i>	16.5.07	13.7.07	17.5.08	14.7.07	58	58	58	6.6.07	22.6.07	8.6.08	23.6.08	16	15	15.5
6.	<i>Digitalis purpurea</i>	11.5.07	10.7.07	12.5.08	12.7.08	60	61	60.5	1.6.07	19.7.07	2.6.08	21.7.08	18	19	18.5
7.	<i>Euphorbia stracheyi</i>	13.5.07	16.7.07	14.5.08	17.7.08	64	64	64	30.5.07	20.6.07	1.6.08	21.6.08	21	21	21

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
8.	<i>Echinacea purpurea</i>	9.5.07	18.7.07	13.5.08	22.7.08	70	70	70	29.5.07	23.6.07	2.6.08	27.6.08	25	25	25
9.	<i>Gypsophila paniculata</i>	5.5.07	4.7.07	6.5.08	5.7.08	60	60	60	27.5.07	16.6.07	28.5.08	17.6.08	20	20	20
10.	<i>Gerbea jamesonii</i>	3.5.07	10.7.07	6.5.08	12.7.08	68	67	67.5	18.5.07	12.6.07	17.5.08	11.6.08	25	25	25
11.	<i>Kniphofia uvaria</i>	4.5.07	15.6.07	8.5.08	19.6.08	42	42	42	20.5.07	5.6.07	22.5.08	10.6.08	17	19	18
12.	<i>Lupinus polyphyllus</i>	8.5.07	18.6.07	11.5.08	21.6.08	40	40	40	26.5.07	4.6.07	27.5.08	5.6.08	9	9	9
13.	<i>Nymphae stellata</i>	25.5.07	30.7.07	26.5.08	31.7.08	66	66	66	20.6.07	8.7.07	21.6.08	9.7.08	18	18	18
14.	<i>Paeonia lactiflora</i>	5.5.07	30.6.07	6.5.08	1.7.08	56	56	56	28.5.07	9.6.07	29.5.08	10.6.08	12	12	12
15.	<i>Penstemon barbatus</i>	5.5.07	5.8.07	7.5.08	7.8.08	82	82	82	10.6.07	30.6.07	12.6.08	1.7.08	20	19	19.5
16.	<i>Papaver orientale</i>	7.5.07	20.6.07	10.5.08	23.6.08	44	44	44	22.5.07	4.6.07	25.5.08	7.6.08	13	13	13
17.	<i>Physalis alkekengi</i>	16.5.07	18.7.07	17.5.08	19.7.08	63	63	63	3.6.07	24.6.07	4.6.08	25.6.08	20	20	20
18.	<i>Sisyrinchium striatum</i>	8.5.07	12.7.07	9.5.08	13.7.08	64	64	64	4.6.07	20.6.07	5.6.08	21.6.08	16	16	16
19.	<i>Stachys byzantina</i>	6.5.07	16.7.07	8.5.08	18.7.08	71	71	71	3.6.07	19.6.07	4.6.08	20.6.08	15	15	15
20.	<i>Typha angustifolia</i>	6.5.07	29.6.07	7.5.08	30.6.08	53	53	53	28.5.07	8.6.07	29.5.08	9.6.08	11	11	11

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
<b>June</b>															
1.	<i>Achillea filipendulina</i>	6.06.07	4.08.07	9.06.08	7.08.08	59	59	59	22.06.07	15.07.07	25.06.08	18.07.08	23	23	23
2.	<i>Achillea millifolium</i>	28.6.07	18.8.07	26.6.08	16.9.08	51	51	51	12.7.07	24.7.07	10.7.08	22.7.08	12	12	12
3.	<i>Aconitum napellus</i>	10.06.07	20.07.07	13.06.08	23.07.08	40	40	40	25.6.07	8.07.07	28.6.08	11.07.08	13	13	13
4.	<i>Althaea rosea</i>	7.6.07	24.7.07	6.6.08	23.7.08	47	47	47	22.6.07	5.07.07	24.6.08	7.7.08	13	13	13
5.	<i>Aster alpinus</i>	6.6.07	30.7.07	8.6.08	1.8.08	54	54	54	27.6.07	8.7.07	29.6.08	10.7.08	11	11	11
6.	<i>Asparagus officinalis</i>	25.6.07	20.8.07	27.6.08	22.8.08	56	56	56	14.7.07	29.7.07	16.7.08	30.7.08	15	14	14.5
7.	<i>Campanula latifolia</i>	13.6.07	29.7.07	14.6.08	30.7.08	46	46	46	30.6.07	13.7.07	1.7.08	14.7.08	13	13	13
8.	<i>Cynara cardunculus</i>	22.6.07	2.9.07	21.6.08	1.9.08	71	71	71	18.7.07	6.8.07	17.7.08	5.8.08	19	19	19
9.	<i>Chrysanthemum leucanthemum</i>	20.6.07	25.8.07	20.6.08	27.8.08	65	67	66	8.7.07	28.7.07	9.7.08	29.7.08	20	20	20
10.	<i>Dianthus chinensis</i>	4.6.07	5.8.07	5.6.08	6.8.08	62	62	62	28.6.07	16.7.07	29.6.08	17.7.08	18	18	18
11.	<i>Delphinium elatum</i>	11.6.07	20.8.07	14.6.08	22.8.08	70	69	69.5	2.7.07	25.7.07	4.7.08	26.7.08	23	22	22.5
12.	<i>Eryngium biebersteinianum</i>	12.6.07	20.8.07	13.6.08	21.8.08	69	69	69	30.6.07	20.7.07	1.7.08	21.7.08	20	20	20
13.	<i>Helenium autumnale</i>	14.6.07	12.8.07	15.6.08	13.8.08	60	60	60	4.7.07	19.7.07	5.7.08	20.7.08	15	15	15
14.	<i>Liatris spicata</i>	25.6.07	21.8.07	26.6.08	22.8.07	57	57	57	15.7.07	28.7.07	17.7.08	30.7.08	13	13	13
15.	<i>Lathyrus latifolius</i>	8.6.07	29.7.07	9.6.08	30.7.08	51	51	51	24.6.07	9.7.08	26.6.07	10.7.08	15	14	14.5
16.	<i>Lavandula angustifolia</i>	13.6.07	28.8.07	15.6.08	29.8.08	76	75	75.5	4.7.07	29.7.07	5.7.08	30.7.08	25	25	25
17.	<i>Nepeta nervosa</i>	10.6.07	12.8.07	12.6.08	14.8.08	63	63	63	2.7.07	16.7.07	3.7.08	18.7.08	13	14	13.5

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
18.	<i>Nelumbo nucifera</i>	16.6.0	30.7.07	18.6.08	1.8.08	44	44	44	2.7.07	15.7.07	3.7.08	16.7.08	12	12	12
19.	<i>Phlox paniculata</i>	8.6.07	25.8.07	9.6.08	26.8.08	78	78	78	3.7.07	26.7.07	4.7.08	27.7.08	23	23	23
20.	<i>Senecio cineraria</i>	4.6.07	28.7.07	6.6.08	31.7.08	53	54	53.5	27.6.07	8.7.07	29.6.08	10.7.08	11	11	11
21.	<i>Tragopogon pratensis</i>	3.6.07	27.7.07	4.6.08	28.7.08	53	53	53	26.6.07	6.7.07	27.6.08	7.7.08	10	10	10
<b>July</b>															
1.	<i>Aconitum heterophyllum</i>	11.7.07	16.9.07	12.7.08	17.9.08	67	67	67	3.8.0.07	18.8.07	2.8.08	17.8.08	15	15	15
2.	<i>Agapanthus africanus</i>	14.07.07	4.09.07	15.07.08	5.09.08	52	51	51.5	29.07.07	14.08.07	30.07.08	15.08.08	16	16	16
3.	<i>Achillea ptarmica</i>	4.7.07	26.08.08	5.7.08	27.8.08	53	53	53	23.7.07	8.8.07	24.7.08	8.8.08	16	15	15.5
4.	<i>Digitalis lanata</i>	16.7.07	21.9.07	14.7.08	20.9.08	67	67	67	10.8.07	30.8.07	9.8.08	29.8.08	20	20	20
5.	<i>Dendranthema x grandiflora</i>	18.7.07	25.9.07	20.7.08	26.9.08	69	68	68.5	9.8.07	28.8.07	10.8.07	29.8.08	19	19	19
6.	<i>Gazania x splendens</i>	20.7.07	15.9.07	21.7.08	16.9.08	57	57	57	8.8.07	28.8.07	9.8.08	29.8.08	20	20	20
7.	<i>Gazania niveae</i>	25.7.07	8.10.07	26.7.08	10.10.08	75	76	75.5	20.8.07	15.9.07	22.8.08	17.9.08	26	26	26
8.	<i>Helianthus autumnale</i>	15.7.07	10.9.07	16.7.08	11.9.08	57	57	57	2.8.07	18.8.07	4.8.08	20.8.08	16	16	16
9.	<i>Inula royleana</i>	5.7.07	28.8.08	7.7.08	30.8.08	54	54	54	23.7.07	3.8.08	24.7.08	4.8.08	11	11	11
10.	<i>Lythrum salicaria</i>	20.7.07	24.9.07	22.07.08	25.9.08	66	65	65.5	22.8.07	4.9.07	23.8.08	5.9.08	13	13	13
11.	<i>Mirabilis jalapa</i>	20.7.07	18.9.07	22.7.08	20.9.08	60	60	60	12.8.07	28.8.07	13.8.08	31.8.08	17	19	18
12.	<i>Oenothera biennis</i>	14.7.07	29.9.07	16.7.08	24.9.08	70	70	70	3.8.07	26.8.07	4.8.08	27.8.08	23	23	23

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
13.	<i>Platycodon grandiflorum</i>	16.7.07	20.9.07	17.7.08	22.9.08	66	67	66.5	9.8.07	24.8.07	10.8.08	25.8.08	15	15	15
14.	<i>Primula vulgaris</i>	4.7.07	29.8.07	7.7.08	1.9.08	55	55	55	27.7.07	9.8.07	29.7.08	13.8.08	13	15	14
15.	<i>Rheum australe</i>	26.7.07	28.9.07	27.7.08	29.9.08	64	64	64	18.8.07	4.9.07	19.8.08	5.9.08	17	17	17
16.	<i>Rubeckia laciniata</i>	2.7.07	26.8.07	4.7.08	28.8.08	54	54	54	26.7.07	8.8.07	27.7.08	9.8.08	13	13	13
17.	<i>Solidago canadensis</i>	28.7.07	10.10.07	29.7.08	11.10.08	74	74	74	26.8.07	15.9.07	27.8.08	16.9.08	20	20	20
<b>August</b>															
1.	<i>Arundo donax</i>	18.8.07	15.10.07	19.8.08	16.10.08	58	58	58	1.9.07	22.9.07	2.9.08	23.9.08	21	21	21
2.	<i>Hedychium gardnerianum</i>	18.8.07	6.10.07	20.8.08	8.10.08	49	49	49	5.9.07	20.9.07	6.9.08	21.9.08	15	15	15
3.	<i>Helianthus x multiflorus</i>	2.8.07	26.9.07	3.8.08	27.9.08	55	55	55	19.8.07	3.9.07	21.8.07	4.9.08	15	14	14.5
4.	<i>Rudbeckia fulgida</i>	4.8.07	10.10.07	6.8.08	12.10.08	68	68	68	29.8.07	19.9.07	30.8.08	20.9.08	21	21	21
5.	<i>Verbascum thapsus</i>	18.8.07	22.10.07	19.8.08	25.10.08	65	67	66	13.9.07	28.9.07	15.9.08	30.9.08	15	15	15
<b>5.2 Bulbous Plants</b>															
<b>January</b>															
1.	<i>Colchicum luteum</i>	5.1.07	26.2.07	3.1.08	24.2.08	52	52	52	22.1.07	10.2.07	19.1.08	8.2.08	19	22	20.5
2.	<i>Sternbergia lutea</i>	2.1.07	18.2.07	4.1.08	20.2.08	46	47	46.5	19.1.07	2.2.07	21.1.08	4.2.08	14	14	14
<b>February</b>															
1.	<i>Anemone biflora</i>	11.2.07	21.3.07	12.2.08	23.3.08	38	39	38.5	26.2.07	9.3.07	28.02.08	11.3.08	11	11	11
2.	<i>Eranthis hyemalis</i>	12.2.07	15.3.07	14.2.08	17.3.08	31	31	31	26.2.07	5.3.07	28.2.08	7.3.08	8	7	7.5

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
3.	<i>Gagea elegans</i>	10.2.07	25.3.07	8.2.08	22.3.08	43	42	42.5	28.2.07	16.3.07	26.2.08	14.3.08	16	16	16
4.	<i>Galanthus nivalis</i>	16.2.07	18.3.07	18.2.08	22.3.08	30	32	31	25.2.07	6.3.07	27.2.08	8.3.08	9	9	9
5.	<i>Leucojum aestivum</i>	19.2.07	23.3.07	20.2.08	21.3.08	32	30	31	1.3.07	15.3.07	3.3.08	17.3.08	14	14	14
6.	<i>Narcissus tazetta</i>	16.2.07	5.4.07	18.2.08	8.4.08	48	49	48.5	3.3.07	18.3.7	5.3.08	21.3.08	15	16	15.5
7.	<i>Narcissus pseudonarcissus</i>	10.2.07	8.4.07	11.2.08	11.4.08	57	59	58	1.3.0	22.3.07	3.3.08	24.3.08	21	20	20.5
<b>March</b>															
1.	<i>Crocus chrysanthus</i>	18.3.07	28.4.07	16.3.08	26.4.08	41	41	41	1.4.07	14.4.07	31.3.08	13.4.08	13	13	13
2.	<i>Fritillaria imperialis</i>	5.3.07	1.4.07	7.3.08	15.4.08	36	38	37	20.3.07	30.3.07	22.3.08	3.4.08	10	12	11
3.	<i>Hyacinthus orientalis</i>	2.3.07	10.4.07	4.3.08	12.4.08	38	38	38	20.3.07	30.3.07	23.3.08	3.4.08	10	11	10.5
4.	<i>Iris reticulate</i>	10.3.07	15.4.07	12.3.08	17.4.08	36	36	36	21.3.07	5.4.07	22.3.08	7.4.08	14	14	14
5.	<i>Iris germanica</i>	26.3.07	29.4.07	24.3.08	27.4.08	34	34	34	8.4.07	18.4.07	10.4.08	20.4.08	10	10	10
6.	<i>Iris unguicularis</i>	8.3.07	16.4.07	11.3.08	23.4.08	38	42	40	19.3.07	1.4.07	20.3.08	4.4.08	13	15	14
7.	<i>Ixiolirion karateginum</i>	21.3.07	20.4.07	22.3.08	22.4.08	29	30	29.5	1.4.07	13.4.07	1.4.08	15.4.08	12	14	13
8.	<i>Muscari armeniacum</i>	22.3.07	25.4.07	25.3.08	26.4.08	34	32	33	4.4.07	15.4.07	7.4.08	18.4.08	11	11	11
9.	<i>Tulipa clusiana</i>	14.3.07	8.4.07	15.3.08	12.4.08	25	28	26.5	21.3.07	29.3.07	24.3.08	2.4.08	10	9	9.5
10.	<i>Tuplipa lanata</i>	20.3.07	22.4.07	21.3.08	23.4.08	33	35	34	1.4.07	12.4.07	4.4.08	14.4.08	11	10	10.5
<b>April</b>															
1.	<i>Alstroemeria aurantiaca</i>	25.4.07	16.6.07	26.4.08	17.6.08	42	42	42	14.5.07	26.5.07	15.5.08	27.5.08	12	12	12
2.	<i>Begonia evansiana</i>	20.4.07	30.5.07	22.4.08	1.6.08	40	40	40	2.5.07	15.5.07	4.5.08	17.5.08	13	13	13

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
3.	<i>Begonia x semperflorens</i>	25.4.07	6.6.07	26.4.08	7.6.08	42	42	42	6.5.07	19.5.07	7.5.08	20.5.08	13	13	13
4.	<i>Clivia miniata</i>	10.4.07	9.5.07	13.4.08	11.5.08	29	28	28.5	17.4.07	24.4.07	19.4.08	26.4.08	7	7	7
5.	<i>Emremurus himalaicus</i>	4.4.07	12.5.07	4.4.08	14.5.08	38	40	39	22.4.07	28.4.07	23.4.08	30.4.08	6	7	6.5
6.	<i>Fressia x hybrida</i>	16.4.07	25.5.07	18.4.08	28.5.08	39	40	39.5	29.4.07	9.5.07	30.4.08	12.5.08	10	12	11
7.	<i>Gladiolus byzanthus</i>	20.4.07	24.5.07	22.4.08	25.5.08	34	33	33.5	10.5.07	18.5.07	12.5.08	20.5.08	8	8	8
8.	<i>Iris ensata</i>	8.4.07	12.5.07	10.4.08	14.5.08	34	34	34	20.4.07	27.4.07	21.4.08	28.4.08	7	7	7
9.	<i>Iris japonica</i>	6.4.07	8.5.07	10.4.08	12.5.08	27	32	29.5	20.4.07	28.4.07	23.4.08	3.05.08	8	10	9
10.	<i>Iris 'Gingerbread Man'</i>	10.4.07	17.5.07	10.4.08	19.5.08	37	39	38	23.4.07	5.5.07	24.4.08	8.5.08	12	14	13
11.	<i>Iris tectorum</i>	5.4.07	10.5.07	6.4.08	12.5.08	35	36	35.5	22.4.07	1.5.07	23.4.08	3.5.08	8	10	9
12.	<i>Iris kashmeriana</i>	14.4.07	18.5.07	15.4.08	17.5.08	34	32	33	29.4.07	7.5.07	30.4.08	8.5.08	8	8	8
13.	<i>Ornithogalum umbellatum</i>	11.4.07	6.5.07	15.4.08	9.5.08	25	24	24.5	26.4.07	26.4.07	3.5.07	28.4.08	7	9	8
14.	<i>Scilla bifolia</i>	6.4.07	27.5.07	7.4.08	28.5.08	50	50	50	28.4.07	7.5.07	29.4.08	8.5.08	9	9	9
15.	<i>Scilla siberica</i>	16.4.07	30.5.07	17.4.08	31.5.08	44	44	44	2.5.07	11.5.07	3.5.08	12.5.08	9	9	9
16.	<i>Zantedeschia elliottiana</i>	20.4.07	25.6.07	21.4.08	26.6.08	66	66	66	11.5.07	24.5.07	12.5.08	25.5.08	13	13	13
<b>May</b>															
1.	<i>Begonia x tuberhydrida</i>	1.5.07	19.6.07	3.5.07	21.6.07	49	49	49	20.5.07	30.5.07	22.5.08	1.6.08	9	10	9.5
2.	<i>Hippeastrum puniceum</i>	10.5.07	8.7.07	13.5.08	9.7.08	59	57	58	28.5.07	15.6.07	29.5.08	18.6.08	18	20	19
3.	<i>Lycoris radiata</i>	22.5.07	18.7.07	25.5.08	20.7.08	57	56	56.5	10.6.07	24.6.07	12.6.08	26.6.08	14	14	14
4.	<i>Sprekelia formosissima</i>	20.5.07	30.6.07	21.5.08	2.7.08	41	42	41.5	8.6.07	15.6.07	9.6.08	16.6.08	7	7	7

