

Floral diversity in urban green spaces: A case study in the city of Chandigarh

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Abstract

In the urban green spaces (UGSs) of Chandigarh city, India, a floral variety inventory was prepared. This inventory attempts to investigate the variety and wealth of trees in planned city of Chandigarh. In order to study urban floral diversity, four categories were used; academic plantations, public parks, botanical gardens and avenue trees that line the sides of roads. Avenue trees with girths at breast height (gbh) less than 10 cm were recorded. In total, 319 species were identified belonging to 90 different families. The results show that the green spaces of the city were dominated by the trees of Fabaceae family, followed by the Apocynaceae. All types of green spaces exhibit a preponderance of trees based on habit distribution, followed by shrubs. Avenue trees were mostly non-native and predominately of the deciduous variety. The findings highlight the significance of Chandigarh's enormous floral diversity in urban green space in the face of urbanisation. The UGSs provide the vital ecosystem services in the cities which is a necessity for sustainable development.

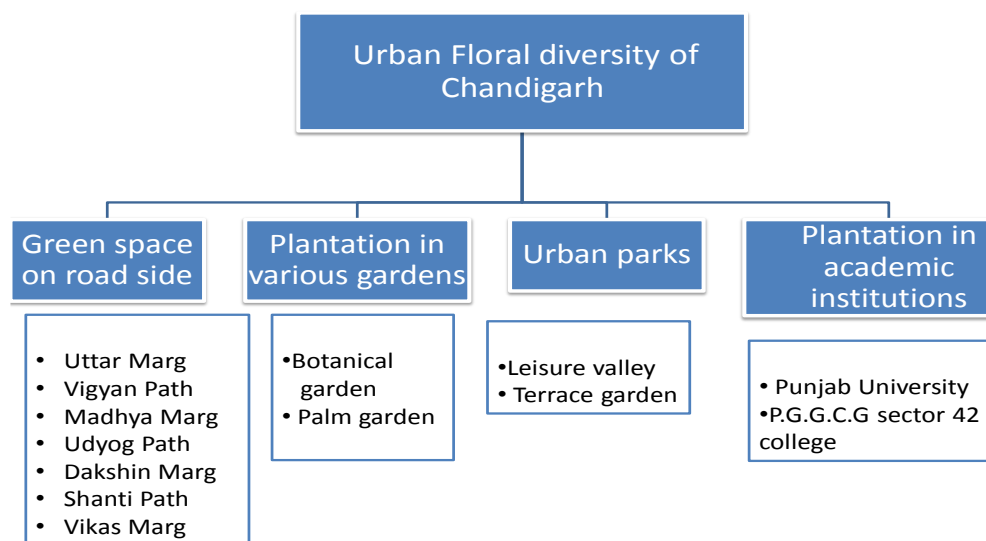
Key words: Urban green space, Avenue trees, Floral diversity, Fabaceae, Plantation

Introduction

The term biodiversity was first introduced by Walter G. Rosen in 1980s. Biodiversity or biological diversity refers to the different variety of living organism in a particular area. Biodiversity is mainly examined as three kinds i.e., Genetic biodiversity (diversity within species), Species biodiversity (diversity between species), and Ecological biodiversity (diversity between ecosystems) (CBD 1992). Article 2 of Convention on Biological Diversity defines biodiversity for the motives of global governance. Biodiversity plays a very crucial role in the life of human beings by providing various provisional and regulating services along with different ecosystem services and non-material benefits (Kondo et al., 2018;

Swanwick et al., 2003). Out of the 17 sustainable development goals (SDGs), 13 directly or indirectly depends upon biodiversity (Mehal et al., 2023; Opoku, 2019). Biodiversity can be studied under two broad views of rural biodiversity and urban biodiversity. In today's world urban biodiversity is of immense importance due to continuous rise in urban population. Today 56% of world population live in cities (World Bank, 2022). Urban biodiversity defines as the diversity of living organisms in the urban ecosystems of a given area and usually measured in the form of species abundance and evenness in that given area or city (Marselle et al., 2021a). Green space, verge vegetation, planted forests and inland water body (blue space) are important contributor to urban biodiversity (Balaban & Puppim de Oliveira, 2017).

Urban trees and gardens were studied which represent urban green spaces and various ecosystem services provided by them (Aronson et al., 2017). Apart from ecological and environmental benefits, urban trees and gardens also provide psychological benefits and may reduce the risk of depression in human beings (Marselle et al., 2020). For instance, many researchers from various developed countries like U.S.A., Germany, Italy, Belgium, California (Rambey et al., 2021; Marselle et al., 2021b; Burghardt et al., 2023; Roebuck et al., 2022) have studied urban trees diversity and their significance. In India various researcher have collected data from different cities and studied the diversity and richness of urban flora and their role in achieving sustainable ecosystem services (Bherwani et al., 2022; Muthulingam & Thangavel, 2012; Bhat et al., 2010; Bhalla & Bhattacharya, 2015).



A significant demographic transition towards urbanisation is taking place on a global scale (Freudenberg et al., 2005) which may have significant impact on biodiversity and environmental services (Liang et al., 2008). Thus, research on urban floral biodiversity becomes crucial. Urban plantation is being given more attention as urbanisation increases in importance for the creation of green space, but it is observed that most of the time, urban plantation is carried out without any scientific study of geography or the native range of plants in that area (Sexton et al., 2023). Additionally, due to globalisation and our increased connection to various forms of trade, we now either intentionally or unintentionally import some alien plant species (Meyerson & Mooney, 2007). In urban green spaces, usually non-native plants are introduced for their aesthetic qualities. Urban areas usually have higher species richness than the neighbouring open landscapes (Wania et al., 2006). However, this is a result of the introduction of non-native species into metropolitan areas (Pregitzer et al., 2019). It is crucial to understand the plant diversity in cities because some of these species, like decorative plants, are unintentionally distributed throughout the metropolis (Sjöman et al., 2012; Gaertner et al., 2017) while others are purposely brought there for their aesthetic qualities. Studying the biodiversity of Chandigarh, the first planned city, which is the capital of two states—Punjab and Haryana—as well as a union territory, is crucial because, in modern times, more plantations are needed nearby in the cities of Panchkula and Mohali due to increased urbanisation (Sharma et al., 2023).

Urban biodiversity awareness and appreciation improves quality of life and aids conservation efforts both inside and outside of cities. Since it is challenging to comprehensively cover the biodiversity of all residential parks, we chose two parks that are particularly rich in biodiversity: Terrace Garden in Sector 33 and Leisure Valley Park in Sector 10. Avenue trees are researched along with the plantations of two academic institutions, one of which is the campus of Punjab University and the other of which is P.G.C.G. 42 College. Two more gardens are included to give it a more thorough feel: one is a botanical garden, and the other is a palm garden. Table No. 1 lists all the locations that were looked into for urban floral biodiversity along with their coordinates.

Table 1. Name of the location and location coordinates of Chandigarh's urban green spaces where an assessment of the city's floral diversity was conducted

Name of study area	Geographical coordination
Academic institutions	
P.G.G.C.G 42 college	30° 43'31.1"N 76° 44'18.8"E
Panjab university	30° 45'28.8"N 76° 46'06.6"E
Parks	
Sector 33 park	30° 42'52.0"N 76° 46'18.1"E
Sector 10 leisure valley	30° 45'16.9"N 76° 47'35.0"E
Gardens	
Botanical gardens	30° 46'35.2"N 76° 45'35.3"E
Palm garden	30° 43'32.9"N 76° 44'13.9"E
Green space on road sides	
Uttar marg	30° 44'49.9"N 76° 48'28.6"E
Vigyan path	30° 45'01.1"N 76° 47'58.9"E
Madhya marg	30° 44'22.9"N 76° 47'30.1"E
Udyog path	30° 44'09.8"N 76° 46'38.8"E
Dakshin marg	30° 42'52.0"N 76° 46'43.7"E
Shanthi path	30° 43'22.1"N 76° 45'16.0"E
Vikas marg	30° 42'55.1"N 76° 44'36.4"E

Study Area

The current study is being conducted in Chandigarh, the capital of India's Punjab and Haryana states. Chandigarh, a Union Territory, is situated on the northern foothills of the Shivalik hill ranges, a part of the delicate Himalayan ecology. With a size of 114 sq km and an annual rainfall of 910 cm (2016), Chandigarh is located between 76° 47' 14E and 30° 44' 14N, with winter lows as low as 2°C and summer highs as high as 43° (Chandigarh website 2022). The first planned city in independent India, Chandigarh features numerous gardens as well as properly planted avenue trees. However, over time, the city's expansion also enveloped the nearby satellite towns of Mohali in Punjab and Panchkula in Haryana, creating a Tricity from the original garden city. The current study is conducted in Chandigarh's green spaces, where floral diversity from a few carefully chosen parks, gardens, and university campuses is inventoried.