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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
<b>June</b>															
1.	<i>Amaryllis belladonna</i>	5.06.07	9.07.07	8.6.08	12.07.08	34	34	34	18.06.07	29.06.07	20.06.08	30.06.08	11	10	10.5
2.	<i>Belamcanda chinensis</i>	10.6.07	28.7.07	11.6.08	29.7.08	48	48	48	29.6.07	13.7.07	30.6.08	14.7.08	14	14	14
3.	<i>Crocospia masoniorum</i>	8.6.07	25.7.07	10.6.08	27.7.08	47	47	47	25.6.07	9.7.07	27.6.08	11.7.08	14	14	14
4.	<i>Dahlia variabilis</i>	9.6.07	20.8.07	11.6.08	22.8.08	72	72	72	25.6.07	20.7.07	26.6.08	21.7.08	25	25	25
5.	<i>Hemerocallis flava</i>	3.6.07	28.7.07	4.6.08	29.7.08	55	55	55	20.6.07	6.7.07	22.6.08	8.7.08	17	17	17
6.	<i>Lilium auratum</i>	13.6.07	13.8.07	14.6.08	14.8.08	61	61	61	9.7.07	26.7.07	11.7.08	28.7.08	17	17	17
7.	<i>Lilium candidum</i>	4.6.07	30.7.07	5.6.08	31.7.08	56	56	56	29.6.07	9.7.07	27.6.08	10.7.08	13	13	13
8.	<i>Lilium longiflorum</i>	10.6.07	10.8.07	11.6.08	13.8.08	61	63	62	4.7.07	19.7.07	5.7.08	20.7.08	15	15	15
9.	<i>Nerine bowdenii</i>	19.6.07	10.8.07	20.6.08	11.8.08	52	52	52	5.7.07	20.7.07	7.7.08	21.7.08	15	14	14.5
10.	<i>Zantedeschia aethiopica</i>	3.6.07	6.8.07	4.6.08	8.8.08	64	65	64.5	25.6.07	13.7.07	26.6.08	15.7.08	18	19	18.5
<b>July</b>															
1.	<i>Gloriosa rothschildiana</i>	4.7.07	29.8.07	6.7.08	30.8.08	56	55	55.5	24.7.07	12.8.07	26.7.08	13.8.08	19	17	18
<b>August</b>															
1.	<i>Anemone x hybrida</i>	12.08.07	5.10.07	10.08.08	4.10.08	54	53	53.5	10.09.07	25.9.07	8.09.08	23.09.08	15	15	15
2.	<i>Canna indica</i>	16.8.07	10.10.07	15.8.08	9.10.08	55	53	54	3.9.07	24.9.07	2.9.08	23.9.08	21	21	21
<b>October</b>															
1.	<i>Crocus sativus</i>	8.10.07	20.11.07	12.10.08	22.11.08	43	41	42	21.10.07	5.11.07	22.10.08	7.11.08	15	16	15.5

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### 5.3 Ground Covers

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
<b>January</b>															
1.	<i>Colchicum luteum</i>	5.1.07	26.2.07	3.1.08	24.2.08	52	52	52	22.1.07	10.2.07	19.1.08	8.2.08	19	22	20.5
<b>February</b>															
1.	<i>Eranthis hyemalis</i>	12.2.07	15.3.07	14.2.08	17.3.08	31	31	31	26.2.07	5.3.07	28.2.08	7.3.08	8	7	7.5
2.	<i>Leucojamaestivum</i>	19.2.07	23.3.07	20.2.08	21.3.08	32	30	31	1.3.07	15.3.07	3.3.08	17.3.08	14	14	14
<b>March</b>															
1.	<i>Bergenia ciliata</i>	5.03.07	13.4.07	8.3.08	15.4.08	39	38	38.5	20.3.07	30.3.07	22.3.08	1.4.08	10	10	10
2.	<i>Muscari armeniacum</i>	22.3.07	25.4.07	25.3.08	26.4.08	34	32	33	4.4.07	15.4.07	7.4.08	18.4.08	11	11	11
3.	<i>Primula denticulata</i>	10.3.07	30.4.07	11.3.08	30.4.08	50	49	49.5	30.3.07	10.4.07	31.3.08	11.4.08	11	11	11
4.	<i>Primula rosea</i>	8.3.07	2.5.07	10.3.08	4.5.08	55	55	55	24.3.07	11.4.07	25.3.08	12.4.08	18	18	18
5.	<i>Viola odorata</i>	1.3.07	5.4.07	3.3.08	9.4.08	34	36	35	18.3.07	28.3.07	20.3.08	31.3.08	10	11	10.5
<b>April</b>															
1.	<i>Ajuga reptans</i>	2.4.07	8.5.07	5.4.08	11.5.08	36	36	36	20.4.07	28.4.07	21.4.08	29.4.08	8	8	8
2.	<i>Aubrieta deltoide</i>	16.4.07	26.5.07	18.4.08	28.5.08	40	41	40.5	30.4.07	11.5.07	1.5.08	12.5.08	11	11	11

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
3.	<i>Bellis perennis</i>	3.4.07	8.5.07	4.4.08	9.5.08	35	35	35	16.4.07	22.4.07	18.4.08	24.4.08	6	6	6
4.	<i>Caltha palustris</i>	8.4.07	20.5.07	9.4.08	23.5.08	42	44	43.5	29.4.07	6.5.07	1.5.08	7.5.08	7	6	6.5
5.	<i>Convallaria majallis</i>	14.4.07	12.5.07	14.4.08	13.5.08	28	29	28.5	24.4.07	7.5.07	25.4.08	8.5.08	13	13	13
6.	<i>Ornithogalum umbellatum</i>	11.4.07	6.5.07	15.4.08	9.5.08	25	24	24.5	26.4.07	3.5.07	28.4.08	7.5.08	7	9	8
<b>May</b>															
1.	<i>Aspidistra elatior</i>	3.5.07	25.6.07	6.5.08	28.6.08	53	53	53	23.5.07	8.6.07	26.5.08	11.6.08	16	16	16
2.	<i>Geranium wallichianum</i>	25.5.07	5.8.07	26.5.08	6.8.08	72	72	72	25.6.07	16.7.07	26.6.08	19.7.08	22	23	22.5
3.	<i>Lycoris radiata</i>	22.5.07	18.7.07	25.5.08	20.7.08	57	56	56.5	10.6.07	24.6.07	12.6.08	26.6.08	14	14	14
4.	<i>Thymus serpyllum</i>	21.5.07	30.7.07	22.5.08	31.7.08	70	70	70	16.6.07	4.7.07	17.6.08	5.7.08	18	18	18
<b>June</b>															
1.	<i>Cerastium tomentosum</i>	2.6.07	28.7.07	3.6.08	30.7.08	55	56	55.5	23.6.07	8.7.07	24.6.08	11.7.08	15	16	15.5
2.	<i>Geranium rectum</i>	10.6.07	10.7.07	11.6.08	11.7.08	30	30	30	5.6.07	20.6.07	6.6.08	21.6.08	15	15	15

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
3.	<i>Nerine bowdenii</i>	19.6.07	10.8.07	20.6.08	11.8.08	52	52	52	5.7.07	20.7.07	7.7.08	21.7.08	15	14	14.5
4.	<i>Saxifraga stolonifera</i>	3.6.07	27.7.07	2.6.08	25.7.08	54	52	53	26.6.07	6.7.07	26.6.08	5.7.08	10	9	9.5
<b>July</b>															
1.	<i>Primula vulgaris</i>	4.7.07	29.8.07	7.7.08	1.9.08	55	55	55	27.7.07	9.8.07	29.7.08	13.8.09	13	15	14
2.	<i>Santolina chamaecyparissus</i>	24.6.07	4.07.07	20.6.08	3.7.08	10	13	11.5	30.06.07	3.7.07	27.6.08	1.7.08	3	4	3.5
3.	<i>Tradescantia sillamontana</i>	20.7.07	13.9.07	22.7.08	15.9.08	55	55	55	5.8.07	20.8.07	7.8.08	22.8.08	15	15	15
<b>August</b>															
1.	<i>Aptenia cordifolia</i>	20.8.07	28.9.07	19.8.08	27.9.08	39	39	39	1.9.07	18.9.07	30.8.08	17.9.08	17	18	17.5
2.	<i>Sedum spectabile</i>	13.8.07	11.10.07	14.8.08	12.10.08	58	58	58	2.9.07	20.9.07	4.9.08	22.9.08	17	17	17
<b>September</b>															
1.	<i>Hosta plantaginea</i>	25.8.07	20.10.07	26.8.08	22.10.08	56	57	56.5	13.9.07	27.9.07	15.9.08	28.9.08	14	13	13.5
2.	<i>Hosta lancifolia</i>	16.8.07	12.10.07	17.8.08	13.10.08	57	57	57	2.9.07	19.9.07	3.9.08	20.9.08	17	17	17

On an average duration of peak flowering period was found to be maximum in *Tradescantia sillamontana* (15 days) and minimum in *Santolina chamaecyparissus* (3.5 days).

In August during both the years flower emergence in *Aptenia cordifolia* was observed in 3<sup>rd</sup> week of August and *Sedum spectabile* in 2<sup>nd</sup> week of August. The specie on an average remained presentable for (39 and 58 days) and span of peak flowering period was observed to be (17.5 days) in case of *Aptenia cordifolia* and (17 days) in *Sedum spectabile*.

In September, during both the years flower emergence was recorded in two ground covers out of which flower emergence in *Hosta lancifolia* was recorded in 3<sup>rd</sup> week and that of *H. plantaginea* in 4<sup>th</sup> week of September. On an average *Hosta lancifolia* remained presentable for (57 days) and *H. plantaginea* for (56.5 days). On an average span of peak flowering period was found to be (17 days) in *Hosta lancifolia* and (13.5 days) in case of *H. plantaginea*.

#### **4.6 Characteristic of flower**

##### **4.6.1 Herbaceous perennials**

###### **4.6.1.1 Type of inflorescence**

Studies on the type of inflorescence was done and the results are presented in table 6.1. Type of inflorescence was divided into nine major groups. Persual of table reveals that out of eighty-one herbaceous



*Hyacinthus orientalis*



*Aquilegia canadensis*



*Matthiola incana*



*Convallaria majalis*

Plate – 8 Plants with fragrant flowers

perennials, seventeen species were having Raceme type of inflorescence as *Aconitum napellus*, *Alcea rosea*. Fifteen were having Solitary inflorescence as *Aquilegia canadensis*, *Coreopsis lanceolata*. Eleven herbaceous perennials were having flower head type of inflorescence as *Centaurea montana*, *Gazania × splendens*. Further perusal of table reveals that ten species were having panicle type of inflorescence as *Arundo donax*, *Gypsophila paniculata*. Eight were having corymb type of inflorescence as *Achillea filipendulina*, *Caltha palustris*. Seven herbaceous perennials possess spike type of inflorescence as *Delphinium elatum*, *Lupinus polyphyllus* and five were observed to have cyme type of inflorescence as *Phlox paniculata*, *Sedum spectabile*. Cluster type of inflorescence was noticed in four species as *Dianthus barbatus* and *Helleborus niger*. Umbel type of inflorescence was noticed in four species (*Agapanthus africanus*, *Primula denticulata*).

#### **4.6.1.2 Flower shape**

Cup shaped flowers were recorded in ten species as in *Caltha palustris* and *Campamula latifolia*. Daisy like flowers were observed in ten species as in case of *Gazania* species. Star shaped flowers were produced by nine flowers as in case of *Achillea* species. Bell shaped flowers were found in eight species as in *Aquilegia Canadensis* and *A. vulgaris*. Cross

shaped flowers were produced by seven species as in case of *Asparagus officinalis* and *Hesperis matronalis*. Saucer shaped flowers were recorded in seven species as in *Helleborus niger* and *Matthiola incana*. Tubular shaped flowers were found in seven species as *Kniphofia uvaria* and *Liatris spicata*. Rosette flowers were found in five species as in case of *Dianthus* species. Spikelets were found in four species as in case of *Typha angustifolia*. Trumpet shaped flowers were found in four species as in case of *Agapanthus africanus*. Pea shaped flowers were found in three species as in case of *Lathyrus latifolius*. Helment shaped flowers were produced by two species as *Aconitum heterophyllum* and *A. napellus*. Funnel shaped flowers were produced by *Alcea rosea* and *Stachys byzantina*. *Eryngium biebersteinianum* produced slipper shaped flower.

#### **4.6.1.3 Flower colour**

Colour is an important component in landscape design and the major contribution is of flowers. The floral colours are more appealing than man-made ones. The range of colours obtained in flowers is very vast. In the present study the flower colour was recorded in eighty-one herbaceous perennials and the same has been presented in table 6.1

It was observed that twenty three species produced yellow flowers as in *Achillea fillipendulina*, *Caltha palustris* and *Coreopsis lanceolata*.

Thirteen herbaceous perennials produced pink flowers. Purple coloured flowers were produced by fourteen flowers and out of these *Aconitum heterophyllum* have greenish-purple flowers whereas *Liatris spicata* and *Stachys byzantina* have pinkish-purple flowers. Eleven species produced white flowers as in *Asparagus officinalis* and *Gypsophila paniculata*. Blue coloured flowers were produced by eight herbaceous perennials and out of these *Nepeta nervosa*, *Tradescantia virginiana* have purplish-blue flowers. Five herbaceous perennials had orange flowers as in *Gazania × splendens*, *Gerbera jamesonii*.

Four species namely *Kniphofia uvaria*, *Penstemon barbatus*, *Rheum australe*, *Lythrum salicaria* produced red flowers and out of these *Penstemon barbataus* produced red flowers with pinkish tinge. Three herbaceous perennials produce violet flowers with *Campanula latifolia* producing deep violet flowers. Cream coloured flowers were reported in *Achillea ptarmica* and *Digitalis lanata*. Brown flower spikelets can be seen in *Typha angustifolia*.

#### **4.6.1.4 Fragrance**

Eighty-one herbaceous perennials were evaluated for the fragrance of their flowers. It was observed that eleven (*Achillea millefolium*,

*Dianthus barbatus*, *Hedychium gardnerianum*, *Lavendula angustifolia*, *Paeonia lactiflora*) produced strong scented flowers.

Six herbaceous perennials (*Alcea rosea*, *Aquilegia canadensis*, *Dianthus chinensis*, *Digitalis lanata*, *D. purpurea* and *Lupinus polyphyllus*) produced mild scented flowers.

Moderate scented flowers were produced by five species (*Cheiranthus cheiri*, *Dendranthema × grandiflorum*, *Hesperis matronalis*, *Lathyrus latifolius* and *Paeonia emodi*).

#### **4.6.2 Bulbous plants**

##### **4.6.2.1 Type of inflorescence**

Fifty-three bulbous plants were evaluated for their type of inflorescence and the results are presented in table 6.2. Perusal of table reveals that out of fifty-three bulbous species fourteen species were having *Solitary inflorescence* (*Crocus chrysanthus*, *Galanthus nivalis*). Twelve bulbous species were found to have raceme type of inflorescence (*Eremurus himalaicus*, *Hyacinthus orientalis*). Spike type of inflorescence was found in ten bulbous species (*Crocasmia masoniorum*, *Gladiolus byzanthus*). Umbel type of inflorescence was present in seven bulbous plants (*Alstroemeria aurantiaca*, *Amaryllis belladonna*). Three species (*Begonia evansiana*, *Begonia × samperflorens*, *Begonia × tuberhybrida*

were having cyme type of inflorescence. *Anemone biflora* and *Anemone × hybrida* and *Gagea elegans* were having cluster type of inflorescence. *Zantedeschia aethiopica* and *Z. elliottiana* have spathe type of inflorescence, whereas flower head type of inflorescence is present in *Dahlia variables* and *Colchicum luteum*.

#### **4.6.2.2 Flower shape**

Funnel shaped flowers were recorded in eleven bulbous plant species as in *Alstroemeria aurantiaca* and *Crocasmia masoniorum*. Nine species produced slipper shaped flowers as in *Gloriosa rothschildiana*, *Iris germanica*, *I. japonica* star shaped flowers were found in eight species as *Eremurus himalaicus*, *Gagea elegans*. Trumpet shaped flowers were observed in seven species as in *Canna indica* and *Clivia miniata*. Cup shaped flowers were observed in *Belamcanda Chinensis*, *Crocus chrysanthus*, *C. sativus* and *Eranthus hyemalis*. Bell shaped flowers were produced by *Fritillaria imperialis*, *Galanthus nivalis*, *Hyacinthus orientalis* and *Leucojum aestivum*. Saucer shaped flowers were observed in *Anemone biflora*, *Anemone × hybrida* and *Scilla siberica*. Goblet shaped flowers were observed in *Tulipa cl Muscari armeniacum* and *Lycoris radiata*. *Dahlia variabilis* produced Pompon shaped flower and *Lilium auratum* bowl shaped flowers.

#### 4.6.2.3 Flower colour

In the present study flower colour was recorded in fifty-three bulbous plants. It was observed that pink flowers were produced by ten species as in *Gladiolus byzanthus* and *Hippeastrum puniceum*. White flowers were produced by twelve species out of which *Lilium auratum* having white tepals with central golden band. Orange coloured flowers were produced by ten species with *Sprekelia formosissima* having bright orange flowers. Red coloured flowers are found in six species with *Canna indica* producing bright red flowers. Blue coloured flowers were produced by five species with *Scilla bifolia* producing purplish-blue flowers. Violet flowers were observed in three species with *Iris reticulata* producing deep violet flowers with a yellow central ridge on each fall. Lavender colour was observed in *Iris japonica* and *I. unguicularis* with former having pale lavender coloured flowers. Offwhite coloured flowers are produced by *Anemone biflora* and *Narcissus tazetta*. *Fressia × hybrida* was observed having mauve coloured flowers. *Crocus sativus* was found to have purple coloured flowers. Lilac coloured flowers were found in *Iris tectorum*. *Iris* ‘Gingerbread Man’ was found with brown coloured flowers having purple beards. *Crocus chrysanthus*, *Colchicum luteum*, *Eranthis hyemalis* and *Gagea elegans* produced yellow flowers.