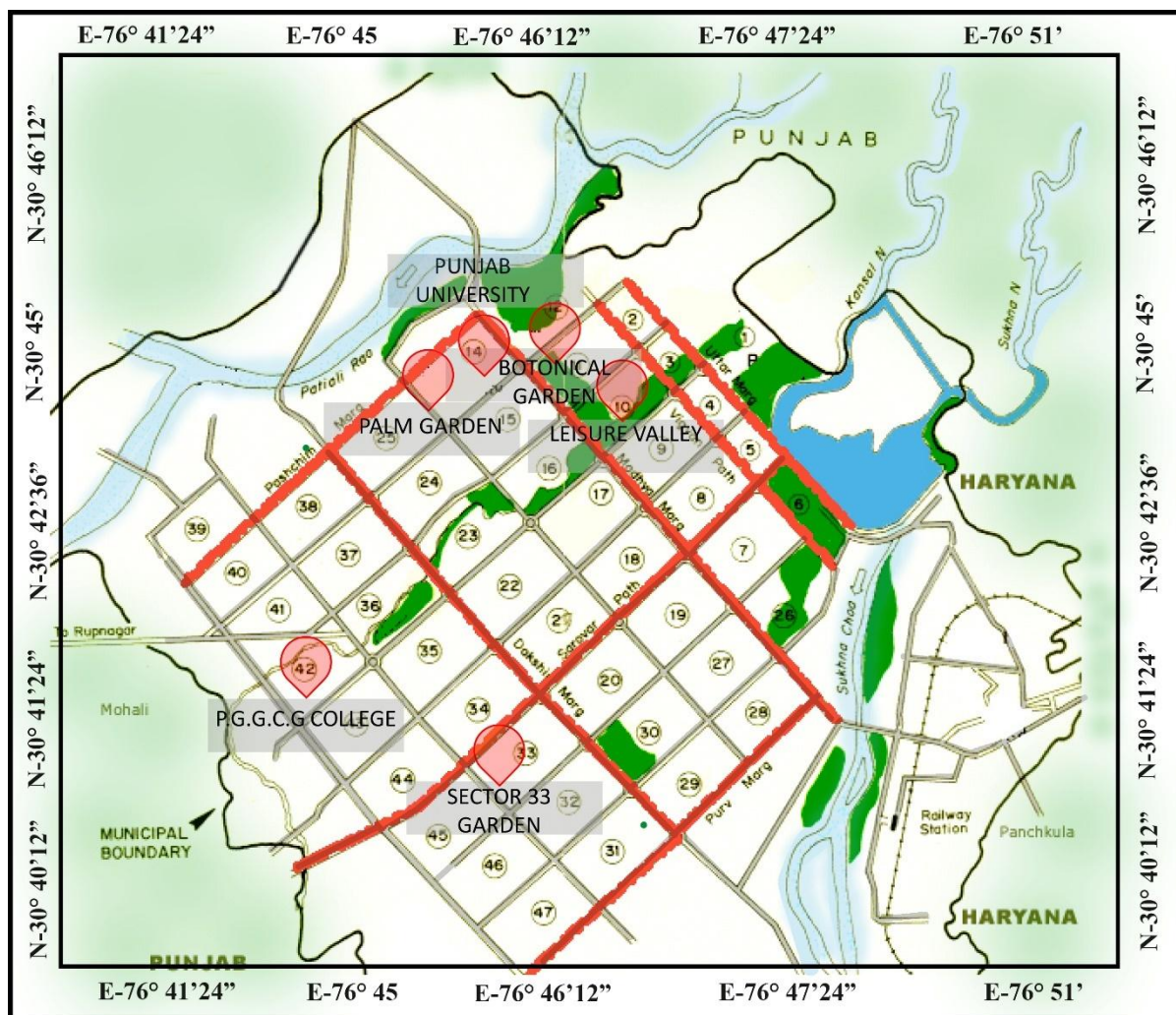


Figure1. A map of the research area indicates the several sites where diversity is examined.

Materials and methods

Field survey

First, several field trips are made to document biodiversity from an ecological standpoint. In order to compile a list of the region's floral varieties, surveys, exploration, specimen collection, and specimen preparation were conducted after that. To evaluate their composition, variety, distribution, and status in nature, phytosociological investigations were carried out (Nautiyal Sunil, 2015). The phenological characteristics of trees and shrubs were considered during the study, and the annual cycles of these groups were documented based on field observations.

Field equipment

For conducting phytosociological study following equipment or tools were used:

- Field bag
- Camera
- Field notebook
- Alcohol and mercuric chloride
- Pen
- Gloves
- Measuring tape and scales
- Global positioning system
- Secateurs for cutting and pruning
- Ropes
- Old newspapers
- Polythene bags for collecting specimen from field

Methods used

Ecologists have suggested a number of approaches for sampling plants. The belt transect method is mostly used to study plant biodiversity. According to several researchers studying phytosociology ((Chauhan et al., 2014); (Fu et al., 2022); (Grant et al., 2004)), this approach is the accepted scientific methodology. In the chosen location, a straight line or transect line was marked; the length of the transect varied depending on the sites surveyed, from 100 metres to one kilometre. Depending on the type of vegetation present, different-sized quadrants were demarcated at each of the chosen locations. 10 m × 10 m, 5 m x 5 m, and 1 m x 1 m quadrants for tree strata, shrubs, and herbs, respectively. The circumference at breast height (CBH), along with the name of the species, family, botanical description, phytoconstituents, and applications, was measured at 1.35m above ground level while sampling different tree species.

Collection methods

The collection of specimens is a crucial component of studying floral diversity. Field notebooks were used to record plant-related descriptions when collecting specimens. The date of collection, local name of the species, family, location of the collection, altitude, habit and

habitat, scientific name, and vegetation of each plant species were all noted in the field notebooks.

Result and discussion

In order to study the floral biodiversity of the Chandigarh region, four categories were chosen: academic institutions, parks, gardens, and green space along roads (table no.1). A total of 320 different plant species from 90 different families were found and categorised as a result of a field survey. The study omitted lichens, bryophytes, pteridophytes, and mycoflora that were difficult to identify. On the Panjab University campus, a total of fifty different plant species belonging to 37 families were detected (table no.3). P.G.G.C.G. College Campus has high floral diversity with 136 plant species belonging to 59 different families (table no.2). Sector 33 Park, which falls under the category of residential parks, has fifty plant species that are members of 28 families (table no.4), and Leisure Valley Park has a total of 39 different plant species belonging to 26 different families (table no.5). The Botanical Garden, which falls under the category of gardens, has 54 plant species belonging to 29 different families (table no.6), and Palm Garden has a total of 44 different plant species in 24 families (table no.7). A total of seventy distinct plant species from 26 different families were listed along the roadside under the last category of green space (table no.8). The origin of avenue trees has also been studied (see table No. 9), and it was shown that 52% of them are not native to the area in which they were planted (figure no.11).

Table 2.- List of plants in the PGGCG college campus

S.NO	Botanical Name	Vernacular Name	Family	Category of plant
1.	<i>Bauhinia variegata</i>	Mountain ebony and kachnar	Fabaceae	Tree
2.	<i>Psidium guajava</i>	Guava, yellow guava, or lemon guava	Myrtaceae	Tree
3.	<i>Acacia angustissima</i>	Wattles or acacias	Fabaceae	Tree
4.	<i>Bougainvillea</i>	Buganvilla	Nyctaginaceae	Tree
5.	<i>Morus alba</i>	White mulberry	Moraceae	Tree
6.	<i>Cassinia aculeata</i>	Chinese Shrub, Sifton Bush, Chinese	Asteraceae	Shrub

		Scrub		
7.	<i>Ficus retusa</i>	Indian Laurel Fig	Moraceae	Tree
8.	<i>Azadirachta indica</i>	Neem, nintree or Indian lilac	Meliaceae	Tree
9.	<i>Phyllostachys aurea</i>	Golden bamboo, Fishpole Bamboo	Poaceae	Tree
10.	<i>Musa acuminata</i>	Banana	Musaceae	Tree
11.	<i>Althaea hirsuta</i>	Marshmallow plant	Malvaceae	Shrub
12.	<i>Bromus catharticus</i>	Rescue grass	Poaceae	Shrub
13.	<i>Fumariaofficinalis</i>	Earth smoke	Papaveraceae	Herb
14.	<i>Parthenium hysterophorus</i>	Carrot grass	Asteraceae	Herb
15.	<i>Pennisetum polystachian</i>	Fountain grasses	Poaceae	Shrub
16.	<i>Vicia faba</i>	Broad bean	Fabaceae	Shrub
17.	<i>Lantana camara</i>	Red-sage	Verbenaceae	Shrub
18.	<i>Sonchus arvensis</i>	The field milk thistle	Asteraceae	Shrub
19.	<i>Alternanthera reineckii</i>	Bhirangijhar	Amaranthaceae	Shrub
20.	<i>Solanum nigrum</i>	European black nightshade	Solanaceae	Herb
21.	<i>Sassafras albidum</i>	Sassafras	Lauraceae	Tree
22.	<i>Ziziphus</i>	Red date	Rhamnaceae	Tree
23.	<i>Artrocarpus heterophyllus</i>	Jack tree	Moraceae	Tree
24.	<i>Eucalyptus</i>	Blue gum tree	Myrtaceae	Tree
25.	<i>Ficus bengahalenis</i>	Banyan, Fig	Moraceae	Tree
26.	<i>Moringa oleifera</i>	Drumstick tree	Moringaceae	Tree
27.	<i>Ricinus communis</i>	Castor bean	Euphorbiaceae	Shrub
28.	<i>Spergularia marina</i>	Salt sand spurrey	Caryophyllaceae	Shrub
29.	<i>Galiumarpine</i>	Sticky weed	Rubiaceae	Climber

30.	<i>Oxalis dillenii</i>	Wood sorrels	Oxalidaceae	Herb
31.	<i>Mangifera indica</i>	Mango	Anacardiaceae	Tree
32.	<i>Syzygiumcumini</i>	Malabar plum	Myrtaceae	Tree
33.	<i>Roystonea oleracea</i>	Cuban royal palm	Aceraceae	Tree
34.	<i>Ailanthus altissima</i>	Tree of heaven	Simaroubaceae	Tree
35.	<i>Ficus thonnigii</i>	Strangler fig	Moraceae	Tree
36.	<i>Saracaasoca</i>	Ashoka tree	Fabaceae	Tree
37.	<i>Phyllanthus emblica</i>	Indian gooseberry, alma	Phyllanthaceae	Tree
38.	<i>Catharanthus roseus</i>	Capeperiwinkle	apocynaceae	Shrub
39.	<i>Tagetes minuta</i>	Southern marigold	Asteraceae	Herb
40.	<i>Hibiscus rosa sinensis</i>	Chinese hibiscus	Malvaceae	Shrub
41.	<i>Euphorbia milii</i>	Crown of thorns	Euphorbiaceae	Shrub
42.	<i>Ligustrum lucidum</i>	Glossy privet	Oleaceae	Shrub
43.	<i>Juniperus communis</i>	Dwarf juniper	Cupressaceae	Tree
44.	<i>Aspidistra lurida</i>	Cast iron plant	Asparagaceae	Shrub
45.	<i>Chlorophytum comosum</i>	Spider plant	Asparagaceae	Shrub
46.	<i>Jacaranda spp.</i>	Jacaranda	Bignoniaceae	Tree
47.	<i>Phoenix canariensis</i>	Pineapple palm	Arecaceae	Tree
48.	<i>Leptospermum Scoparium</i>	Broom tea tree	Myrtaceae	Tree
49.	<i>Chukrasiatabularis</i>	Indian mahogany	Meliaceae	Tree
50.	<i>Santaium album</i>	Indian sandal wood	santalaceae	Tree
51.	<i>Araucaria heterophylla</i>	Norfolk island pine	Araucariaceae	Tree
52.	<i>Dracaena fragrans</i>	Corn Plant	Asparagaceae	Tree

53.	<i>Schefflera arboricola</i>	Australia umbrella	Araliaceae	Tree
54.	<i>Gazania linearis</i>	Treasure flower	Asteraceae	Herb
55.	<i>Antirinum majus</i>	Dragon flowers	Plantaginaceae	Herb
56.	<i>Matthiola incana</i>	Hoary stock	Brassicaceae	Tree
57.	<i>Tropaeolum majus</i>	Garden nasturtium	Tropaeolaceae	Climber
58.	<i>Jasminum officinale</i>	Common jasmine	Oleaceae	Shrub
59.	<i>Tagetes erecta</i>	Mexican Marigold	Asteraceae	Herb
60.	<i>Dactylis glomerata</i>	Cocks foot	Poaceae	Tree
61.	<i>Asparagus acthiopicus</i>	Spengers asparagus	Asparagaceae	Shrub
62.	<i>Dianthus caryophyllus</i>	Carnation	Caryophyllaceae	Shrub
63.	<i>Gardenia jasminoides</i>	Cape jasmine	Rubiaceae	Shrub
64.	<i>Albizia lebbek</i>	Lebbeck tree	Fabaceae	Tree
65.	<i>Leptospermum scoparium</i>	Broom tea tree	Myrtaceae	Tree
66.	<i>Roystonea regia</i>	Cuban royal palm	Araceae	Tree
67.	<i>Duranta erecta</i>	Golden dewdrop	Verbenaceae	Shrub
68.	<i>Epipremnum pinnatum</i>	Devil's lvy	Araceae	Tree
69.	<i>Petunia axillaris</i>	Petunia	Solanaceae	Herb
70.	<i>Pteris tremula</i>	Ribbon fern	Pteridaceae	Shrub
71.	<i>Yucca gloriosa</i>	Spanish dagger	Asparagaceae	Tree
72.	<i>Verbena bonariensis</i>	Purple top vervain	Verbenaceae	Herb
73.	<i>Caryota</i>	Solitary fishtail palm	Arecaceae	Tree
74.	<i>Russelia equisetiformis</i>	Fountain bush	Plantaginaceae	Tree
75.	<i>Lathyrus odoratus</i>	Sweet pea	Fabaceae	Shrub
76.	<i>Labularia maritima</i>	Sweet alison	Brassicaceae	Shrub