#### 4.6.2.4 Fragrance

Fifty-three bulbous plants were evaluated for fragrance of their flowers. Out of these six flowers had strong scented fragrance as in case of *Amaryllis belladonna*, *Fressia* × *hybrida*, *Hyacinthus orientalis*. Foul smelling flowers were found in *Fritillaria imperialis*. Moderate smelling flowers were found in nine species as *Alostroemeria aurantiaca*, *Clivia miniata*, *Leucojum aestivum*.

#### 4.6.3 Ground covers

##### 4.6.3.1 Type of inflorescence

Studies on the type of inflorescence was done and the results are presented in table 6.3. The perusal of table reveals that solitary type of inflorescence was present in seven ground cover species as in *Ajuga reptans*, *Hosta plantaginea*, *H. lancifolia*. Raceme type of inflorescence was observed in six species with *Convallaria majalis* having arching raceme type of inflorescence. Cyme type of inflorescence was found in six species as in *Cerastium tomentosum*, *Geranium rectum*, *G. wallichianum* and *Tradescantia sillamontana*. Umbel type of inflorescence was found in five species as *lycoris radiata*, *Nerine bowdenii*. Flower heads were produced by *Colchicum luteum* and *Santolina cheamaecyparissus*. *Thymus serpyllum* produced Cluster type of inflorescence whereas *Bergenia ciliata*

produced panicle type of inflorescence. Corymb type of inflorescence was produced by *Caltha palustris*.

#### **4.6.3.2 Flower shape**

Twenty-nine ground covers were evaluated for their flower shape and have been presented in table 6.3. The results reveal that out of twenty-nine ground covers, seven species were having bell shaped flowers as in *Aspidistra elatior*, *Bergenia ciliate* and *Leucojum aestivum*. Rosette type of flowers were found in *Aubrieta deltoide*, *Aptenia cordifolia*, *Santolina chamaecyparissus* and *Primula vulgaris*. Saucer shaped flowers were produced by *Geranium rectum*, *G. wallichianum* and *Tradescandia sillamontana*. Tubular flowers were found in *Muscari armeniacum*, *Thymus serphyllum* and *Lycoris radiata*. Three species produced cup shaped flowers as *Eranthis hyemalis*. Cross shaped flowers were produced by three species as *Viola odorata* star shaped flowers were produced by three species as *Sedum spectabile*, tubular flowers were produced by three species as *Lycoris radiata*. Goblet flowers were produced by *Colchicum luteum*, funnel shaped by *Nerine bowdenii* and pompon by *Bellis perennis*.

#### **4.6.3.3 Flower colour**

White coloured flowers were produced by six species with *Leucojum aestivum* having white coloured flowers with green tips. Purple coloured

**Table-6 : Characteristics of flower****6.1 Herbaceous Perennials**

<b>S. No.</b>	<b>Scientific name</b>	<b>Type of inflorescence</b>	<b>Size (cm)</b>	<b>Shape</b>	<b>Colour</b>	<b>Fragrance</b>
<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>	<b>(5)</b>	<b>(6)</b>	<b>(7)</b>
1.	<i>Achillea filipendulina</i>	Corymb	12	Star shaped	Yellow	-
2.	<i>Achillea millefolium</i>	Corymb	10	Star shaped	Pink	Strong
3.	<i>Achillea ptarmica</i>	Corymb	8	Star shaped	Off-white	-
4.	<i>Aconitum heterophyllum</i>	Raceme	26	Helment shaped	Green-purple	-
5.	<i>Aconitum napellus</i>	Raceme	24	Helment shaped	Indogo blue	-
6.	<i>Agapanthus africanus</i>	Umbel	27	Trumpet shaped	Blue	-
7.	<i>Alcea rosea</i>	Raceme	8	Funnel shaped	Pink	Mild
8.	<i>Aquilegia canadensis</i>	Solitary	15	Bell shaped	Lemon yellow	Mild
9.	<i>Aquilegia vulgaris</i>	Solitary	16	Bell shaped	Deep violet	-
10.	<i>Arundo donax</i>	Panicle	30	Spikelets	Light green	-
11.	<i>Asparagus officinalis</i>	Raceme	1	Cross-shaped	White	-

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)
12.	<i>Aster alpinus</i>	Solitary	5	Star shaped	Violet	-
13.	<i>Caltha palustris</i>	Corymbs	5	Cup shaped	Yellow	-
14.	<i>Campanula latifolia</i>	Racemes	6	Cup shaped	Deep violet	-
15.	<i>Campanula medium</i>	Racemes	8	Bell shaped	White, pink, blue	-
16.	<i>Centaurea montana</i>	Flower head	5	Star shaped	Blue	-
17.	<i>Cheiranthus cheiri</i>	Cluster	5	Cross shaped	Purple	Moderate
18.	<i>Chrysanthemum leucanthemum</i>	Solitary	4	Pompon	White	-
19.	<i>Coreopsis grandiflora</i>	Solitary	6	Rosette	Yellow	-
20.	<i>Coreopsis lanceolata</i>	Solitary	6	Rosette	Yellow	-
21.	<i>Cynara cardunculus</i>	Flower heads	8	Cup-shaped	Purple	-
22.	<i>Delphinium elatum</i>	Spikes	4	Cup shaped	Purple	-
23.	<i>Dendranthema x grandiflorum</i>	Solitary	18	Pompon	White, yellow, pink	Moderate
24.	<i>Dianthus barbatus</i>	Cluster	10	Rosette	Pink	Strong
25.	<i>Dianthus caryophyllus</i>	Cymes	5	Rosette	Pink	Strong
26.	<i>Dianthus chinensis</i>	Cymes	8	Cross shaped	Pink	Mild

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)
27.	<i>Digitalis lanata</i>	Raceme	5	Bell shaped	Pale cream	Mild
28.	<i>Digitalis purpurea</i>	Raceme	6	Bell shaped	Purple	Mild
29.	<i>Echinacea purpurea</i>	Flower head	12	Star shaped	White	-
30.	<i>Eryngium Biebersteinianum</i>	Flower head	3	Slipper shaped	Light purple	-
31.	<i>Euphorbia stracheyi</i>	Flower head	11	Star shaped	Yellow	-
32.	<i>Gazania niveae</i>	Flower heads	9	Daisy like	Orange	-
33.	<i>Gazania x splendens</i>	Flower heads	8	Daisy like	Orange	-
34.	<i>Gerbera jamesonii</i>	Solitary	12	Daisy like	Orange	-
35.	<i>Gypsophila paniculata</i>	Panicles	2	Trumpet shaped	White	-
36.	<i>Hedychium gardnerianum</i>	Racemes	14	Trumpet shaped	Yellow	Strong
37.	<i>Helianthus autumnale</i>	Flower head	7	Daisy like	Yellow	-
38.	<i>Helianthus autumnale</i>	Corymbs	15	Daisy like	Yellow	-
39.	<i>Helianthus x multiflorus</i>	Corymbs	12	Daisy like	Yellow	-
40.	<i>Helleborus niger</i>	Cluster	7	Saucer shaped	White	-
41.	<i>Hesperis matronalis</i>	Racemes	4	Cross shaped	Purple	Moderate

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)
42.	<i>Inula royleana</i>	Solitary	12	Daisy like	Yellow	-
43.	<i>Kalanchoe blossfeldiana</i>	Corymb like panicles	2	Tubular shaped	Orange	-
44.	<i>Kniphofia uvaria</i>	Racemes	3	Tubular	Orange red	-
45.	<i>Lathyrus latifolius</i>	Racemes	3	Pea shaped	Pink purple	Moderate
46.	<i>Lavendula angustifolia</i>	Spikes	0.5	Tubular	Deep purple	Strong
47.	<i>Liatris spicata</i>	Spike	1	Tubular	Pinkish purple	-
48.	<i>Limonium latifolium</i>	Panicles	1	Tubular	Deep purple	-
49.	<i>Lunaria annua</i>	Racemes	1	Cross shaped	Light purple	-
50.	<i>Lupinus polyphyllus</i>	Spike	1.5	Pea shaped	White, yellow pink	Mild
51.	<i>Lythrum salicaria</i>	Spike	2	Star shaped	Purplish red	-
52.	<i>Matthiola incana</i>	Racemes	2.5	Saucer shaped	Mauve, purple	Strong
53.	<i>Mimulus nepalensis</i>	Racemes	1	Tubular	Yellow	-
54.	<i>Mirabilis jalapa</i>	Axillary corymbs	4	Trumpet shaped	Pink	Strong

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)
55.	<i>Nelumbo nucifera</i>	Solitary	30	Saucer shaped	Pink	Strong
56.	<i>Nepeta nervosa</i>	Cymes	2	Spikelets	Purplish blue	-
57.	<i>Nymphae stellata</i>	Solitary	25	Saucer shaped	Yellow	Mild
58.	<i>Oenothera biennis</i>	Racemes	5	Cup shaped	Golden yellow	Strong
59.	<i>Paeonia emodi</i>	Solitary	16	Cup shaped	White	Moderate
60.	<i>Paeonia lactiflora</i>	Solitary	10	Cup shaped	White	Strong
61.	<i>Papaver orientale</i>	Solitary	16	Cup shaped	Oreange scarlet	-
62.	<i>Penstemon barbatus</i>	Panicles	4	Tubular	Red with pink tinge	-
63.	<i>Phlox paniculata</i>	Cymes	2.5	Cross shaped	Dark pink	Strong
64.	<i>Physalis alkekengi</i>	Panicles	2	Bell shaped	White	-
65.	<i>Platycodon grandiflorum</i>	Solitary	5	Bell shaped	Purplish blue	-
66.	<i>Primula denticulata</i>	Umbel	2	Bell shaped	Yellow	-
67.	<i>Primula rosea</i>	Umbels	2.5	Cross shaped	Pink	-
68.	<i>Primula vulgaris</i>	Umbels	4	Rosette	Pale yellow	-
69.	<i>Ranunculus falcatus</i>	Panicles	5	Saucer shaped	Yellow	-

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)
70.	<i>Rheum australe</i>	Panicles	1	Star shaped	Deep red	-
71.	<i>Rudbeckia fulgida</i>	Flower heads	7	Daisy like	Orange yellow	-
72.	<i>Rudbeckia laciniata</i>	Flower heads	14	Daisy like	Pale yellow	-
73.	<i>Salvia sclarea</i>	Panicles	1.5	Pea shaped	Purple	-
74.	<i>Senecio cineraria</i>	Corymbs	2.5	Daisy like	Mustard yellow	-
75.	<i>Sisyrinchium striatum</i>	Cluster	2.5	Cup shaped	Pale yellow	-
76.	<i>Solidago canadensis</i>	Panicles	1.4	Spikelets	Deep yellow	-
77.	<i>Stachys byzantina</i>	Spikes	1.5	Funnel shaped	Pinkish purple	-
78.	<i>Tradescantia virginiana</i>	Cymes	4	Saucer shaped	Purplish blue	-
79.	<i>Tragopogon pratensis dubins</i>	Flower heads	3	Cup shaped	Blue	
80.	<i>Typha angustifolia</i>	Spikes	20	Spikelets	Brown	-
81.	<i>Verbascum thapsus</i>	Raceme	3	Sauver shaped	Yellow	-

Continued .....

## 6.2 Bulbous Plants

(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	<i>Alstroemeria aurantiaca</i>	Umbel	8	Funnel shaped	Orange, yellow pink	Moderate
2.	<i>Amaryllis belladonna</i>	Umbel	20	Funnel shaped	Pink	Strong
3.	<i>Anemone biflora</i>	Cluster	3	Saucer shaped	Off white	-
4.	<i>Anemone x hybrida</i>	Cluster	9	Saucer shaped	White	-
5.	<i>Begonia evansiana</i>	Cyme	3.5	Star shaped	Pink	-
6.	<i>Begonia x semperflorens</i>	Cyme	3.5	Star shaped	Pink	-
7.	<i>Begonia x tuberhybrida</i>	Cyme	4	Star shaped	White, orange, pink	-
8.	<i>Belamcanda chinensis</i>	Solitary	4	Cup shaped	Pink to red	-
9.	<i>Canna indica</i>	Raceme	7	Trumpet shaped	Bright red	-
10.	<i>Clivia miniata</i>	Umbel	3	Trumpet shaped	Orange	Moderate
11.	<i>Colchicum luteum</i>	Flower head	3	Goblet shaped	Yellow	-
12.	<i>Crocsmia masoniorum</i>	Spikelets	1	Funnel shaped	Orange red	-
13.	<i>Crocus chrysanthus</i>	Solitary	4.5	Cup shaped	Yellow	-

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)
14.	<i>Crocus sativus</i>	Solitary	5	Cup shaped	Purple	-
15.	<i>Dahlia variabilis</i>	Flower head	20	Pompon	White, orange, pink	-
16.	<i>Eranthis hyemalis</i>	Solitary	3	Cup shaped	Yellow	Moderate
17.	<i>Eremurus himalaicus</i>	Raceme	2.5	Star shaped	White	-
18.	<i>Fressia x hybrida</i>	Raceme	5	Funnel shaped	Mauve	Strong
19.	<i>Fritillaria imperialis</i>	Umbel	8	Bell shaped	Orange	Strong
20.	<i>Gagea elegans</i>	Cluster	2	Star shaped	Yellow	-
21.	<i>Galanthus nivalis</i>	Solitary	1	Bell shaped	White	-
22.	<i>Gladiolus byzanthus</i>	Spikelets	5	Funnel shaped	Pink	Strong
23.	<i>Gloriosa rothschildiana</i>	Solitary	9	Slipper shaped	Red with yellow margins	-
24.	<i>Hemerocallis flava</i>	Solitary	10	Trumpet shaped	Orange	-
25.	<i>Hippeastrum puniceum</i>	Umbel	15	Funnel shaped	Pink	-
26.	<i>Hyacinthus orientalis</i>	Racemes	2.5	Bell shaped	Violet	Strong
27.	<i>Iris ensata</i>	Spikelets	13	Slipper shaped	Blue	-

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)
28.	<i>Iris germanica</i>	Spikelets	10	Slipper shaped	Violet with yellow beards	-
29.	<i>Iris 'Gingerbread Man'</i>	Spikelets	6	Slipper shaped	Brown with purple beards	-
30.	<i>Iris japonica</i>	Spikelets	5	Slipper shaped	Pale lavender	-
31.	<i>Iris kashmeriana</i>	Spikelets	10	Slipper shaped	Yellow	-
32.	<i>Iris reticulata</i>	Spikelets	5	Slipper shaped	Deep violet with a yellow central ridge on each fall	Strong
33.	<i>Iris tectorum</i>	Spikelets	8	Slipper shaped	Lilac	-
34.	<i>Iris unguicularis</i>	Spikelets	7	Slipper shaped	Lavender	Moderate
35.	<i>Ixiolirion karateginum</i>	Racemes	5	Funnel shaped	Blue	-
36.	<i>Leucojum aestivum</i>	Solitary	4	Bell shaped	White with green tips	Moderate
37.	<i>Lilium auratum</i>	Racemes	30	Bowl shaped	White tepals, central golden band	Moderate

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)
38.	<i>Lilium candidum</i>	Racemes	5	Trumpet shaped	White	Moderate
39.	<i>Lilium longiflorum</i>	Racemes	6	Trumpet shaped	White	Strong
40.	<i>Lycoris radiata</i>	Umbel	1	Tubular	Deep red	-
41.	<i>Muscari armeniacum</i>	Racemes	0.5	Tubular	Bright blue	-
42.	<i>Narcissus pseudonarcissus</i>	Solitary	4	Trumpet	Yellow	-
43.	<i>Narcissus tazetta</i>	Solitary	4	Trumpet	Off-white	Moderate
44.	<i>Nerine bowdenii</i>	Umbels	8	Funnel shaped	Pink	Moderate
45.	<i>Ornithogalum umbellatum</i>	Racemes	2	Star shaped	White	-
46.	<i>Scilla bifolia</i>	Racemes	4	Star shaped	Purple blue	-
47.	<i>Scilla siberica</i>	Racemes	1.5	Saucer shaped	Bright blue	-
48.	<i>Sprekelia formosissima</i>	Solitary	12	Star shaped	Bright orange	-
59.	<i>Sternbergia lutea</i>	Solitary	4	Funnel shaped	Yellow	-
50.	<i>Tulipa Clusiana</i>	Solitary	5	Goblet shaped	White with pink streaks	-
51.	<i>Tulipa Lanata</i>	Solitary	4	Goblet shaped	Red	-
52.	<i>Zantedeschia aethiopica</i>	Spathes	25	Funnel shaped	White	-
53.	<i>Zantedeschia elliottiana</i>	Spathes	15	Funnel shped	Golden yellow	-

Continued .....

### 6.3 Ground Covers

(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	<i>Ajuga reptans</i>	Raceme	1.5	Cross shaped	Purple	-
2.	<i>Aptenia cordifolia</i>	Solitary	1	Rosette	Red	-
3.	<i>Aspidistra elatior</i>	Solitary	3	Bell shaped	Cream	-
4.	<i>Aubrieta deltoide</i>	Solitary	1.5	Rosette	Red	-
5.	<i>Bellis perennis</i>	Solitary	2.5	Pompon	Pink to red	-
6.	<i>Bergenia ciliata</i>	Panicle	3	Bell shaped	Pinkish white	Mild
7.	<i>Cerastium tomentosum</i>	Cymes	2.5	Star shaped	White	-
8.	<i>Caltha palustris</i>	Corymbs	5	Cup shaped	Yellow	-
9.	<i>Colchicum luteum</i>	Flower head	3	Goblet shaped	Yellow	-
10.	<i>Convallaria majalis</i>	Arching raceme	1	Bell shaped	White	-

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)
11.	<i>Eranthis hyemalis</i>	Solitary	3	Cup shaped	Yellow	Moderate
12.	<i>Geranium rectum</i> Trautv	Cymes	7	Saucer shaped	Purple	-
13.	<i>Geranium wallichianum</i> D. Don	Cymes	7	Saucer shaped	Purple	-
14.	<i>Hosta lancifolia</i> Engler	Racemes	5	Bell shaped	Purple	-
15.	<i>Hosta plantaginea</i> Aschers	Racemes	5	Bell shaped	White	Strong
16.	<i>Leucojum aestivum</i> L.	Solitary	0.4	Bell shaped	White with green tips	Moderate
17.	<i>Lycoris radiata</i>	Umbel	1	Tubular	Deep red	-
18.	<i>Muscari armeniacum</i> Leicht.	Racemes	0.5	Tubular	Bright blue	-
19.	<i>Nerine bowdenii</i>	Umbel	8	Funnel shaped	Pink	Moderate
20.	<i>Ornithogalum umbellatum</i>	Racemes	2	Star shaped	White	-

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)
21.	<i>Primula denticulata</i>	Umbel	2	Bell shaped	Yellow	-
22.	<i>Primula rosea</i>	Umbel	2.5	Cross shaped	Pink	-
23.	<i>Primula vulgaris</i>	Umbel	4	Rosette	Pale yellow	-
24.	<i>Santolina chamaecyparissus</i> L.	Flower head	1	Rosette	Bright yellow	Mild
25.	<i>Saxifraga stonilfera</i>	Cymes	2	Cup shaped	Pale pink	-
26.	<i>Sedum spectabile</i> Boreau	Cymes	1	Star shaped	Pink	-
27.	<i>Thymus serpyllum</i> L.	Clusters	5	Tubular	Purple	-
28.	<i>Tradescantia sillamontana</i>	Cymes	3	Saucer shaped	Magenta	-
29.	<i>Viola odorata</i> L.	Solitary	2	Cross shaped	Blue	Strong

flowers were present in five ground covers as in *Ajuga reptans* and *Thymus serpyllum*. Red coloured flowers were found in *Aubrieta deltoide*, *Aptenia cordifolia* and *Lycoris radiata*. Yellow coloured flowers were found in six species with *Santolina chamaecyparissus* producing bright yellow flowers. Blue coloured flowers were found in two species with *Muscari armeniacum* having bright blue flowers. Magenta coloured flowers were produced by *Tradescantia sillamontana*. *Aspidistra elatior* produced cream coloured flower where as pink flowers were produced by four species with *Saxifrage stonilfera* producing pale pink flowers.

#### **4.6.3.4 Fragrance**

Out of twenty nine ground cover species, *Fragrance emitted* by seven species with *Hosta plantaginea*, *Viola odorata* having strong smell. *Eranthis hyemalis*, *Leucojum aestivum* and *Nerine bowdenii* having moderate smell. Mild smell was found in *Bergenia ciliata* and *Santolina chamaecyparissus*.

### **4.7 Characteristics of ornamental fruit**

#### **4.7.1 Herbaceous perennials**

##### **4.7.1.1 Fruit type**

Eighty two herbaceous perennials were evaluated for their ornamental fruit and the results are present in table 7.1. The perusal of table depicts that out of eighty-two herbaceous perennials, twenty-seven species

were having capsule type of fruit with papaver orientale having Capsule covered with bristles. Twenty six species were found to have achene type of fruit with *Achillea filipendulina*, *A. millefolium* and *A. ptarmica* having achenes without pappus. Ten species were reported to have follicle type of fruit with *Aconitum napellus* having fruit of 3-5 hairy follicles, beaked and many seeded. Nut type of fruit was found in eight species with *Rheum australe* having a small nut enclosed in the persistent calyx. Pod type of fruit was found in six species with *Matthiola incana* having pods crowned by short stigmas. Three species were having berry type of fruit with *Nymphae stellata* having spongy berry ripening under water. *Alcea rosea* was found to have beakless 1-seeded carpels whereas Sori type of fruit was reported in *Adiantum capillus Veneris*.

#### **4.7.1.2 Fruit shape**

Different shapes of ornamental fruits have been reported and the results are presented in table 7.1 which reveals that cylindrical shaped fruits were produced by thirteen species as *Aconitum napellus*, *Chrysanthemum leucanthemum*. Twelve species produced ovoid shaped fruits as *Dianthus barbatus*, *D. caryophyllus*, *D. chinensis* and *Digitalis lanata*. Angled fruit were produced by eleven species with *Cynara cardunculus* having four angled fruit. Round shaped fruit was found in ten species with *Lunaria*

*annua* producing silvery rounded seed pods. Globular fruits were observed in seven species like *Asparagus officinalis*, *Hedychium gardnerianum*. Oblong shaped fruits were produced by seven species as *Oenothera biennis*. Compressed fruits were produced by five species like *Achillea filipendulina*, *A. millifolium*. Flattened fruits were produced by four species namely *Kalanchoe blossfeldiane*, *Helleborus niger*, Loculicidal fruits were produced by three species as *Agapanthus africanus*. Obovate fruits were produced by *Helianthus autumnale*, *H. multiflorus*. Ribbed fruits were found in *Mirabilis jalapa* and *Solidago canadensis*. Erect fruit were produced by *Aquilegia canadensis*, *A. vulgaris*.

*Cheiranthus cheiri* produced Siliquose fruit. Circular fruits were produced by *Adiantum capillus Veneris*. *Echinacea purpurea* produced quadrangular fruit where as Orbicular shaped fruit was found in *Coreopsis grandiflora*.

## **4.7.2 Bulbous plants**

### **4.7.2.1 Fruit type**

Out of fifty-three bulbous plants evaluated for their ornamental fruit it was observed that thirty seven bulbous species possessed capsule type of fruit out of which *Amaryllis belladonna* was found to have capsule with several seeds, opening in 3 valves. Pod type of fruit was found in eight

species as in *Iris germanica*, *I. ensata*, *I. japonica*. Achene type of fruit was found in four species as in *Anemone biflora*, *Dahlia variabilis*. Baccate type of fruit was possessed by *Zantedeschia aethiopica*, *Z. elliotiana*. *Clivia miniata* was observed to have berry type of fruit. *Sranthis hyemalis* produced follicle type of fruit.

#### 4.7.2.2 Fruit shape

Fifty-three bulbous plants were evaluated for their fruit shape and the results have been presented in table 7.2. The perusal of table depicts that out of fifty-three bulbous plants twenty species were found to have Loculicidal fruits (*Nerine bowdenii*, *Scilla bifolia*, *S. siberica*). Ten species were found to have angled fruits with *Canna indica* having 3-angled bristly capsules. Oblong shaped fruits were found in eight species (*Tulipa lanata*, *T. clusiana*). Globose fruit was observed in six species (*Clivia miniata*, *Hippeastrum puniceum*). Cylindrical fruit was found in *Zantedeschia aethiopica*, *Z. elliotiana*. Septicidal fruit was found in *Begonia* × *semperflorens*. Ovoid shaped fruit was found in *Galanthus nivalis*. Obovoid fruit was present in *Colchicum luteum* and *Fritillaria imperialis* and round fruit was found in *Eranthus hyemalis* and *Sternbergia lutea*. Hexagonal shaped fruit was found in *Ornithogalum umbellatum*.

### **4.7.3 Ground covers**

#### **4.7.3.1 Fruit type**

It was observed that out of twenty-nine ground covers eighteen species were found to have capsule type of fruit with *Viola odorata* having bluntly 3-angled capsule often purplish in colour. Follicle type of fruit was found in three species with *Eranthis hyemalis* having 5-8 stalked follicles. Nut type of fruit was found in *Ajuga reptans* and *Thymus serpyllum*. Berry type of fruit was found in two species with *Convallaria majalis* having poisonous and red coloured berry. *Bellis perennis* and *Santolina chamaecyparissus* were observed to have achene type of fruit. A short silique was found in case of *Aubrieta deltoidea*. Fruit stalks were found in *Bergenia ciliata*.

#### **4.7.3.2 Fruit shape**

Six species were found to have loculicidal fruits. With *Muscari armeniacum* having 3-angled loculicidal capsule. Five species were found to have round shaped fruit with *Viola odorata* having round Capsule, bluntly 3-angled, downy often purplish. Globose fruit was reported in three species with *Convallaria majalis* having *Globose poisonous* berry. Obovoid shaped fruit was found in *Ajuga reptans* and *Colchicum luteum*. Globular fruit was found in *Primula rosea* and *P. vulgaris*. Cylindrical fruit was present in

**Table-7 : Characteristics of Ornamental Friut**

**7.1 Herbaceous Perennials**

<b>S. No.</b>	<b>Scientific name</b>	<b>Type</b>	<b>Shape</b>
<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>
1.	<i>Achillea filipendulina</i>	Achenes	Compressed
2.	<i>Achillea millifolium</i>	Achenes	Compressed
3.	<i>Achillea ptarmica</i>	Achenes	Compressed
4.	<i>Aconitum heterophyllum</i>	Follicles	Cylindrical
5.	<i>Aconitum napellus</i>	Follicles	Cylindrical
6.	<i>Adiantum-capillus Veneris</i>	Sori	Circular
7.	<i>Agapanthus africanus</i>	Capsule	Loculicidal
8.	<i>Alcea rosea</i>	Carpels	Compressed
9.	<i>Aquilegia canadensis</i>	Follicle	Erect
10.	<i>Aquilegia vulgaris</i>	Follicle	Erect

Continued .....

(1)	(2)	(3)	(4)
11.	<i>Arundo donax</i>	Nut	Ovoid
12.	<i>Asparagus officinalis</i>	Berry	Globular
13.	<i>Aster alpinus</i>	Achene	Cylindrical
14.	<i>Caltha palustris</i>	Follicles	Flattened
15.	<i>Campanula latifolia</i>	Capsule	Ovoid
16.	<i>Campanula medium</i>	Capsule	Ovoid
17.	<i>Centaurea montana</i>	Achene	Compressed
18.	<i>Cheiranthus cheiri</i>	Pods	Siliquose
19.	<i>Chrysanthemum leucanthemum</i>	Achene	Cylindrical
20.	<i>Coreopsis grandiflora</i>	Achene	Orbicular
21.	<i>Coreopsis lanceolata</i>	Achene	Flattened
22.	<i>Cynara cardunculus</i>	Achene	Four angled
23.	<i>Delphinium elatum</i>	Follicles	Oblong

Continued .....

(1)	(2)	(3)	(4)
24.	<i>Dendranthema x grandiflorum</i>	Achene	Cylindrical
25.	<i>Dianthus barbatus</i>	Capsule	Ovoid
26.	<i>Dianthus caryophyllus</i>	Capsule	Ovoid
27.	<i>Dianthus chinensis</i>	Capsule	Ovoid
28.	<i>Digitalis lanata</i>	Capsule	Ovoid
29.	<i>Digitalis purpurea</i>	Capsule	Ovoid
30.	<i>Echinacea purpurea</i>	Achene	Quadrangular
31.	<i>Eryngium biebersteinianum</i>	Achene	Ovoid
32.	<i>Euphorbia stracheyi</i>	Capsule	Globular
33.	<i>Gazania niveae</i>	Achene	Angled
34.	<i>Gazania x splendens</i>	Achene	Angled
35.	<i>Gerbera jamesonii</i>	Achene	Angled
36.	<i>Gypsophila paniculata</i>	Capsule	Globular

Continued .....

(1)	(2)	(3)	(4)
37.	<i>Hedychium gardnerianum</i>	Capsule	Globular
38.	<i>Helenium autumnale</i>	Achene	Four-angled
39.	<i>Helianthus autumnale</i>	Achene	Obovate
40.	<i>Helianthus x multiflorus</i>	Achene	Obovate
41.	<i>Helleborus niger</i>	Follicles	Flattened
42.	<i>Hesperis matronalis</i>	Pods 3	Nearly cylindrical
43.	<i>Inula royleana</i>	Achene	Cylindrical
44.	<i>Kalanchoe blossfeldiana</i>	Follicle	Flattened
45.	<i>Kniphofia uvaria</i>	Capsule	Loculicidal
46.	<i>Lathyrus latifolius</i>	Pod	Cylindrical
47.	<i>Lavendula angustifolia</i>	Nutlets	Rounded
48.	<i>Liatris spicata</i>	Achenes	Angled
49.	<i>Limonium latifolium</i>	Capsule	Oblong

Continued .....

(1)	(2)	(3)	(4)
50.	<i>Lunaria annua</i>	Pods	Rounded
51.	<i>Lupinus polyphyllus</i>	Pod	Cylindrical
52.	<i>Lythrum salicaria</i>	Capsule	Angled
53.	<i>Matthiola incana</i>	Pods	Cylindrical
54.	<i>Mimulus napalensis</i>	Capsule	Oblong
55.	<i>Mirabilis jalapa</i>	Achenes	Ribbed
56.	<i>Nelumbo nucifera</i>	Spongy nut	Rounded
57.	<i>Nepeta nervosa</i>	Nutlets	Rounded
58.	<i>Nymphae stellata</i>	Spongy berry	Cylindrical
59.	<i>Oenothera biennis</i>	Capsule	Oblong
60.	<i>Paeonia emodi</i>	Follicle	Oblong
61.	<i>Paeonia lactiflora</i>	Follicle	Oblong
62.	<i>Papaver orientale</i>	Capsule	Rounded

Continued .....

(1)	(2)	(3)	(4)
63.	<i>Penstemon barbatus</i>	Capsule	Oblong
64.	<i>Phlox paniculata</i>	Capsule	Ovoid
65.	<i>Physalis alkekengi</i>	Berry.	Rounded
66.	<i>Platycodon grandiflorum</i>	Capsule	Angled
67.	<i>Primula denticulata</i>	Capsule	Cylindrical
68.	<i>Primula rosea</i>	Capsule	Globular
69.	<i>Primula vulgaris</i>	Capsule	Globular
70.	<i>Ranunculus falcatus</i>	Achenes	Rounded
71.	<i>Rheum australe</i>	Small nut	Rounded
72.	<i>Rudbeckia fulgida</i>	Achene.	Four-angled
73.	<i>Rudbeckia laciniata</i>	Achene.	Four-angled
74.	<i>Salvia sclarea</i>	Nutlets	Rounded

Continued .....

(1)	(2)	(3)	(4)
75.	<i>Senecio cineraria</i>	Achene	Cylindrical
76.	<i>Sisyrinchium striatum</i>	Capsule	Loculicidal
77.	<i>Solidago canadensis</i>	Achene	Ribbed
78.	<i>Stachys byzantina</i>	Nutlets	Ovoid
79.	<i>Tradescantia virginiana</i>	Capsule	Angled
80.	<i>Tragopogon pratensis dubins</i>	Achene	Rounded
81.	<i>Typha angustifolia</i>	Nutlets	Ovoid
82.	<i>Verbascum thapsus</i>	Capsule	Globular

## 7.2 Bulbous Plants

1.	<i>Alstroemeria aurantiaca</i>	Capsule	Loculicidal
2.	<i>Amaryllis belladonna</i>	Capsule	Globuse
3.	<i>Anemone biflora</i>	Achenes	Oblong

Continued .....

(1)	(2)	(3)	(4)
4.	<i>Anemone x hybrida</i>	Achenes	Oblong
5.	<i>Begonia evansiana</i>	Capsule	Loculicidal
6.	<i>Begonia x semperflorens</i>	Capsule	Septicidal
7.	<i>Begonia x tuberhybrida</i>	Capsule	Loculicidal
8.	<i>Belamcanda chinensis</i>	Capsule	Loculicidal
9.	<i>Canna indica</i>	Capsule	3-angled
10.	<i>Clivia miniata</i>	Berry	Globuse
11.	<i>Colchicum luteum</i>	Capsule	Obovoid
12.	<i>Crocospia masoniorum</i>	Capsule	Oblong
13.	<i>Crocus chrysanthus</i>	Capsule	Oblong
14.	<i>Crocus sativus</i>	Capsule	Oblong
15.	<i>Dahlia variabilis</i>	Achene	Oblong

Continued .....

(1)	(2)	(3)	(4)
16.	<i>Eranthis hyemalis</i>	Follicles	Rounded
17.	<i>Eremurus himalaicus</i>	Capsule	Locucidal
18.	<i>Fritillaria imperialis</i>	Capsule	Obovoid
19.	<i>Fressia x hybrida</i>	Capsule	Locucidal
20.	<i>Gagea elegans</i>	Capsule	Nearly globular
21.	<i>Galanthus nivalis</i>	Capsule	Ovoid
22.	<i>Gladiolus byzanthus</i>	Capsule	Loculicidal
23.	<i>Gloriosa rothschildiana</i>	Capsule	Locucidal
24.	<i>Hemerocallis flava</i>	Capsule	Loculicidal
25.	<i>Hippeastrum puniceum</i>	Capsule	Globuse
26.	<i>Hyacinthus orientalis</i>	Capsule	Three-angled
27.	<i>Iris ensata</i>	Capsule	Angled

Continued .....

(1)	(2)	(3)	(4)
28.	<i>Iris germanica</i>	Capsule	Angled
29.	<i>Iris 'Gingerbread Man'</i>	Capsule	Angled
30.	<i>Iris japonica</i>	Capsule	Angled
31.	<i>Iris kashmeriana</i>	Capsule	Angled
32.	<i>Iris reticulata</i>	Capsule	Angled
33.	<i>Iris tectorum</i>	Capsule	Angled
34.	<i>Iris unguicularis</i>	Capsule	Angled
35.	<i>Ixiolirion karateginum</i>	Capsule	Loculicidal
36.	<i>Leucojum aestivum</i>	Capsule	Loculicidal
37.	<i>Lilium auratum</i>	Capsule	Loculicidal
38.	<i>Lilium candidum</i>	Capsule	Loculicidal
39.	<i>Lilium longiflorum</i>	Capsule	Loculicidal
40.	<i>Lycoris radiata</i>	Capsule	Loculicidal

Continued .....

(1)	(2)	(3)	(4)
41.	<i>Muscari armeniacum</i>	Capsule	Loculicidal
42.	<i>Narcissus pseudonarcissus</i>	Capsule	Globose
43.	<i>Narcissus tazetta</i>	Capsule	Globose, often obtusely trigonous
44.	<i>Nerine bowdenii</i>	Capsule	Loculicidal
45.	<i>Ornithogalum umbellatum</i>	Capsule	Hexagonal
46.	<i>Scilla bifolia</i>	Capsule	3-Loculicidal
47.	<i>Scilla siberica</i> Haw.	Capsule	Loculicidal
48.	<i>Sprekelia formosissima</i> Herb.	Capsule	Loculicidal
49.	<i>Sternbergia lutea</i> Roem and Schult	Achenes	Rounded
50.	<i>Tulipa Clusiana</i> D.C	Capsule	Oblong
51.	<i>Tulipa Lanata</i> Rgl.	Capsule	Oblong
52.	<i>Zantedeschia aethiopica</i> Spreng	Baccate	Cylindrical
53.	<i>Zantedeschia elliottiana</i> Engler	Baccate	Cylindrical

Continued .....

### 7.3 Ground Covers

(1)	(2)	(3)	(4)
1.	<i>Ajuga reptans</i>	Nutlets	Obovoid
2.	<i>Aptenia cordifolia</i>	Capsule	Loculicidal
3.	<i>Aspidistra elatior</i>	Berry	Round
4.	<i>Aubrieta deltoide</i>	Silique	Oblong
5.	<i>Bellis perennis</i>	Achenes	Compressed
6.	<i>Bergenia ciliata</i>	Fruit stalks	Almost round
7.	<i>Caltha palustris</i>	Follicles	Flattened
8.	<i>Cerastium tomentosum</i>	Capsule	Cylindrical
9.	<i>Colchicum luteum</i>	Capsule	Obovoid
10.	<i>Convallaria majalis</i>	Berry	Globose
11.	<i>Eranthis hyemalis</i>	Follicles	Rounded
12.	<i>Geranium rectum</i>	Capsule	Globose
13.	<i>Geranium wallichianum</i>	Capsule	Globose

Continued .....