77.	<i>Ocimum tenuiflorum</i>	Holy basil	Lamiaceae	Herb
78.	<i>Syngonium podophyllum</i>	Arrow head	Araceae	Shrub
79.	<i>Epipremnum aureum</i>	Golden pothos	Araceae	Climber
80.	<i>Sphagneticolobata</i>	Singapore daisy	Asteraceae	Herb
81.	<i>Canna indica</i>	Canna lily	cannaceae	Shrub
82.	<i>Alstoniascholaris</i>	Devil tree	Apocynaceae	Tree
83.	<i>Citrus reticulata</i>	Mandarin	Rutaceae	Tree
84.	<i>Monstera deliciosa</i>	Swiss cheese plant	Araceae	Shrub
85.	<i>Maranataarundinacea</i>	West Indian arrow root	Marantaceae	Tree
86.	<i>Ruscus aculeatus</i>	Butchers broom	Asparagaceae	Shrub
87.	<i>Calathea zebrina</i>	Zebra plant	Asparagaceae	Shrub
88.	<i>Begonia rex</i>	House plant	Begoniaceae	Shrub
89.	<i>Tradescantia zebrina</i>	Inch plant	Commelinaceae	Shrub
90.	<i>Justicabrandegeana</i>	Mexican shrimp plant	Acanthaceae	Shrub
91.	<i>Pilea cadierei</i>	Aluminium plant	Urticaceae	Shrub
92.	<i>Plectranthuscutellarioides</i>	Painted plant	Lamiaceae	Shrub
93.	<i>Spathoglottis plicata</i>	Large purple orchid	Orchidaceae	Herb
94.	<i>Aglaonema commutatum</i>	Chinese evergreen	Araceae	Shrub
95.	<i>Pyrostegia</i>	Flame Vine	Bignoniaceae	Shrub
96.	<i>Nerium oleander</i>	Nerium	Apocynaceae	Tree

97.	<i>Jasmine sambac</i>	Arabian jasmine	Oleaceae	Shrub
98.	<i>Buddlejadavidii</i>	Butterfly bushes	Scrophulariaceae	Shrub
99.	<i>Rosea hybrida</i>	Gulab	Rosaceae	Shrub
100.	<i>Papaver somniferum</i>	Poppy plant	Papaveraceae	Herb

101.	<i>Gazania rigens</i>	Dasy	Asteraceae	Herb
102.	<i>Cassia fistula</i>	Golden shower	Fabaceae	Tree
103.	<i>Rhapis humilis</i>	Lady palm	Arecaceae	Tree
104.	<i>Livistonia chinensis</i>	Fan palm	Arecaceae	Tree
105.	<i>Galphima</i>	Spray of gold	Malpighiaceae	Shrub
106.	<i>Callistemon lanceolatus</i>	Bottle brush	Myrtaceae	Shrub
107.	<i>Callistemon pachyphyllus</i>	Copper brush	Myrtaceae	Shrub
108.	<i>Antigonon leptopus</i>	Coral vine	Polygonaceae	Herb
109.	<i>Cascabelathevetia</i>	Yellow oleander	Apocynaceae	Tree
110.	<i>Celastrus paniculatus</i>	Black oil plant	Celastraceae	Tree
111.	<i>Stevia spp,</i>	Candy leaf	Asteraceae	Shrub
112.	<i>Grevelia robusta</i>	Silk oak	Proteaceae	Tree
113.	<i>Agave americana</i>	Century plant	Asparagaceae	Tree
114.	<i>Cinnamomum camphora</i>	Camphor tree	Lauraceae	Herb
115.	<i>Lawsonia inermis</i>	Hina	Lythraceae	Herb
116.	<i>Desmodium janetium</i>	Tick tree foil	Fabaceae	Tree
117.	<i>Murraya koenigii</i>	Curry tree	Rutaceae	Tree
118.	<i>Ocimum basilicum</i>	Basil	Lamiaceae	Herb
119.	<i>Mimosa pudica</i>	Sensitive plant	Fabaceae	Herb
120.	<i>Bryophyllum pinnatum</i>	Air plant	Crassulaceae	Tree
121.	<i>Trachyspermum ammi</i>	Ajowan plant	Apiaceae	Herb
122.	<i>Asclepias curassavica</i>	Tropical milk weed	Apocynaceae	Herb
123.	<i>Jatropha curcas</i>	Physicnut	Euphorbiaceae	Tree
124.	<i>Cymbopogon citratus</i>	West indian grass	Poaceae	Shrub