(1)	(2)	(3)	(4)
14.	<i>Hosta lancifolia</i>	Capsule	Elongated
15.	<i>Hosta plantaginea</i>	Capsule	Elongated
16.	<i>Leucojum aestivum</i>	Capsule	Loculicidal
17.	<i>Lycoris radiata</i>	Capsule	Loculicidal
18.	<i>Muscari armeniacum</i>	Capsule	Loculicidal
19.	<i>Nerine bowdenii</i>	Capsule	Loculicidal
20.	<i>Ornithogalum umbellatum</i>	Capsule	Hexagonal
21.	<i>Primula denticulata</i>	Capsule	Cylindrical
22.	<i>Primula rosea</i>	Capsule	Globular
23.	<i>Primula vulgaris</i>	Capsule	Globular
24.	<i>Santolina chamaecyparissus</i>	Achene	Angled
25.	<i>Saxifraga stolonifera</i>	Capsule	Rounded
26.	<i>Sedum spectabile</i> Boreau	Follicles	Erect
27.	<i>Thymus serpyllum</i>	Nutlets	Ovoid
28.	<i>Tradescantia sillamontana</i>	Capsule	Loculicidal
29.	<i>Viola odorata</i>	Capsule	Round

*Cerastium tomentosum* and *Primula denticulata* elongated fruit was produced by two species of Hosta. *Bellis perennis* was found to have compressed achenes without ribs. Hexagonal shaped fruit was found in *Ornithogalum umbellatum*. Angled achenes were reported in *Santolina chaemaecyparissus* and ovoid nutlets were found in *Thymus serpyllum*. Erect fruits were produced by *sedum spectabile* whereas flattened fruits were observed in *Caltha palustris*.

## **4.8 Landscape use**

### **4.8.1 Herbaceous perennials**

The specific uses of herbaceous perennial species has been presented in table 8.1.

#### **Beds**

Eighty two herbaceous perennial species were evaluated for their specific landscape use and it was observed that thirty three herbaceous perennials (*Aquilegia Canadensis*, *Achillea ptarmica*, *Aster alpinus*) are suitable for growing in beds.

#### **Borders**

Out of eighty two herbaceous perennials seventy three species are best suited for growing in borders (*Aconitum napellus*, *Agapanthus*

*praecox*, *Achillea millefolium*, *Alcea rosea*, *Caltha palustris*) being some of these plants.

### **Woodlands**

Twenty-seven herbaceous perennials (*Aconitum heterophyllum*, *Campanula medium*, *Digitalis lanata*) are suitable for woodlands.

### **Rock garden**

Forty-two herbaceous perennials (*Achillea filipendulina*, *Centaurea montana*, *Coreopsis lanceolata*, *Chrysanthemum leucanthemum*) are best suited for rock garden.

### **Companion plant**

Among eighty-two herbaceous perennial species (*Paeonia emodi* and *P. lactiflora*) are used as companion plants.

### **Specimen plant**

*Agapanthus praecox*, *Arundo donax*, *Cynara cardunculus*, *Digitalis lanata* and *D. purpurea* are suitable for growing as specimen plants.

### **Back drop**

*Aquilegia canadensis*, *A. vulgaris*, *Alcea rosea* and *Arundo donax* can be used as back drop in landscape designs

## **Pool**

Out of eighty-two herbaceous perennials, seven species such as *Arundo donax*, *Adiantum capillus Veneris*, *Caltha palustris*, *Lythrum salicaria*, *Nelumbo nucifera*, *Nymphae stellata* and *Typha angustifolia* are adaptable to moist conditions and are suitable for pool.

### **4.8.2 Bulbous plants**

#### **Beds**

Among Fifty-three bulbous plants twenty-six species (*Anemone biflora*, *A × hybrida*, *Begonia evansiana*, *Canna indica*, *Clivia miniata*) are suitable for growing in beds.

#### **Borders**

Out of fifty-three bulbous species evaluated for various landscape uses, it was observed that forty bulbs (*Alstroemeria aurantiaca*, *Belamcanda chinensis*, *Crocsmia masonorum*) are best suited for use in borders

#### **Pathways**

It was observed that among bulbous plants *Nerine bowdenii* and *Lycoris radiata* are suitable for growing against pathways

## **Rock garden**

Twenty-three Bulbous plants (*Crocus chrysanthus*, *C. sativus*, *Fritillaria imperialis*, *Galanthus nivalis*) are best suited for rock gardens

## **Specimen plant**

*Dahlia variabilis* was observed to be suitable for growing as specimen plants.

## **Pots**

Flowering pots add charm and beauty to landscape design. Among forty-eight bulbous plants, five species (*Iris reticulata*, *Iris japonica*) are suitable for growing in pots.

## **Ground covers**

Out of fifty three bulbous plants five plants can serve as ground covers (*Colchicum luteum*, *Muscari armeniacum*).

### **4.8.3 Ground covers**

The specific uses of twenty-nine ground covers has been presented in Table 8.3.

## **Beds**

It was observed that twenty-three ground covers (*Ajuga reptans*, *Bellis perennis*, *Bergenia ciliate*, *Eranthis hyemalis*) can be grown in beds.

## **Borders**

It was observed that the species most ideal for growing in borders are (*Hosta plantaginea*, *H. lancifolia*, *Caltha palustris*, *Lycoris radiata*, *Primula denticulata*, *P. rosea*, *P. vulgaris*, *Saxifraga stolonifera*, *Sedum spectabile* .

## **Woodlands**

The most attractive species which can be grown in woodlands are *Ajuga reptans*, *Aspidistra elatior*, *Aptenia cordifolia*, *Bellis perennis*, *Bergenia ciliata*, *Convallaria majalis*, *Geranium wallichianum*, *Hosta plantaginea*, *H. lancifolia*, *Saxifraga stolonifera* and *Viola odorata*.

## **Lightly shaded areas**

Out of twentyone ground covers the most suitable species for lightly shaded areas are *Eranthis hyemalis*, *Hosta lancifolia*, *H. plantaginea*, *Leucogramma aestivum*, *Muscari armeniacum*, *Thymus serpyllum*, *Tradescantia sillamontana* and *Viola odorata*.

## **Pathways**

*Lycoris radiata* and *Nerine bowdenii* are suitable for planting along pathways.

**Table-8 : Landscape Value**

**8.1 Herbaceous Perennials**

S. No.	Scientific name	Beds	Borders	Pathways	Woodlands	Rock garden	Companion plant	Ground cover	Specimen plant	Back-drop	Pool
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1.	<i>Achillea filipendulina</i>		✓			✓					
2.	<i>Achillea millefolium</i>		✓			✓					
3.	<i>Achillea ptarmica</i>	✓	✓			✓					
4.	<i>Aconitum heterophyllum</i>		✓		✓						
5.	<i>Aconitum napellus</i>		✓		✓						
6.	<i>Adiantum-capillus Veneris</i>				✓	✓					✓
7.	<i>Agapanthus africanus</i>		✓						✓		
8.	<i>Alcea rosea</i>		✓			✓				✓	
9.	<i>Aquilegia canadensis</i>	✓	✓		✓					✓	
10.	<i>Aquilegia vulgaris</i>	✓	✓		✓					✓	
11.	<i>Arundo donax</i>								✓	✓	✓

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
12.	<i>Asparagus officinalis</i>		✓								
13.	<i>Aster alpinus</i>	✓	✓			✓					
14.	<i>Caltha palustris</i>	✓	✓								✓
15.	<i>Campanula latifolia</i>		✓		✓	✓					
16.	<i>Campanula medium</i>		✓		✓	✓					
17.	<i>Centaurea montana</i>	✓	✓			✓					
18.	<i>Cheiranthus cheiri</i>	✓	✓								
19.	<i>Chrysanthemum leucanthemum</i>	✓	✓			✓					
20.	<i>Coreopsis grandiflora</i>	✓	✓			✓		✓			
21.	<i>Coreopsis lanceolata</i>	✓	✓			✓		✓			
22.	<i>Cynara cardunculus</i>		✓						✓		
23.	<i>Delphinium elatum</i>		✓			✓					
24.	<i>Dendranthema x grandiflorum</i>	✓	✓			✓					

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
25.	<i>Dianthus barbatus</i>	✓	✓								
26.	<i>Dianthus caryophyllus</i>	✓	✓								
27.	<i>Dianthus chinensis</i>	✓	✓								
28.	<i>Digitalis lanata</i>		✓		✓				✓		
29.	<i>Digitalis purpurea</i>		✓		✓				✓		
30.	<i>Echinacea purpurea</i>		✓		✓	✓					
31.	<i>Eryngium biebersteinianum</i>		✓								
32.	<i>Euphorbia stracheyi</i>		✓		✓	✓					
33.	<i>Gazania niveae</i>	✓									
34.	<i>Gazania x splendens</i>	✓									
35.	<i>Gerbera jamesonii</i>		✓								
36.	<i>Gypsophila paniculata</i>	✓	✓			✓					
37.	<i>Hedychium gardnerianum</i>		✓								
38.	<i>Helenium autumnale</i>										

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
39.	<i>Helianthus autumnale</i>		✓			✓					
40.	<i>Helianthus x multiflorus</i>		✓			✓					
41.	<i>Helleborus niger</i>		✓		✓	✓					
42.	<i>Hesperis matronalis</i>		✓			✓					
43.	<i>Inula royleana</i>				✓	✓					
44.	<i>Kalanchoe blossfeldiana</i>	✓	✓								
45.	<i>Kniphofia uvaria</i>		✓			✓					
46.	<i>Lathyrus latifolius</i>		✓		✓	✓					
47.	<i>Lavendula angustifolia</i>		✓		✓	✓		✓			
48.	<i>Liatris spicata</i>		✓								
49.	<i>Limonium latifolium</i>	✓	✓								
50.	<i>Lunaria annua</i>		✓		✓						
51.	<i>Lupinus polyphyllus</i>	✓	✓			✓					
52.	<i>Lythrum salicaria</i>		✓								✓

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
53.	<i>Matthiola incana</i>	✓	✓								
54.	<i>Mimulus napalensis</i>	✓	✓		✓						
55.	<i>Mirabilis jalapa</i>		✓		✓						
56.	<i>Nelumbo nucifera</i>										✓
57.	<i>Nepeta nervosa</i>		✓		✓			✓			
58.	<i>Nymphae stellata</i>										✓
59.	<i>Oenothera biennis</i>	✓	✓			✓					
60.	<i>Paeonia emodi</i>		✓			✓	✓				
61.	<i>Paeonia lactiflora</i>		✓				✓				
62.	<i>Papaver orientale</i>		✓			✓					
63.	<i>Penstemon barbatus</i>	✓	✓			✓					
64.	<i>Phlox paniculata</i>	✓	✓			✓					
65.	<i>Physalis alkekengi</i>		✓								
66.	<i>Platycodon grandiflorum</i>		✓			✓					
67.	<i>Primula denticulata</i>	✓	✓			✓					

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
68.	<i>Primula rosea</i>	✓	✓			✓					
69.	<i>Primula vulgaris</i>	✓	✓			✓					
70.	<i>Ranunculus falcatus</i>	✓				✓					
71.	<i>Rheum australe</i>		✓		✓						
72.	<i>Rudbeckia fulgida</i>	✓	✓		✓						
73.	<i>Rudbeckia laciniata</i>	✓	✓		✓						
74.	<i>Salvia sclarea</i>	✓	✓		✓						
75.	<i>Senecio cineraria</i>	✓	✓			✓					
76.	<i>Sisyrinchium striatum</i>		✓			✓					
77.	<i>Solidago canadensis</i>		✓			✓					
78.	<i>Stachys byzantina</i>	✓				✓					
79.	<i>Tradescantia virginiana</i>		✓								
80.	<i>Tragopogon pratensis</i>		✓		✓						
81.	<i>Typha angustifolia</i>										✓
82.	<i>Verbascum thapsus</i>		✓		✓	✓					

Continued .....

## 8.2 Bulbous Plants

S. No.	Scientific name	Beds	Borders	Pathways	Woodlands	Rock garden	Companion plant	Ground cover	Specimen plant	Back-drop	Pots
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1.	<i>Alstroemeria aurantiaca</i>		✓								
2.	<i>Amaryllis belladonna</i>		✓								
3.	<i>Anemone biflora</i>	✓	✓								
4.	<i>Anemone x hybrida</i>	✓	✓								
5.	<i>Begonia evansiana</i>	✓	✓		✓						
6.	<i>Begonia x semperflorens</i>	✓	✓								
7.	<i>Begonia x tuberhybrida</i>	✓	✓								
8.	<i>Belamcanda chinensis</i>		✓			✓					
9.	<i>Canna indica</i>	✓	✓								
10.	<i>Clivia miniata</i>	✓	✓								
11.	<i>Colchicum luteum</i>	✓						✓			
12.	<i>Crocsmia masoniorum</i>		✓								
13.	<i>Crocus chrysanthus</i>	✓	✓			✓					✓

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
14.	<i>Crocus sativus</i>	✓	✓			✓					
15.	<i>Dahlia variables</i>	✓							✓		
16.	<i>Eranthis hyemalis</i>	✓						✓			
17.	<i>Eremurus himalaicus</i>		✓								✓
18.	<i>Fressia x hybrida</i>		✓								
19.	<i>Fritillaria imperialis</i>	✓	✓		✓	✓					
20.	<i>Gagea elegans</i>	✓			✓	✓					
21.	<i>Galanthus nivalis</i>		✓		✓	✓					
22.	<i>Gladiolus byzanthus</i>		✓								
23.	<i>Gloriosa rothschildiana</i>	✓									
24.	<i>Hemerocallis flava</i>		✓		✓	✓					
25.	<i>Hippeastrum puniceum</i>		✓								
26.	<i>Hyacinthus orientalis</i>	✓									
27.	<i>Iris ensata</i>		✓			✓					

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
28.	<i>Iris germanica</i>		✓			✓					✓
29.	<i>Iris 'Gingerbread Man'</i>		✓			✓					
30.	<i>Iris unguicularis</i>		✓			✓					✓
31.	<i>Iris kermesiana</i>		✓			✓					
32.	<i>Iris reticulata</i>		✓			✓					
33.	<i>Iris tectorum</i>		✓			✓					
34.	<i>Iris japonica</i>		✓			✓					✓
35.	<i>Ixiolirion karateginum</i>	✓									
36.	<i>Leucojum aestivum</i>	✓						✓			
37.	<i>Lilium auratum</i>		✓		✓	✓					
38.	<i>Lilium candidum</i>		✓		✓	✓					
39.	<i>Lilium longiflorum</i>		✓		✓	✓					
40.	<i>Lycoris radiata</i>		✓			✓					
41.	<i>Narcissus pseudonarcissus</i>		✓		✓	✓					

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
42.	<i>Narcissus tazetta</i>		✓		✓	✓					
43.	<i>Nerine bowdenii</i>			✓		✓					
44.	<i>Muscari armeniacum</i>	✓				✓					
45.	<i>Ornithogalum umbelatum</i>	✓				✓		✓			
46.	<i>Scilla bifolia</i>	✓	✓								
47.	<i>Scilla siberica</i>	✓	✓								
48.	<i>Sprekelia formosissima</i>		✓								
49.	<i>Sternbergia lutea</i>		✓		✓	✓					
50.	<i>Tulipa Clusiana</i>	✓	✓		✓						
51.	<i>Tulipa Lanata</i>	✓	✓		✓						
52.	<i>Zantedeschia aethiopica</i>	✓			✓						
53.	<i>Zantedeschia elliottiana</i>	✓			✓						

Continued .....

### 8.3 Ground Covers

S. No.	Scientific name	Beds	Borders	Pathways	Woodlands	Rock garden	Companion plant	Ground cover	Specimen plant	Back-drop	Pool
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1.	<i>Ajuga reptans</i>	✓			✓			✓			✓
2.	<i>Aptenia cordifolia</i>	✓			✓			✓			
3.	<i>Aspidistra elatior</i>	✓			✓			✓			
4.	<i>Aubrieta deltoide</i>	✓				✓		✓			
5.	<i>Bellis perennis</i>	✓			✓			✓			
6.	<i>Bergenia ciliata</i>	✓			✓	✓		✓			✓
7.	<i>Caltha palustris</i>	✓	✓								✓
8.	<i>Cerastium tomentosum</i>	✓						✓			
9.	<i>Colchicum luteum</i>	✓						✓			
10.	<i>Convallaria majalis</i>	✓			✓			✓			
11.	<i>Eranthis hyemalis</i>	✓						✓			
12.	<i>Geranium rectum</i>	✓						✓			

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
13.	<i>Geranium wallichianum</i>	✓			✓			✓			
14.	<i>Hosta lancifolia</i>		✓		✓			✓			
15.	<i>Hosta plantaginea</i>		✓		✓	✓					
16.	<i>Leucojum aestivum</i>	✓						✓			
17.	<i>Lycoris radiata</i>		✓	✓		✓					
18.	<i>Muscari armeniacum</i>	✓				✓		✓			
19.	<i>Nerine bowdenii</i>	✓	✓			✓					
20.	<i>Ornithogalum umbellatum</i>	✓				✓		✓			
21.	<i>Primula denticulata</i>	✓	✓			✓					
22.	<i>Primula rosea</i>	✓	✓			✓					
23.	<i>Primula vulgaris</i>	✓	✓			✓					
24.	<i>Santolina chamaecyparissus</i>	✓						✓			
25.	<i>Saxifraga stolonifera</i>		✓		✓	✓					
26.	<i>Sedum spectabile</i>		✓			✓					
27.	<i>Thymus serpyllum</i>	✓				✓		✓			
28.	<i>Tradescantia sillamontana</i>	✓						✓			
29.	<i>Viola odorata</i>	✓			✓			✓			

## **Sunny areas**

It was observed that out of twentyone ground covers suitable for growing in sunny areas the most suitable species were *Bellis perennis*, *Cerastium tomentosum*, *Geranium rectum*, *G. wallichianum* and *Santolina chamaecyparissus*.

## **Pool**

*Ajuga reptans* and *Bergenia ciliata* and *Caltha palustris* are suitable for pool situations.

## **Rock gardens**

Nine ground cover species are suitable for planting in rock gardens (*Aubrieta deltoide*, *Bergenia ciliate*).