125.	<i>Acorus calamus</i>	Sweet flag	Acoraceae	Tree
126.	<i>Mentha pipertia</i>	Mentha	Lamiaceae	Herb
127.	<i>Euphorbia triucalli</i>	Pencil tree	Euphorbiaceae	Shrub
128.	<i>Eclipta alba</i>	False daisy	Asteraceae	Herb
129.	<i>Aloe vera</i>	Aloe vera	Asphodelaceae	Herb
130.	<i>Vinca rosea</i>	Periwinkle	Apocynaceae	Herb
131.	<i>Fagus sylvatica</i>	European fagus	Fagaceae	Tree
132.	<i>Tabernaemontan a divaricata</i>	Pinewheel flower	Apocynaceae	Shrub
133.	<i>Saliva officinalis</i>	Sage	Lamiaceae	Herb
134.	<i>Calendula officinalis</i>	Pot marigold	Asteraceae	Herb
135.	<i>Matthiolaincana</i>	Hoary stock	Brassicaceae	Herb
136.	<i>Butea monosperma</i>	Flame of the forest	Fabaceae	Tree

Table 3.- List of plants in the Panjab University

S. No	Scientific Name	Vernacular Name	Family	Plant Category
1	<i>Dillenia indica</i>	Elephant apple	Dilleniaceae	Shrub/Small tree
2	<i>Pinus roxburghii</i>	Long leaf Indian Pine	Pinaceae	Tree
3	<i>Artocarpus lakoocha</i>	Monkey fruit	Moraceae	Tree
4	<i>Cinnamomum tamala</i>	Indian bay leaf	Lauraceae	Tree
5	<i>Eriobotrya japonica</i>	Japanese plum	Rosaceae	Tree
6	<i>Cananga odorata</i>	Cananga tree	Annonaceae	Tree
7	<i>Nandina domestica</i>	Heavenly bamboo	Berberidaceae	Shrub
8	<i>Solanum virginianum</i>	Yellow nightshade	Solanaceae	Herb
9	<i>Colebrookea oppositifolia</i>	Indian squirrel tail	Lamiaceae	Shrub
10	<i>Agathis robusta</i>	Kauri Pine	Araucariaceae	Tree
11	<i>Pteris vittata</i>	Chinese brake	Pteridaceae	Herb
12	<i>Ephedra foliata</i>	Shrubby Horsetail	Ephedraceae	Shrub
13	<i>Euphorbialactea cristata</i>	Coral Cactus	Euphorbiaceae	Shrub
14	<i>Melaleuca leucadendra</i>	White Paperbark	Myrtaceae	Tree

15	<i>Melaleuca linarifolia</i>	Narrow-leaved paperbark	Myrtaceae	Tree
16	<i>Holarrhena antidysenterica</i>	Kurchi	Apocynaceae	Tree
17	<i>Cycas circinalis</i>	Queen Sago	Cycadaceae	Shrub
18	<i>Ixora coccinea</i>	Flames of wood	Rubiaceae	Shrub
19	<i>Beaucarnea recurvata</i>	Ponytail palm	Asparagaceae	Shrub
20	<i>Justicia adhatoda</i>	Malabar nut	Acanthaceae	Shrub
21	<i>Putranjivaroxyburghii</i>	Lucky bean tree	Euphorbiaceae	Tree
22	<i>Rivinia axillaris</i>	Blood berry	Petiveriaceae	Shrub
23	<i>Sansevieria cylindrica</i>	Cylindrical snake plant	Asparagaceae	Herb
24	<i>Sambucus nigra</i>	Elderberry	Adoxaceae	Shrub/Small tree
25	<i>Salvinia auriculata</i>	Butterfly fern	Salviniaceae	Fern
26	<i>Ruscus aculeatus</i>	Butcher's Broom	Asparagaceae	Shrub
27	<i>Adenocalymma alliaceum</i>	Garlic vine	Bignoniaceae	Climber
28	<i>Buddleja asiatica</i>	Butterfly Bush	Scrophulariaceae	Shrub
29	<i>Ficus carica</i>	Common Fig	Moraceae	Tree
30	<i>Nephrolepis cordifolia</i>	Fishbone fern	Nephrolepidaceae	Fern
31	<i>Tabernaemontana coronaria</i>	Pinwheel flower	Apocynaceae	Shrub
32	<i>Pongamia glabra</i>	Indian beech	Fabaceae	Tree
33	<i>Borassus flabellifer</i>	Ice apple	Arecaceae	Tree
34	<i>Lupinus polyphyllus</i>	Blue pod lupine	Fabaceae	Herb
35	<i>Neolamarckiacadamba</i>	Burflower tree	Rubiaceae	Tree
36	<i>Madhuca longifolia</i>	Mahua	Sapotaceae	Tree
37	<i>Albizia lebeck</i>	Lebeck	Fabaceae	Tree
38	<i>Murraya exotica</i>	Orange Jasmine	Rutaceae	Shrub/Small tree
39	<i>Nyctanthes arbour tristis</i>	Night flowering jasmine	Oleaceae	Shrub/Small tree
40	<i>Clematis flammula</i>	Fragrant virgin's bower	Ranunculaceae	Climber
41	<i>Furcraea foetida</i>	Giant cabuya	Asparagaceae	Shrub
42	<i>Lagerstroemia parviflora</i>	Small flowered crape myrtle	Lythraceae	Tree
43	<i>Bischofia javanica</i>	Bishop wood	Phyllanthaceae	Tree
44	<i>Prunus persica</i>	Persian plum	Rosaceae	Tree
45	<i>Rosa moschata</i>	Musk rose	Rosaceae	Shrub
46	<i>Shorea robusta</i>	Sal tree	Dipterocarpaceae	Tree
47	<i>Citrus japonica</i>	Kumquat	Rutaceae	Tree
48	<i>Aloe Barbadensis miller</i>	Ghritkumari	Asphodelaceae	Shrub
49	<i>Syzygium aromaticum</i>	Long clove	Myrtaceae	Tree
50	<i>Calendula officinalis</i>	Pot marigold	Asteraceae	Shrub