## **4.9 Time of planting**

### **4.9.1 Herbaceous perennials**

Out of eighty two herbaceous perennials evaluated for their time of planting. It was observed that eleven species can be planted in mid September (*Helleborus niger*, *Primula rosea*, *P. denticulata*). Eight species can be planted in late September (*Ixiolirion karateginum*, *Aquilegia vulgaris*, *Cheiranthus cheiri*). Thirteen species can be planted in early October (*Centaurea montana*, *Campanula medium*, *Gypsophyla*

*paniculata*). Five species namely *Coreopsis lanceolata*, *Dianthus caryophyllus*, *Digitalis purpurea*, *Euphorbia stratcheyi* and *Physalis alkekengi* can be planted in mid October. Two species namely *Coreopsis grandiflora*, *Nimphaea stellata* can be planted in late October. In early March fifteen species (*Achillea filipendulina*, *Aconitum napellus*, *Alcea rosea*) can be planted. Six species can be planted in mid March (*Asparagus officinalis*, *Cynara cardunculus*, *Liatris spicata*). Further perusal of table depicts that nine species can be planted in early April (*Aconitum heterophyllum*, *Agapanthus praecox*, *Achillea ptarmica*). Six species can be planted in mid April (*Digitalis lanata*, *Mirabilis jalapa*). Seven species can be planted in late April (*Gazania nivea*, *Solidago canadensis*).

#### **4.9.2 Bulbous plants**

The perusal of table 9.2 depicts that out of fifty-three bulbous plants, eight species (*Anemone hybrida* and *Sternbergia lutea*) can be planted in mid September. *Narsissus pseudonarcissus* can be planted in late September. Six species can be planted in early October (*Anemone biflora*, *Galanthus nivalis*, *Leucojum aestivum*). Thirteen species can be planted in mid October (*Cliia miniata*, *Eremurus himalaicus*, *Iris ensata*). Seven species can be planted in late October (*Alstroemeria aurantiaca*, *Begonia evansiana*). Ten species can be planted in early March (*Begonia* ×

**Table-9 : Time of planting**

**9.1 Herbaceous Perennials**

S. No.	Scientific name	Mid September	Late September	Early October	Mid October	Late October	Early March	Mid March	Late March	Early April	Mid April	Late April
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1.	<i>Achillea filipendulina</i>						✓					
2.	<i>Achillea millifolium</i>							✓				
3.	<i>Achillea ptarmica</i>									✓		
4.	<i>Aconitum heterophyllum</i>									✓		
5.	<i>Aconitum napellus</i>						✓					
6.	<i>Adiantum-capillus Veneris</i>									✓		
7.	<i>Agapanthus praecox</i>									✓		
8.	<i>Alcea rosea</i>						✓					
9.	<i>Aquilegia canadensis</i>	✓										
10.	<i>Aquilegia vulgaris</i>		✓									
11.	<i>Arundo donax</i>		✓									

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
12.	<i>Asparagus officinalis</i>							✓				
13.	<i>Aster alpinus</i>	✓					✓					
14.	<i>Caltha palustris</i>						✓					
15.	<i>Campanula latifolia</i>			✓								
16.	<i>Campanula medium</i>			✓								
17.	<i>Centaurea montana</i>		✓									
18.	<i>Cheiranthus cheiri</i>							✓				
19.	<i>Chrysanthemum leucanthemum</i>					✓						
20.	<i>Coreopsis grandiflora</i>				✓							
21.	<i>Coreopsis lanceolata</i>							✓				
22.	<i>Cynara cardunculus</i>						✓					
23.	<i>Delphinium elatum</i>						✓					
24.	<i>Dendranthema x grandiflorum</i>										✓	

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
25.	<i>Dianthus barbatus</i>	✓										
26.	<i>Dianthus caryophyllus</i>				✓							
27.	<i>Dianthus chinensis</i>						✓					
28.	<i>Digitalis lanata</i>										✓	
29.	<i>Digitalis purpurea</i>				✓							
30.	<i>Echinacea purpurea</i>			✓								
31.	<i>Eryngium biebersteinianum</i>						✓					
32.	<i>Euphorbia stracheyi</i>				✓							
33.	<i>Gazania niveae</i>											✓
34.	<i>Gazania x splendens</i>										✓	
35.	<i>Gerbera jamesonii</i>			✓								
36.	<i>Gypsophila paniculata</i>			✓								
37.	<i>Hedychium gardnerianum</i>											✓
38.	<i>Helenium autumnale</i>						✓					

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
39.	<i>Helianthus autumnale</i>									✓		
40.	<i>Helianthus x multiflorus</i>											✓
41.	<i>Helleborus niger</i>	✓										
42.	<i>Hesperis matronalis</i>	✓										
43.	<i>Inula royleana</i>									✓		
44.	<i>Kalanchoe blossfeldiana</i>		✓									
45.	<i>Kniphofia uvaria</i>			✓								
46.	<i>Lathyrus latifolius</i>						✓					
47.	<i>Lavendula angustifolia</i>						✓					
48.	<i>Liatris spicata</i>							✓				
49.	<i>Limonium latifolium</i>		✓									
50.	<i>Lunaria annua</i>	✓										
51.	<i>Lupinus polyphyllus</i>			✓								
52.	<i>Lythrum salicaria</i>										✓	

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
53.	<i>Matthiola incana</i>		✓									
54.	<i>Mimulus napalensis</i>	✓										
55.	<i>Mirabilis jalapa</i>										✓	
56.	<i>Nelumbo nucifera</i>							✓				
57.	<i>Nepeta nervosa</i>						✓					
58.	<i>Nymphae stellata</i>					✓						
59.	<i>Oenothera biennis</i>									✓		
60.	<i>Paeonia emodi</i>	✓										
61.	<i>Paeonia lactiflora</i>			✓								
62.	<i>Papaver orientale</i>			✓								
63.	<i>Penstemon barbatus</i>			✓								
64.	<i>Phlox paniculata</i>						✓					
65.	<i>Physalis alkekengi</i>				✓							
66.	<i>Platycodon grandiflorum</i>										✓	

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
67.	<i>Primula denticulata</i>	✓										
68.	<i>Primula rosea</i>	✓										
69.	<i>Primula vulgaris</i>									✓		
70.	<i>Ranunculus falcatus</i>		✓									
71.	<i>Rheum australe</i>											✓
72.	<i>Rudbeckia fulgida</i>											✓
73.	<i>Rudbeckia laciniata</i>									✓		
74.	<i>Salvia sclarea</i>		✓									
75.	<i>Senecio cineraria</i>						✓					
76.	<i>Sisyrinchium striatum</i>			✓								
77.	<i>Solidago canadensis</i>											✓
78.	<i>Stachys byzantina</i>			✓								
79.	<i>Tradescantia virginiana</i>	✓										
80.	<i>Tragopogon pratensis</i>						✓					
81.	<i>Typha angustifolia</i>			✓								
82.	<i>Verbascum thapsus</i>											✓

Continued .....

## 9.2 Bulbous Plants

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1.	<i>Alstroemeria aurantiaca</i>					✓						
2.	<i>Amaryllis belladonna</i>						✓					
3.	<i>Anemone biflora</i>			✓								
4.	<i>Anemone x hybrida</i>	✓										
5.	<i>Begonia evansiana</i>					✓						
6.	<i>Begonia x semperflorens</i>					✓						
7.	<i>Begonia x tuberhybrida</i>						✓					
8.	<i>Belamcanda chinensis</i>						✓					
9.	<i>Canna indica</i>	✓										
10.	<i>Clivia miniata</i>				✓							
11.	<i>Colchicum luteum</i>	✓										
12.	<i>Crocsmia masoniorum</i>						✓					
13.	<i>Crocus chrysanthus</i>				✓							

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
14.	<i>Crocus sativus</i>											✓
15.	<i>Dahlia variabilis</i>						✓					
16.	<i>Eranthis hyemalis</i>	✓										
17.	<i>Eremurus himalaicus</i>				✓							
18.	<i>Fressia x hybrida</i>					✓						
19.	<i>Fritillaria imperialis</i>			✓								
20.	<i>Gagea elegans</i>	✓										
21.	<i>Galanthus nivalis</i>			✓								
22.	<i>Gladiolus byzanthus</i>					✓						
23.	<i>Gloriosa rothschildiana</i>									✓		
24.	<i>Hemerocallis flava</i>						✓					
25.	<i>Hippeastrum puniceum</i>						✓					
26.	<i>Hyacinthus orientalis</i>			✓								
27.	<i>Iris ensata</i>				✓							

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
28.	<i>Iris germanica</i>				✓							
29.	<i>Iris 'Gingerbread Man'</i>				✓							
30.	<i>Iris japonica</i>				✓							
31.	<i>Iris keshmeriana</i>				✓							
32.	<i>Iris reticulata</i>				✓							
33.	<i>Iris tectorum</i>				✓							
34.	<i>Iris unguicularis</i>			✓								
35.	<i>Ixiolirion karateginum</i>	✓										
36.	<i>Leucojum aestivum</i>	✓										
37.	<i>Lilium auratum</i>							✓				
38.	<i>Lilium candidum</i>						✓					
39.	<i>Lilium longiflorum</i>						✓					
40.	<i>Lycoris radiata</i>							✓				
41.	<i>Muscari armeniacum</i>			✓								

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
42.	<i>Narcissus pseudonarcissus</i>		✓									
43.	<i>Narcissus tazetta</i>			✓								
44.	<i>Nerine bowdenii</i>							✓				
45.	<i>Ornithogalum umbellatum</i>			✓								
46.	<i>Scilla bifolia</i>				✓							
47.	<i>Scilla siberica</i>					✓						
48.	<i>Sprekelia formosissima</i>						✓					
49.	<i>Sternbergia lutea</i>	✓										
50.	<i>Tulipa Clusiana</i>				✓							
51.	<i>Tulipa Lanata</i>				✓							
52.	<i>Zantedeschia aethiopica</i> Spreng						✓					
53.	<i>Zantedeschia elliottiana</i> Engler					✓						

Continued .....

### 9.3 Ground Covers

S. No.	Scientific name	Mid September	Late September	Early October	Mid October	Late October	Early March	Mid March	Late March	Early April	Mid April	Late April	Early May
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1.	<i>Ajuga reptans</i>			✓									
2.	<i>Aptenia cordifolia</i>	✓											
3.	<i>Aspidistra elatior</i>							✓					
4.	<i>Aubrieta deltoide</i>			✓									
5.	<i>Bellis perennis</i>			✓									
6.	<i>Bergenia ciliata</i>		✓										
7.	<i>Caltha palustris</i>						✓						
8.	<i>Cerastium tomentosum</i>									✓			
9.	<i>Colchicum luteum</i>	✓											
10.	<i>Convallaria majalis</i>			✓									
11.	<i>Eranthis hyemalis</i>	✓											
12.	<i>Geranium rectum</i>									✓			
13.	<i>Geranium wallichianum</i>								✓				

Continued .....

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
14.	<i>Hosta lancifolia</i>												✓
15.	<i>Hosta plantaginea</i>												✓
16.	<i>Leucojum aestivum</i>	✓											
17.	<i>Lycoris radiata</i>							✓					
18.	<i>Muscari armeniacum</i>			✓									
19.	<i>Nerine bowdenii</i>							✓					
20.	<i>Ornithogalum umbellatum</i>			✓									
21.	<i>Primula denticulata</i>	✓											
22.	<i>Primula rosea</i>	✓											
23.	<i>Primula vulgaris</i>									✓			
24.	<i>Santolina chamaecyparissus</i>											✓	
25.	<i>Saxifraga stolonifera</i>						✓						
26.	<i>Sedum spectabile</i>											✓	
27.	<i>Thymus serpyllum</i>								✓				
28.	<i>Tradescantia sillamontana</i>											✓	
29.	<i>Viola odorata</i>		✓										

*tuberhybridi*, *Hippeastrum puniceum*). Four species (*Lycoris radiata*, *Sprekelia formosissima*, *Lilium auratum*, *Nerine bowdenii*) can be planted in mid March. Two species of Crocus (*Crocus chrysanthus*, *C. sativus*) can be planted in early April. Two species (*Anemone* × *hybrida* and *Canna indica*) can be planted in mid April.

#### **4.9.3 Ground covers**

Out of twenty-nine ground cover species, six species (*Colchicum luteum*, *Eranthis hyemalis*, *Leucojum aestivum*) can be planted in mid September two species (*Bergenia ciliata*, *Viola odorata* in late September. Six species can be planted in early October. *Caltha palustris* and *Saxifraga stonilfera* can be planted in early March. *Astpidistra elatior*, *Lycoris radiata* and *Nerine bowdenii* can be planted in mid march whereas *Geranium wallichianum* and *Thymus serpyllum* can be planted in late March. In early April *Cerastium tomentosum*, *Geranium rectum* and *Primula vulgaris* can be planted. Three species namely *Sedum spectabile*, *Santolina chamaecyparissus* and *Tradescantia sillamontana* can be planted in late April whereas *Hosta lancifolia*, *H. plantaginea* can be planted in early May.

## **CHAPTER – 5**

### **DISCUSSION**

Plants are the major elements used in landscape design. Their constantly changing form enhances a design concept in a number of ways. They contribute not only to the visual quality of man's environment but also to the physical quality, and have relevant design features such as form, colour and texture that can be used by designers to generate the character of a landscape. They provide contrast of colour, texture and form in a built environment, introducing the shapes, colours and feelings for nature into man-made geometric patterns of roads and buildings.

The horticulture notes incorporating habit, habitat, shape, size, texture, fragrance, flower colour, leaf, and fruit characters of landscape value and use are pre-requisite for preparing landscape planting plan (Nambison, 1992).

Despite the attempts of several plants explorers, who visited the valley for botanizing it, know fruitful record of its vegetation has been presented for landscape use. In view of it and also to place before the professionals, zone-wise species wealth of this temperate bowl, the present study was undertaken to survey and identify the native and exotic

ornamental plant species and to evaluate the distinguishing characteristics of the available plant material for landscaping. The salient features of the investigation are described here under.

### **5.1 Habit, habitat and mode of propagation**

Shapes in herbaceous perennial species vary considerably from the erect shaped (*Aquilegia canadensis*) to mound forming (*Achillea millifolium*) to the spreading forms of (*Dianthus barbatus*) and clump forming (*Helleborus niger*) to climbing habit of (*Lathyrus latifolius*) and rosette forming habit of (*Primula rosea*). During the present investigation, the shapes of various herbaceous perennials were recorded and one can pick a particular shape to suit a specific location or one can group together herbaceous perennials with different shapes to make a group with an interesting varied outline. Similarly among bulbous plant species it was observed that the shape was erect in *Alstroemeria aurantiaca*, *Canna indica*, *Gladiolus byzanthus* and Iris species; mound forming in *Anemone biflora*, *Galanthus nivalis*; clump forming in *Belamcanda chinensis*, *Eremurus himalaicus*; mat forming in crocus species; stemless in *Clivia miniata*. Spreading in *Ornithogalum umbellatum* and climbing in *Gloriosa rothschildiana*.

In ground covers, creeping shape was observed in *Ajuga reptans*; mound forming in *Aptenia cordifolia*, *Bellis perennis* and *Convallaria majalis*; erect in *Colchicum luteum*; spreading in *Geranium rectum*, *G.wallichianum*; clump forming in *Hosta plantaginea*; Arching in *Hosta lancifolia*. Mat forming in *Cerastium tomentosum* and rosette in *Primula* species. The studies get support from the findings of Brickell (1996).

The rate of growth also varies from species to species. The relation between ultimate size and rate of growth emphasizes the distinctive character of plants as living and obviously changing material. The rate of change and development of most plants and their flexibility in adjusting to their habitat, make it necessary to project and visualize three-dimensional arrangements ahead. This means that the use of the land should be planned ahead as far as possible, in order to avoid major rearrangement. During the present studies the observation revealed that herbaceous perennials like *Aconitum heterophyllum*, *Arundo donax*, *Centaurea montana*, *Campanula montana*, *Delphinium elatum* and *Nepeta nervosa* were found to have medium growth rate. *Alcea rosea*, *Aster alpinus*, *Cheiranthus cheiri*, *Digitalis lanata*, *Lupinus polyhyllus* had rapid growth rate where as *Hesperis matronlis*, *Tragopogon pretense* and *Verbascum thapsus* were observed to have slow growth rate (Table 2.1). Among bulbous plants

*Amaryllis belladonna*, *Anemone* × *hybrida*, *Eremurus himalaicus* and *Galanthus nivalis* had medium growth rate. *Crocasmia masoniorum*, *Gladiolus byzanthus*, *Hemerocallis flava*, *Narcissus tazetta* had rapid growth rate. In case of ground covers *Bergenia ciliata*, *Colchicum luteum* were observed to have slow growth rate. *Caltha palustris*, *Lycoris radiata* had medium growth rate whereas *Leucojum aestivum*, *Muscari armeniacum* were found to have rapid growth rate.

As regard, habitat preference *Agapanthus praecox*, *Achillea filipendulina*, *Centaurea montana*, *Caltha palustris*, *Coreopsis grandiflora*, *Cynara cardunculus* prefer full sun. *Digitalis lanata*, *Gerbera jamesonii*, *Lupinus polyphyllus*, *Paeonia emodi* prefer semi shade. *Primula rosea*, *P. vulgaris*, *Phlox Paniculata*, *Rudbeckia fulgida* grows well in full sun/semi shade. Among bulbous plants *Alstroemeria aurantiaca*, *Begonia* × *semperflorens*, *Belamcanda chinensis*, *Crocus chrysanthus* prefer full sun. *Clivia miniata*, *Galanthus nivalis*, *Lilium candidum*, *L. longiflorum* prefer semishade where as *Crocasmia masoniorum*, *Hippeastrum puniceum*, *Hyacinthus orientalis* prefer full sun/semi shade.

In case of ground covers *Aubrieta deltoide*, *Colchicum luteum*, *Cerastium tomentosum* prefer full sun. *Ajuga reptans*, *Bellis perennis*,

*Geranium rectum*, *Hosta plantaginea*, *H. lancifolia* prefer semi-shade  
*Tradescantia sillamontana*, *Viola odorata* prefer full sun/semishade.

The shapes of different herbaceous perennials/ bulbous plants/ground covers were recorded and is presented in (Tables 2.1 to 2.3). From the list one can pick a specific shape for a particular location. Similarly the nature of growth (slow/fast) rate of all the species under study has been recorded which will help the landscape designers in proper selection of planting materials.

Regarding mode of propagation it is evident that majority of the plants are propagated through seeds and division 30.48 per cent, followed by seed/cutting/division 27.43 per cent, seed/ bulb 12.19 per cent, seed 6.70 per cent, seed/cutting 6.09 per cent and through seed/division/bulb 3.65, seed/division/rhizomes 3.04 per cent and 1.21 per cent through cutting/division and 1.21 per cent through seed/sucker, 0.60 each through bulb, seed/cutting/grafting, seed/corm, spores, seed/division/sucker, seed/cutting/division/bulb. The results get support from the work of various workers (Brickell, 1996; Hartmann *et al.*, 1993).

## **5.2 Mature height and spread**

The herbaceous perennial plants are available in various sizes and can be put to various landscape uses. When selecting herbaceous perennial,

bulbous plants and ground covers it is important to consider their ultimate size as it varies with the kind, soil aspect, nearness to other plant, local weather condition, the purpose and the need for quick results.

The studies revealed that ten herbaceous perennial species (12.19%) were having mature height up to 30 cm, twenty-six species (31.7%) between 31 to 60 cm, twenty species (24.40%) between 61 to 90 cm and twenty six species (31.70%) recorded mature height greater than 90 cm (Table-3.1). Twenty three herbaceous perennial species (28%) at maturity recorded spread up to 30 cm, twenty-eight (34.14%) showed between 31 to 45 cm, eighteen species (22%) between 46 to 75 cm and thirteen species (15.86%) depicted mature spread greater than 75 cm (Table 3.1).

Twenty bulbous plant species(37.74%) were having mature height up to 30 cm, sixteen species (30.18%) between 31 to 60 cm, six species (11.33%) between 61 to 90 cm and eleven species (20.75%) recorded mature height greater than 90 cm. Further perusal of Table 3.2 revealed that thirty-four bulbous species (64.15%) were having mature spread up to 15 cm, thirteen species (24.53%) recorded spread at maturity between 16 to 30 cm and six species (11.32%) were having mature spread greater than 30 cm.

Data presented in Table 3.3 revealed that eight ground cover species (27.59%) were having up to 30 cm height, ten species (34.48%) between 16

to 30 cm and eleven species (37.93%) greater than 30 cm. Among 29 ground covers eleven species (37.93%) were having mature spread up to 15 cm, three species (10.34%) between 16 to 30 cm and fifteen species (51.73%) greater than 30 cm. These results are in conformity to the authentic taxonomic descriptions given by various workers (Hooker,1872; Bailey 1949; Brickell, 1996).

### **5.3 Peculiarities of foliage**

The predominant foliage colour is green in nature. The green is a cool, soothing colour. However, the intensity of green colour is not uniform in all plants. This runs from grey, silver grey through grey green, light, mid to dark green to various purple and red shades. The unusual looking coloured foliage plants certainly have their uses in landscaping. During the present studies the most striking plants from foliage point of view recorded were of *Aquilegia Canadensis* (bluish green), *Begonia* × *tuberhybrida* (reddish green), *Cynara cardunculus*, *Senecio cineraria* (silvery grey), *Digitalis purpurea* (grey green), *Cerastium tomentosum*, *Santolina chamaecyparissus* (greyish white) *Begonia evansiana* (Dark green with reddish beneath) and in many other plants (Table 4.1 to 4.3).

Some plants bear different textured foliage (distinctive qualities) and are grown mainly for providing nearness and distance to the landscape. The

foliage of *Aquilegia canadensis*, *Agapanthus praecox*, *Coreopsis lanceolata*, *Gagea elegans*, *Lythrum salicaria*, *Alstroemeria aurantiaca*, *Belamcanda chinensis*, *Fritillaria imperialis*, *Sternbergia lutea*, *Bellis perennis*, *Convallaria majalis* were described as smooth textured. *Aconitum napellus*, *Digitalis lanata*, *Delphinium elatum*, *Hedychium gardenerianum*, *Matthiola incana*, *Sisyrinchium striatum*, *Dahlia variables*, *Ajuga reptans*, *Geranium rectum* had a pubescent texture. *Campanula medium*, *C. latifolia*, *Hesperis matronalis*, *Liatris spicata*, *Physalis alkekengi*, *Solidago canadensis*, *Stachys byzantina*, *Crocasmia masoniorum*, *Iris unguicularis*, *Eranthis hyemalis*, *Muscari armeniacum* had rough texture. *Dianthus caryophyllus*, *Dianthus chinensis*, *Mimulus nepalensis*, *Mirabilis Jalapa*, *Phlox Paniculata*, *Verbascum thapsus*, *Ornithogalum umbellatum*, *Santolina chamaecyparissus*, *Thymus serphyllum* had soft texture. *Gerbera jamesonii*, *Digitalis purpurea*, *Centaurea montana*, *Cerastium tomentosum* has tomentose foliage. *Aster alpinus*, *Adiantum capillus-Veneris*, *Limonium latifolium*, *Inula royleana*, *Nymphae stellata*, *Begonia evansiana*, *Iris japonica*, *Leucojum aestivum* are valued for their glossy texture.

#### **5.4 Phenology**

Phenology was recorded in 152 species. Perusal of Table 5.1 revealed that out of eighty-one herbaceous perennial species under study

none of the species bloomed in January and February during both the years. About 5 per cent of the species bloomed in March. The species like *Primula denticulata* remained presentable for 49.5 days. During the month of April 17 per cent of the species bloomed. Species like *Paeonia emodi* remained presentable for 36.5 days. Further perusal of Table 5.1 revealed that 24 percent species bloomed in May, 26 per cent in June, 22 per cent in July. About 6 per cent of the species bloomed in August. None of the herbaceous perennial species bloomed in September, October, November and December at the sites under study.

Out of fifty-three bulbous plant species, on an average 3.77 per cent of the species under discussion bloomed in January; 13.20 per cent in February; 18.86 per cent in March; 30 per cent in April; 7.54 per cent in May; 18.86 per cent in June; 2 per cent in July; 3.77 per cent in August and 2 per cent in October. None of the species bloomed in September, November and December at the sites under study (Table 5.2).

Studies on phenology of ground cover species revealed that 3.44 per cent of the species bloomed in the month of January. Out of the species under discussion 6.89 per cent bloomed in February; 17.24 per cent in March; 20.68 per cent in April; 13.80 per cent in May; 13.80 per cent in June; 10.34 per cent in July; 6.90 per cent in August; 6.90 per cent in

September. None of the ground cover species bloomed in the month of October, November and December.

### **5.5 Peculiarities of flower**

Out of 152 species under study, thirty four species were having solitary inflorescence; thirty three species were having raceme inflorescence; seventeen species were having spike inflorescence; fourteen species were having cyme inflorescence; fourteen species were having flower head type of inflorescence. Further perusal of table depicts that eleven species were having panicle inflorescence; eleven species umbel; eight species corymb; eight species cluster; two species spathe and one specie peduncled head (Table 6.1 to 6.3). Star shaped flowers were produced by twenty three species; bell shaped flowers by seventeen species; cup shaped by fifteen species; funnel shaped by fifteen species; saucer shaped by thirteen species; trumpet shaped by eleven species; tubular shaped by ten species; daisy like by ten species; slipper shaped by ten species; cross shaped by eight species; rosette shaped by five species; pompon by four species; pea shaped by three species; goblet shaped by three species; helmet shaped by two species; rod shaped by two species and Bowl shaped by one specie.

Colour is an important component in landscape design. A plant in full bloom is an awe inspiring sight as they change the colour of entire landscaping. During the present studies the flower colour of herbaceous perennials, bulbous plants and groundcovers under study were recorded in Table 6.1 to 6.3. The most suitable species for landscaping bearing white flowers were *Achillea ptarmica*, *Asparagus officinalis*, *Gypsophila paniculata*, *Paeonia emodi*, *P. lactiflora*, *Lilium candidum*, *L. longiflorum*, *Zantedeschia aethiopica*, *Convallaria majalis*, *Ornithogalum umbellatum*. Similarly prominent red flowers were recorded in *Penstemon barbatus*, *Rheum australe*, *Kniphofia uvaria*, *Canna indica*, *Lycoris radiata*, *Aubrieta deltoide*, *Aptenia cordifolia*. Violet flowers by *Campanula latifolia*, *Iris reticulata*, *Aquilegia vulgaris*. Yellow flowers by *Zantedeschia elliottiana*, *Santolina chamaecyparissus*. Pink flowers by *Achillea millefolium*, *Dianthus barbatus* and *Amaryllis belladonna*.

## **5.6 Fragrance**

Fragrance is associated with religious and spiritual life of man from the dawn of civilization. Sweet fragrance makes the environment solaceous and pervades the whole atmosphere. In the cool of a summer's evening which after all, is the most pleasant time for relaxation in the garden, this wonderful sweet fragrance happily enriches the mellowing dusk for many

meters around. It may give much pleasure even to blind people who happen to visit fragrant garden. The addition of fragrance to the other natural attributes of a plant-add to its charm and increase its value as a garden plant. The decorative quality of flowers is of no consequence to blind people but highly scented character of the plant is of great value to them.

Perusal of Table 6.1 to 6.3 revealed that out of one hundred and fifty three species under study, twenty three species were observed to have fragrant flowers. However, the most sweetly scented flowers were recorded in *Achillea millifolium*, *Dianthus barbatus*, *D. caryophyllus*, *Hedychium gardnerianum*, *Lavendula angustifolia*, *Matthiola incana*, *Nelumbo nucifera*, *Oenothera biennis*, *Paeonia emodi*, *P. lactiflora*, *Amaryllis belladonna*, *Freesia × hybrida*, *Iris reticulate*, *Lilium longiflorum*, *Hosta plantaginea*.

### **5.7 Peculiarities of fruit**

Some plants bear colourful ornamental fruits and these are grown mainly for providing colour to the landscape. On the basis of present studies the most suitable species with ornamental fruits recorded were *Cynara cardunculus*, *Eryngium biebersteinianum*, *Lavendula angustifolia*, *Matthiola incana*, *Nelumbo nucifera*, *Nymphae stellata*, *Lunaria annua*, *Typha angustifolia*. The results are in close conformity with (Coventry, 1923; Baltter, 1984).

## 5.8 Landscape Use

Beds are highly decorative as well as useful. Plants suitable for beds should be attractive with attractive foliage, flowers/fragrance and fruits. On the basis of present studies species like *Aquilegia canadensis*, *A. vulgaris*, *Aster alpinus*, *Chrysanthemum leucanthemum*, *Dianthus barbatus*, *Helenium autumnale*, *Anemone biflora*, *Begonia evansiana*, *Dahlia variables*, *Gloriosa rothschildiana* are suitable for beds.

To plant along the borders, species like *Aconitum napellus*, *Agapanthus praecox*, *Achillea ptarmica*, *Alcea rosea*, *Cynara cardunculus*, *Gyphosphila paniculata*, *Lythrum salicaria*, *Mirablis jalapa*, *Primula rosea*, *P. denticulata*, *Sisyrinchium striatum*, *Tradescantia virginiana*, *Alstroemeria aurantiaca*, *Belamcanda chinensis*, *Clivia miniata*, *Galanthus nivalis*, *Hippeastrum puniceum*, *Scilla siberica*, *S. bifolia*, *Sternbergia lutea* were found suitable for this purpose.

Woodland Garden is a place where non indigenous shrubs are grown with underplanting of shade loving herbaceous plants and bulbs and often with artificially created open glades. Species suitable for this purpose were found to be *Aquilegia vulgaris*, *Aconitum heterophyllum*, *Campunula medium*, *Digiatalis purpurea*, *Gagea elegans*, *Inula royleana*, *Salvia sclarea*, *Fritillaria imperialis*, *Galanthus nivalis*, *Narcissus pseudonarcissus*, *N.tazetta*, *Tulipa clusiana*, *T. lanata*.

Species that were found suitable to blend with the features of a rock garden are *Achillea filipendulina*, *A. ptarmica*, *Adiantum capillus-veneris*, *Delphinium elatum*, *Senecio cineraria*, *Belamcanda chinensis*, *Crocus chrysanthus*, *C. sativus*, *Iris ensata*, *I. germanica*, *I. japonica*, *Lycoris radiata*.

An attractive plant that can compliment the beauty of another plant can be used as a companion plant. Species like *Paeonia emodi*, *P. lactiflora* were found suitable for this purpose. An attractive or interesting plant of distinctive habit is ideal for planting as specimens in lawns. On the basis of present studies species like *Arundo donax*, *Dahlia variables*, *Agapanthus praecox*, *Cynara cardunculus*, *Digitalis lanata*, *D. purpurea* are suitable specimen plants for their attractive shapes and wonderful display of foliage and blossom.

Species like *Aquilegia canadensis*, *A. vulgaris*, *Alcea rosea*, *Digitalis purpurea* can be used as a backdrop in a garden. A pool with water loving plants in it can add to the natural beauty of a garden. Species suitable for pool situations are *Arundo donax*, *Adiantum capillus Veneris*, *Caltha palustris*, *Lythrum salicaria*, *Nelumbo nucifera*, *Nymphae stellata* and *typha angustifolia*. Flowering pots add charm and beauty to landscape design. Species like *Iris japonica* and *I. reticulata* were found suitable for this purpose. The result are supported by the findings of Spooner (1973),

Sehgal and Bhat (1978), Jindal (1986), Reiley and Shry (1991), Chaurasia *et al.* (2006), John *et al.* (2007).

## **5.9 Ground covers in the landscape**

Ground covers are low-growing plants that play an important role in landscaping because they can be used in areas where the soil is not suitable for growing grasses. These areas may be too steep, rocky, shady, and shallow soiled or eroded. Any single ground cover planting of uniform height when grown in the same exposure, can be a means of emphasizing land contours.

If the land is level, the cover will have the tranquil quality of a lake surface and if the land has pleasant undulations these will be dramatized by the light growing ground covers such as *Viola odorata*. Most significantly, ground covers define shapes of open areas in the garden. For a landscape architect ground covers and other plants are the tools to use in reaching design objectives. Selecting the most appropriate ground cover is as exacting a challenge. One must be aware not only of the merits of each plant, but also sensitive to their aesthetic relationship to each other. In addition to the beauty, ground covers can accomplish several useful functions in the landscape. Among the most important are soil stabilization and low maintenance. Ground covers can serve as a unifying element in a landscape design. In a lightly shaded area, *Bergenia ciliate*, *Eranthis*

*hyemalis*, *Muscari armeniacum*, *Thymus serpyllum* were observed the good choices. For a sunny bank *Bellis perennis*, *Cerastium tomentosum* and *Santolina chamaecyparissus* were the best specimens. For planting in an area with continuous shade on the north side of the building, *Hosta lancifolia*, *H. plantaginea* and *Viola odorata* were recorded as the best. These findings get support from Hay and Beckett (1971), Koller *et al.* (1978).

### **5.10 Time of planting**

To decide when to plant perennials, one have to follow a general guideline. In spring those perennials should be planted that flower in summer or autumn. Perennials that flower in spring should be planted in early autumn. As a general rule planting should be avoided during the heat of summer or, in cold winter which can prove fatal for the plants. Out of eighty two herbaceous perennials evaluated for their time of planting.

It was observed that eleven species (13.41%) can be planted in mid September; eight species (9.75) in late September; thirteen species (15.85%) in early October; five species (6.09%) in mid October; two species (2.43%) in late October. Further perusal of Table 9.1 depicts that fifteen species (18.29%) can be planted in early March; six species (7.31%) in mid March. In early April nine species (10.97%) can be planted, with six species (7.31%) in mid April and seven species (8.53%) in late April.

The perusal of Table 9.2 depicts that out of 53 bulbous plants under study eight species (15.09%) can be planted in mid September; one species (1.88%) in late September; six species (11.32%) in early October; thirteen species (24.52%) in mid October; seven species (13.20%) in late October; ten species (18.86%) in early March; four species (7.54%) in mid March; two species (3.77%) in early April and two species (3.77%) can be planted in mid April.

Out of twenty nine ground covers six species (20.68%) can be planted in mid September; two species (6.89%) in late September; six species (20.68%) in early October; two species (6.89%) in early March; three species (10.34%) in mid March; two species (6.89%) in late March; three species (10.34%) in early April; three species (10.34%) in late April and two species (6.89%) can be planted in early May.

## CHAPTER – 6

### SUMMARY AND CONCLUSION

The investigation entitled “Studies on herbaceous perennials of Kashmir valley for landscape use” was conducted during 2006-09 at four locations of valley with a view to identify and group the herbaceous perennials for various landscape uses. For this purpose different sites surveyed during the study included Sheikhbagh, Sonawar, Gupkar, Shankeracharry, Hills, Cheshmashahi, Zaberwan Hills, Nishat, Shalimar, Telbal, Naseembagh, Hazratbal, Dachigam, Thajwas, Sonamarg, Tangmarg, Baba Reshi, Gulmarg, Wangan, Sagan and Kokernag.

Various characteristics features of the herbaceous perennials viz. shape, habitat, ultimate size, texture, colour of foliage, flowers, bloom period and fragrance were recorded during the study. The salient features of the study are summarized here under:

- The study revealed number of ornamentals viz., herbaceous perennials (82), Bulbous plants (53) and ground covers (29) growing satisfactorily in this environment.
- The herbaceous perennial shapes varied considerably from the erect (*Aquilegia canadensis*); mound forming (*Anemone biflora*); spreading (*Dianthus barbatus*); clump forming (*Belamcanda*

*chinensis*); mat forming (*Crocus chrysanthus*); creeping (*Ajuga reptans*); arching (*Hosta lancifolia*); rosette (*Primula rosea*) to climbing ones (*Lathrus latifolius*). One can select a particular shape to suite a specific location or group together plants with different shapes to make an interesting varied outline.

- As regards habit preference 88 species were observed to prefer full sun; 49 species full sun/semi shade and 27 species shady locations.
- Among 82 herbaceous perennial species 10 species were having ultimate height up to 30 cm; 26 species between 31-60 cm; 20 species between 61-90 cm and 26 species > 90cm.
- Among 53 bulbous plant species 20 species were having height up to 30 cm; 16 species between 31-60; 6 species between 61-90 cm and 11 species > 90cm.
- Among 29 ground covers 8 species were having height upto 15 cm; 10 species between 16-30 cm and 11 species > 30cm.
- As regards ultimate spread of the herbaceous perennials, 23 species were having spread upto 30 cm; 28 species between 31-45 cm; 18 species between 46-75cm and 13 species >75cm.
- Out of 53 bulbous plants, 34 species were having spread upto 15 cm; 3 species between 16-30 cm and 6 species >30cm.

- Among 29 ground covers, 11 species were having spread upto 15cm; 3 species between 16-30 cm and 15 species >30cm.
- The interesting foliage colour variations were recorded ranging from grey, silver grey, grey green, light, mid to dark green to various purple and red shades. The interesting variations were also recorded in the foliage texture which vary from smooth to pubescent to rough to soft to glossy texture.
- The studies on phenology of flowering revealed that large number of ornamentals flowered in the month of April (67.78%) followed by June (57.80%); May (45.34%); March (41.24%); July (34.34%); February (20.09%); August (16.67%); January (7.21%); September (6.90%), October (2%). The emergence of flowering was recorded in none of the species during the months of November and December. However the blooming observed during these months was from the species which bloomed in the preceding months.
- As regards flower colour the species were classified into 14 groups viz., yellow (33 species), pink (27 species), white (29 species), purple (20 species), orange (15 species), blue (18 species), red (13 species), violet (6 species), creamy-off white (5 species), lavender (2 species), lilac (1 species), mauve (1 specie), brown (2 specie) lavender (2 specie), magenta (1 specie) and liliac (1 specie).