Table 4.- List of plants in the Terrace Garden sec-33 park

Terrace garden sec-33				
S. No	Scientific Name	Vernacular Name	Family	Plant Category
1	<i>Mangifera indica</i>	Mango	Anacardiaceae	Tree
2	<i>Duranta erecta</i>	Golden dewdrop	Verbenaceae	Shrub
3	<i>Cassia fistula</i>	Golden shower	Fabaceae	Tree
4	<i>Canna indica</i>	Canna lily	Cannaceae	Shrub
5	<i>Ligustrum sinense</i>	Chinese privet	Oleaceae	Shrub
6	<i>Plumeria alba</i>	Dok champa	Apocynaceae	Shrub
7	<i>Yucca gloriosa</i>	Spanish dagger	Asparagaceae	Shrub/Small tree
8	<i>Rubus pyramidalis</i>	Kaltenb	Rosaceae	Shrub
9	<i>Lonicera sempervirens</i>	Scarlet honeysuckle	Caprifoliaceae	Climber
10	<i>Mimosa pudica</i>	Touch me not	Fabaceae	Herb
11	<i>Cotoneaster coriaceus</i>	Red Clusterberry	Rosaceae	Shrub
12	<i>Acer japonicum</i>	Full moon maple	Sapindaceae	Tree
13	<i>Bischofiapolycarpa</i>	Bishop wood	Phyllanthaceae	Tree
14	<i>Ficus retusa</i>	Banyan Tree	Moraceae	Tree
15	<i>Jatropha integerrima</i>	Perigrina	Euphorbiaceae	Shrub/Small Tree
16	<i>Jasminum sambac</i>	Arabian jasmine	Oleaceae	Shrub
17	<i>Magnolia grandiflora</i>	Bull bay	Magnoliaceae	Tree
18	<i>Nerium oleander</i>	Nerium	Apocynaceae	Shrub
19	<i>Tabernaemontana divaricata</i>	Crape jasmine	Apocynaceae	Shrub
20	<i>Celosia argentea</i>	Silver cock's comb	Amaranthaceae	Herb
21	<i>Psidium guajava</i>	Guava	Myrtaceae	Tree
22	<i>Asclepias fascicularis</i>	Narrowleaf milkweed	Apocynaceae	Herb
23	<i>Mitchella repens</i>	Partridge berry	Rubiaceae	Shrub
24	<i>Agave americana</i>	Century plant	Asparagaceae	Herb
25	<i>Buxus sempervirens</i>	Boxwood	Buxaceae	Shrub
26	<i>Catharanthus roseus</i>	Bright eyes	Apocynaceae	Herb
27	<i>Caesalpinia pulcherrima</i>	Peacock flower	Fabaceae	Shrub
28	<i>Searsialancea</i>	Karee	Anacardiaceae	Tree
29	<i>Sphagneticolatrilobata</i>	Singapore daisy	Asteraceae	Herb
30	<i>Rhus copallinum</i>	Winged sumac	Anacardiaceae	Tree
31	<i>Telekia speciosa</i>	Heartleaf oxeye	Asteraceae	Herb
32	<i>Eucalyptus</i>	Safeda	Myrtaceae	Tree
33	<i>Tagetes erecta</i>	Mexican marigold	Asteraceae	Herb
34	<i>Casuarina</i>	Ironwood	Casuarinaceae	Tree
35	<i>Albizia lebeck</i>	Lebeck	Fabaceae	Tree
36	<i>Saraca asoca</i>	Ashoka	Fabaceae	Tree
37	<i>Hamelia patens</i>	Firebush	Rubiaceae	Shrub
38	<i>Thuja occidentalis</i>	White cedar	Cupressaceae	Shrub
39	<i>Dypsis lutescens</i>	Areca palm	Arecaceae	Shrub

40	<i>Juglans nigra</i>	Black walnut	Juglandaceae	Tree
41	<i>Melia azedarach</i>	China berry	Meliaceae	Tree
42	<i>Agathis robusta</i>	Barked kauri	Araucariaceae	Tree
43	<i>Delonix regia</i>	Royal poinciana	Fabaceae	Tree
44	<i>Rosa damascena</i>	Damask rose	Rosaceae	Shrub
45	<i>Azadirachta indica</i>	Neem	Meliaceae	Tree
46	<i>Sauropus androgynous</i>	Katuk	Phyllanthaceae	Shrub
47	<i>Alpinia zerumbet</i>	Shell ginger	Zingiberaceae	Shrub
48	<i>Lagestroemia speciosa</i>	Crepe myrtle	Lythraceae	Tree
49	<i>Roystonea regia</i>	Cuban royal palm	Arecaceae	Tree
50	<i>Cycas angulata</i>	Zamia palm	Cycadaceae	Tree