- Sweet fragrance makes the environment solaceous and prevails in the whole atmosphere. During the present studies the fragrance was observed in 44 species respectively. The most sweetly scented flowers were recorded in *Achillea millefolium*, *Dianthus barbatus*, *D. caryophyllus*, *Hadychium gardner anum*, *Lavendula angustifolia*, *Matthiola incana*, *Nelumbo nucifera*, *Oenothera biennis*, *Paeonia emodi*, *P. lactiflora*, *Amaryllis belladonna*, *Fressia × hybrida*, *Iris reticulate*, *Lilium candidum*, *L. longiflorum* and *Hosta plantaginea*.
- Regarding mode of propagation it is evident that majority of the plants are propagated through seeds and division 30.48 per cent, followed by seed/cutting/division 27.43 per cent, seed/bulb 12.19 per cent, seed 6.70 per cent, seed/cutting 6.09 per cent and 4.26 per cent through seed/division/bulb, 3.65 per cent through division. Seed/division/rhizomes 3.04 and 1.21 per cent through cutting/division and 1.21 per cent through seed/sucker, 0.60 each through bulb, seed/cutting/grafting, seed/corm, spores, seed/division/sucker, seed/ cutting/division/bulb.
- Based on the morphological, phenological and landscape features worked out during the present study, 120 plants are recommended for borders, 81 for beds, 79 for rock gardens, 51 for woodlands, 10

for pools, 6 for specimen plant, 7 for pots, 4 for backdrop, 2 for companion plants, 4 for pathways, 13 for sunny areas, 7 for lightly shaded areas.

- The studies on planting time revealed that large number of ornamentals were planted in early March (16.46%) followed by mid September and early October (15.24%) each; mid October (11%); early April (8.53%); late September (6.70%); late April (6.06%); mid March (8%); late October (5.48%); mid April (4.87); early May and late March (1.21%) each.

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## LIST OF TAXA STUDIED

### Medium to tall growing herbaceous perennials

<i>Achillea filipendulina</i>	<i>Digitalis purpurea</i>	<i>Nepeta nervosa</i>
<i>Achillea millefolium</i>	<i>Echinacea purpurea</i>	<i>Nymphae stellata</i>
<i>Achillea ptarmica</i>	<i>Eryngium biebersteinianum</i>	<i>Oenothera biennis</i>
<i>Aconitum heterophyllum</i>	<i>Euphorbia stracheyi</i>	<i>Paeonia emodi</i>
<i>Aconitum napellus</i>	<i>Gazania niveae</i>	<i>Paeonia lactiflora</i>
<i>Adiantum-capillus Veneris</i>	<i>Gazania x splendens</i>	<i>Papaver orientale</i>
<i>Agapanthus africanus</i>	<i>Gerbera jamesonii</i>	<i>Penstemon barbatus</i>
<i>Alcea rosea</i>	<i>Gypsophila paniculata</i>	<i>Phlox paniculata</i>
<i>Aquilegia canadensis</i>	<i>Hedychium gardnerianum</i>	<i>Physalis alkekengi</i>
<i>Aquilegia vulgaris</i>	<i>Helenium autumnale</i>	<i>Platycodon grandiflorum</i>
<i>Arundo donax</i>	<i>Helianthus autumnale</i>	<i>Primula denticulata</i>
<i>Asparagus officinalis</i>	<i>Helianthus x multiflorus</i>	<i>Primula rosea</i>
<i>Aster alpinus</i>	<i>Helleborus niger</i>	<i>Primula vulgaris</i>
<i>Caltha palustris</i>	<i>Hesperis matronalis</i>	<i>Ranunculus falcatus</i>
<i>Campanula latifolia</i>	<i>Inula royleana</i>	<i>Rheum australe</i>
<i>Campanula medium</i>	<i>Kalanchoe blossfeldiana</i>	<i>Rudbeckia fulgida</i>
<i>Centaurea montana</i>	<i>Kniphofia uvaria</i>	<i>Rudbeckia laciniata</i>
<i>Cheiranthus cheiri</i>	<i>Lathyrus latifolius</i>	<i>Salvia sclarea</i>
<i>Chrysanthemum leucanthemum</i>	<i>Lavendula angustifolia</i>	<i>Senecio cineraria</i>
<i>Coreopsis grandiflora</i>	<i>Liatris spicata</i>	<i>Sisyrinchium striatum</i>
<i>Coreopsis lanceolata</i>	<i>Limonium latifolium</i>	<i>Solidago canadensis</i>
<i>Cynara cardunculus</i>	<i>Lunaria annua</i>	<i>Stachys byzantina</i>
<i>Delphinium elatum</i>	<i>Lupinus polyphyllus</i>	<i>Tradescantia virginiana</i>
<i>Dendranthema x grandiflorum</i>	<i>Lythrum salicaria</i>	<i>Tragopogon pratensis</i>
<i>Dianthus barbatus</i>	<i>Matthiola incana</i>	<i>Typha angustifolia</i>
<i>Dianthus caryophyllus</i>	<i>Mimulus nepalensis</i>	<i>Verbascum thapsus</i>
<i>Dianthus chinensis</i>	<i>Mirabilis jalapa</i>	
<i>Digitalis lanata</i>	<i>Nelumbo nucifera</i>	

Contd...

## Bulbous plants

<i>Alstroemeria aurantiaca</i>	<i>Fritillaria imperialis</i>	<i>Lilium auratum</i>
<i>Amaryllis belladonna</i>	<i>Gagea elegans</i>	<i>Lilium candidum</i>
<i>Anemone biflora</i>	<i>Galanthus nivalis</i>	<i>Lilium longiflorum</i>
<i>Anemone x hybrida</i>	<i>Gladiolus byzanthus</i>	<i>Lycoris radiata</i>
<i>Begonia evansiana</i>	<i>Gloriosa rothschildiana</i>	<i>Muscari armeniacum</i>
<i>Begonia x semperflorens</i>	<i>Hemerocallis flava</i>	<i>Narcissus pseudonarcissus</i>
<i>Begonia x tuberhybrida</i>	<i>Hippeastrum puniceum</i>	<i>Narcissus tazetta</i>
<i>Belamcanda chinensis</i>	<i>Hyacinthus orientalis</i>	<i>Nerine bowdenii</i>
<i>Canna indica</i>	<i>Iris ensata</i>	<i>Ornithogalum umbellatum</i>
<i>Clivia miniata</i>	<i>Iris germanica</i>	<i>Scilla bifolia</i>
<i>Colchicum luteum</i>	<i>Iris 'Gingerbread Man'</i>	<i>Scilla siberica</i>
<i>Crocsmia masoniorum</i>	<i>Iris japonica</i>	<i>Sprekelia formosissima</i>
<i>Crocus chrysanthus</i>	<i>Iris kashmeriana</i>	<i>Sternbergia lutea</i>
<i>Crocus sativus</i>	<i>Iris reticulata</i>	<i>Tulipa Clusiana</i>
<i>Dahlia variabilis</i>	<i>Iris tectorum</i>	<i>Tulipa lanata</i>
<i>Eranthis hyemalis</i>	<i>Iris unguicularis</i>	<i>Zantedeschia aethiopica</i>
<i>Eremurus himalaicus</i>	<i>Ixiolirion karateginum</i>	<i>Zantedeschia elliottiana</i>
<i>Fressia x hybrida</i>	<i>Leucojum aestivum</i>	

Contd...

**Ground covers (low growing herbaceous perennials)**

<i>Ajuga reptans</i>	<i>Eranthis hyemalis</i>	<i>Primula denticulata</i>
<i>Aptenia cordifolia</i>	<i>Geranium rectum</i>	<i>Primula rasea</i>
<i>Aspidistra elatior</i>	<i>Geranium wallichianum</i>	<i>Primula vulgaris</i>
<i>Aubrieta deltoide</i>	<i>Hosta lancifolia</i>	<i>Santolina chamaecyparissus</i>
<i>Bellis perennis</i>	<i>Hosta plantaginea</i>	<i>Saxifraga stonilfera</i>
<i>Bergenia ciliata</i>	<i>Leucojum aestivum</i>	<i>Sedum spectabile Boreau</i>
<i>Caltha palustris</i>	<i>Lycoris radiata</i>	<i>Thymus serpyllum</i>
<i>Cerastium tomentosum</i>	<i>Muscari armeniacum</i>	<i>Tradescantia sillamontana</i>
<i>Colchicum luteum</i>	<i>Nerine bowdenii</i>	<i>Viola odorata</i>
<i>Convallaria majalis</i>	<i>Ornithogalum umbellatun</i>	

## LIST OF FLOWER COLOUR RECORDED AS PER RHS COLOUR CHART

Name of Species	Colour
<i>Achillea filipndulina</i>	Canary yellow-2
<i>Achillea millifolium</i>	Naples yellow-403/3
<i>Achillea ptarmica</i>	Pure white
<i>Aconitum heterophyllum</i>	Violet-36
<i>Aconitum napellus</i>	Pansy violet-003/2
<i>Adiantum capillus veneris</i>	*
<i>Agapanthus africanus</i>	White and Wisteria blue-640
<i>Ajuga reptans</i>	Mallow Purple-630/2
<i>Alcea rosea</i>	Fuchsia Purple 28/3
<i>Alstroemeria aurantiaca</i>	Fuchsine Pink-627/2
<i>Amaryllis belladonna</i>	Persian Rose-628/2
<i>Anemone biflora</i>	White + Magenta 27/3
<i>Anemone × hybrida</i>	Pure white
<i>Aptenia cordifolia</i>	Rose Bengal-25
<i>Aquilegia Canadensis</i>	Mimosa Yellow 602/3 and Garnet Brown 00918/1
<i>Aquilegia vulgaris</i>	Aconite Violet-937/2
<i>Arundo donax</i>	*
<i>Asparagus officinalis</i>	*
<i>Aspidistra elatior</i>	*
<i>Aster alpinus</i>	Sea Lavender Violet- 637/1
<i>Aubrieta deltoide</i>	Cyclamen Purple-30/2
<i>Begonia evansiana</i>	Magenta-27/3
<i>Begonia × semperflorens</i>	Blood Red 802/7
<i>Begonia × tuberhybrida</i>	Magenta 27/2
<i>Belamcanda chinensis</i>	Mandarin Red-17 Spots of Cadmium Orange-8/2 base
<i>Bellis perennis</i>	Rose Madder-23/3 and Fuchsia Purple-28/1
<i>Bergenia ciliata</i>	White + Magenta- 27/2
<i>Caltha palustris</i>	Aureolin-3/1
<i>Campanula latifolia</i>	Veronica Violet-639/1
<i>Campanula medium</i>	Mineral Violet-635
<i>Canna indica</i>	Vermilion-18
<i>Centaurea montana</i>	Phlox Purple-032/1

<i>Cerastium tomentosum</i>	Pure white
<i>Cheiranthus cheiri</i>	Mineral Violet-635/1
<i>Chrysanthemum leucanthemum</i>	Pure white
<i>Clivia miniata</i>	Nasturtium Red-14/1
<i>Colchium luteum</i>	Buttercup Yellow-5
<i>Convallaria majalis</i>	Pure white
<i>Coreopsis grandiflora</i>	Lemon Yellow-4
<i>Coreopsis lanceolata</i>	Capsicum Red-715/2 with straw Yellow tips-604
<i>Crococsmia masoniorum</i>	Delft Rose-020/1
<i>Crocus chrysanthus</i>	Buttercup Yellow-5
<i>Crocus sativus</i>	Campanula Violet-37/1
<i>Cynara cardunculus</i>	Blue bird blue-042/1
<i>Dahlia variabilis</i>	-
<i>Delphinium elatum</i>	Cornflower Blue-742/2
<i>Dendranthema × grandiflorum</i>	-
<i>Dianthus barbatus</i>	Persian Rose-628/2
<i>Dianthus caryophyllus</i>	Dianthus Purple-730/1
<i>Dianthus chinensis</i>	Dianthus Purple-730/2
<i>Digitilis lanata</i>	Pale Cream
<i>Digitilis purpurea</i>	Mallow Purple-630
<i>Echinacea purpurea</i>	Roseine Purple-629/1
<i>Eranthis hyemalis</i>	Lemon Yellow-4/1
<i>Eremurus himalaicus</i>	Canary Yellow-2/3
<i>Eryngium Biebersteinianum</i>	Greyish Green
<i>Euphorvia stracheyi</i>	*
<i>Fressia × hybrida</i>	-
<i>Fritillaria imperialis</i>	Orpiment Orange10/1
<i>Gagea elegans</i>	Sulphur Yellow-1/3
<i>Galanthus nivalis</i>	Pure White with Inner Tepals Nickel Green tipped-57
<i>Gazania nivea</i>	Auroelin-3
<i>Gazania × splendis</i>	Canary Yellow-2
<i>Geranium rectum</i>	Aster Violet-38
<i>Geranium wallichianum</i>	Aster Violet-38/1
<i>Gerbera jamesonii</i>	Mandarian Red-17/1
<i>Gladiolus byzanthus</i>	Rhodanine Purple 29
<i>Gloriosa rothschildiana</i>	Cherry 72+ Lemon Yellow Steks-4/2
<i>Gypsophila paniculata</i>	Pure White
<i>Hedychium gardnerianum</i>	Pure White
<i>Helenium autumnale</i>	Sulphur Yellow-2/1
<i>Helianthus autumnale</i>	Lemon Yellow-4

<i>Helianthus × multiflorus</i>	Lemon Yellow-4
<i>Helleborus niger</i>	Naples Yellow-403/3
<i>Hemerocallis flava</i>	Lemon Yellow-4
<i>Hesperis matronalis</i>	Dauphins Violet-039/3
<i>Hippeastrum puniceum</i>	Dutch Vermillion-717
<i>Hosta lancifolia</i>	Wistaria Bue-640/2
<i>Hosta plantaginea</i>	Pure White
<i>Hyacinthus orientalis</i>	Spectrum Blue-45/1
<i>Inula royleana</i>	Aureolin 3
<i>Iris ensata</i>	Wistaria Blue-640
<i>Iris germanica</i>	Hyacinth Blue-40/1
<i>Iris`Gingerbread Man`</i>	Garnet Brown-00919
<i>Iris japonica</i>	White+ Blue Bird Blue-042/2 Margins
<i>Iris kashmeriana</i>	Campanula Violet- 37/2
<i>Iris reticulata</i>	Hyacinth Blue-40
<i>Iris tectorum</i>	Campanula Violet-37
<i>Iris unguicularis</i>	Veronica Viloet-639/1
<i>Ixiolirion karateginum</i>	Lobelia Blue-41/3
<i>Kalanchoe blossfeldiana</i>	Crimson 22/1
<i>Kniphofia uvaria</i>	Persimon Orange-710
<i>Lathyrus latifolius</i>	Rose Madder-23/1
<i>Lavendula angustifolia</i>	Gentian Blue 42/2
<i>Leucojum aestivum</i>	Pure White
<i>Liatris spicata</i>	Victoria Violet-738
<i>Lilium auratum</i>	White tepals with central gold band
<i>Lilium candidum</i>	Pure white
<i>Lilium longiflorum</i>	White
<i>Limonium latifolium</i>	Campanula Violet-37/1
<i>Lunaria annua</i>	Cyclamen Purple-31/1
<i>Lupinus Polyphyllus</i>	Gentian Blue-42/1
<i>Lycoris radiata</i>	Scarlet-19/1
<i>Lythrum salicaria</i>	Petunia Purple-32/2
<i>Matthiola incana</i>	Rhodamine Purple-29
<i>Mimulus nepalensis</i>	-
<i>Mirabilis jalapa</i>	Phlox Purple-632
<i>Muscari armeniacum</i>	Lobelia Blue-41
<i>Narcissus peseudonarcissus</i>	Yellowish cream
<i>Narcissus tazetta</i>	Cream
<i>Nelumbo nucifera</i>	Pinkish White-32/2
<i>Nymphae stellata</i>	-
<i>Oenothera biennis</i>	Sulphur Yellow-1

<i>Ornithogalum umbellatum</i>	Pure white with Agathia Green base-60/3
<i>Paeonia emodi</i>	Pure white
<i>Paeonia lactiflora</i>	Persion Rose-628/1
<i>Papaver orientale</i>	Marigold Orange 11/1
<i>Penstemon barbatus</i>	Caramine-21
<i>Phlox paniculata</i>	Phlox Pink 625/1
<i>Physalis alkekengi</i>	Cream
<i>Platycodon grandiflorum</i>	Campanula Violet 37/1
<i>Primula denticulata</i>	Bishops Violet-34
<i>Primula rosea</i>	Magenta-27/1
<i>Primula vulgaris</i>	Mauve-633/1
<i>Ranunculus falcatus</i>	-
<i>Rheum australe</i>	-
<i>Rudbeckia fulgida</i>	Magenta Rose 27/1
<i>Rudbeckia laciniata</i>	Roseine Purple-629/1
<i>Salvia sclarea</i>	Plum Purple-934/3
<i>Santolina chamaecyparissus</i>	Indian Yellow-6/1
<i>Saxifraga stonilfera</i>	Pure white
<i>Scilla bifolia</i>	Dahlia Purple-931/3
<i>Scilla siberica</i>	Spectrum Blue-45/1
<i>Sedum spectabile</i>	Persian Rose-628/3
<i>Senecio cineraria</i>	Lemon Yellow-4
<i>Sisyrinchium striatum</i>	Canary yellow-2/3
<i>Solidago canadensis</i>	Canary Yellow2/1
<i>Sprekalia formosissima</i>	Scarlet-19
<i>Stachys byzantina</i>	Magenta-27/3
<i>Sternbergia lutea</i>	Lemmon Yellow-4
<i>Thymus serpyllum</i>	Tyrian Rose-24/2
<i>Tradescantia sillamontana</i>	Tyrian Rose 24/2
<i>Tradescantia virginiana</i>	Magenta-27/2
<i>Tragopogon pratensis</i>	-
<i>Tulipa clusiana</i>	White, Stripped with tyrian Rose24/3
<i>Tulipa lanta</i>	Jasper Red018
<i>Typha angustifolia</i>	-
<i>Verbascum Thapsus</i>	Primrose Yellow 601
<i>Viola odorata</i>	Cobalt Violet 634
<i>Zantedeschia aethiopica</i>	Pure White
<i>Zantedeschia elliottiana</i>	Aureolin3

★ Inconspicuous flowers

**Sher-e-Kashmir**  
**University of Agricultural Sciences & Technology of Kashmir**  
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**CERTIFICATE**

This is to certify that all the corrections/modifications as suggested by External Examiners in the thesis manuscript entitled “**Studies on Herbaceous Perennials of Kashmir Valley for Landscape Use**” by **Mrs. Sumina Ramzan (Regd. No. 2006-146-D)** have been taken care before final binding of the same.

*(Dr. T.M. Paul)*  
*Chairman*  
*Advisory Committee*