Table5.- List of plants in the Leisure Valley

Leisure valley				
S. No	Scientific Name	Vernacular Name	Family	Plant Category
1	<i>Magnolia champaca</i>	Champak	Magnoliaceae	Tree
2	<i>Morus indica</i>	Mulberry	Moraceae	Tree
3	<i>Solanum americanum</i>	American black nightshade	Solanaceae	Herb
4	<i>Callistemon citrinus</i>	Bottle brush	Myrtaceae	Tree
5	<i>Melia azadirachta</i>	Chinaberry tree	Meliaceae	Tree
6	<i>Cascabelathevetia</i>	Yellow oleander	Apocynaceae	Shrub/Small Tree
7	<i>Amaranthus cruentus</i>	Grain amaranth	Amaranthaceae	Herb
8	<i>Hevea brasiliensis</i>	Rubber tree	Euphorbiaceae	Tree
9	<i>Fagus sylvatica</i>	Copper beech	Fagaceae	Tree
10	<i>Robinia pseudoacacia</i>	Black locust	Fabaceae	Tree
11	<i>Ligustrum lucidum</i>	Glossy privet	Oleaceae	Tree
12	<i>Azadirachta indica</i>	Neem	Meliaceae	Tree
13	<i>Nerium oleander</i>	Nerium	Apocynaceae	Shrub
14	<i>Styphnolobium japonicum</i>	Chinese Scholar tree	Fabaceae	Tree
15	<i>Magnolia grandiflora</i>	Magnolia or bull bay	Magnoliaceae	Tree
16	<i>Ficus religiosa</i>	Sacred fig	Moraceae	Tree
17	<i>Thuja occidentalis</i>	Northern white cedar	Cupressaceae	Shrub
18	<i>Phoenix dactylifera</i>	Date palm	Arecaceae	Tree
19	<i>Hibiscus rosa sinensis</i>	China rose	Malvaceae	Shrub
20	<i>Bambusa vulgaris</i>	Bamboo	Poaceae	Tree
21	<i>Gardenia jasminoides</i>	Cape jasmine	Rubiaceae	Shrub
22	<i>Lophostemonconfertus</i>	Brush box	Myrtaceae	Tree
23	<i>Pereskia aculeata</i>	Barbados	Cactaceae	Shrub
24	<i>Grevillea robusta</i>	Southern silky oak	Proteaceae	Tree
25	<i>Antigononleptopus</i>	Coral vine	Polygonaceae	Climber

26	<i>Ficus aurea</i>	Florida strangler fig	Moraceae	Tree
27	<i>Ceiba speciosa</i>	Silkfloss tree	Malvaceae	Tree
28	<i>Prunus caroliniana</i>	Cherry laurel	Rosaceae	Shrub
29	<i>Parthenium hysterophorus</i>	Santa- maria	Asteraceae	Herb
30	<i>Medicago polymorpha</i>	California burclover	Fabaceae	Herb
31	<i>Broussonetia papyrifera</i>	Paper mulberry	Moraceae	Tree
32	<i>Sapindussaponaria</i>	Western soapberry	Sapindaceae	Tree
33	<i>Lysimachia arvensis</i>	Scarlet pimpernel	Primulaceae	Herb
34	<i>Alstoniascholaris</i>	Devil's Tree	Apocynaceae	Tree
35	<i>Cassia fistula</i>	Golden shower	Fabaceae	Tree
36	<i>Mangifera indica</i>	Mango	Anacardiaceae	Tree
37	<i>Sterculia foetida</i>	Indian almond	Malvaceae	Tree
38	<i>Cycas circinalis</i>	Queen Sago	Cycadaceae	Tree
39	<i>Oxalis dillenii</i>	Wood sorrel	Oxalidaceae	Herb

Table6.- List of plants in the Botanical Garden

Botanical Garden				
S. No	Scientific Name	Vernacular Name	Family	Plant Category
1	<i>Saracaasoca</i>	Ashoka	Fabaceae	Tree
2	<i>Neolamarckiacadamba</i>	Kadam	Rubiaceae	Tree
3	<i>Syzygiumcumini</i>	Jamun	Myrtaceae	Tree
4	<i>Alstoniascholaris</i>	Devil's tree	Apocynaceae	Tree
5	<i>Chukrasiatubularis</i>	Chukrasia	Meliaceae	Tree
6	<i>Callistemon citrinus</i>	Bottle brush	Myrtaceae	Tree
7	<i>Nyctanthes arbour tristis</i>	Night blooming jasmine	Oleaceae	Tree
8	<i>Justicia adhatoda</i>	Vasaka	Acanthaceae	Shrub
9	<i>Aloe vera</i>	Ghritkumari	Asphodelaceae	Herb
10	<i>Calotropis procera</i>	Aak	Apocynaceae	Shrub
11	<i>Coleus barbatus</i>	Patharchat, Coleus	Lamiaceae	Herb
12	<i>Cinnamomum tamala</i>	Tejapatta	Lauraceae	Tree
13	<i>Cymbopogon citratus</i>	Lemon grass	Poaceae	Herb
14	<i>Hibiscus rosa-sinensis</i>	China rose	Malvaceae	Shrub
15	<i>Mentha spicata</i>	Mint	Lamiaceae	Herb
16	<i>Mimosa pudica</i>	Lajwanti	Fabaceae	Herb
17	<i>Ocimumbasilicum</i>	Tulsi	Lamiaceae	Herb
18	<i>Punica protopunica</i>	Pomegranate	Lythraceae	Shrub/Small Tree
19	<i>Euphorbia tirucalli</i>	Aveloz	Euphorbiaceae	Shrub/Small

				Tree
20	<i>Echinocactusgrusonii</i>	Golden barrel cactus	Cactaceae	Shrub
21	<i>Beaucarneagracilis</i>	Ponytail palm	Asparagaceae	Shrub/Small Tree
22	<i>Ficus variegata Blume</i>	Variegated fig	Moraceae	Tree
23	<i>Wrightiaantidysenterica</i>	Milky way	Apocynaceae	Shrub
24	<i>Tradescantia pallida</i>	Purple queen	Commelinaceae	Herb
25	<i>Euphorbia milii</i>	Crown of thorns	Euphorbiaceae	Shrub
26	<i>Cascabelathevetia</i>	Pili kaner	Apocynaceae	Shrub/Small Tree
27	<i>Ficus racemosa</i>	Goolar (gular)	Moraceae	Tree
28	<i>Durantaerecta</i>	Golden dewdrop	Verbenaceae	Shrub
29	<i>Cycas revoluta</i>	Sago palm	Cycadaceae	Shrub
30	<i>Agave deserti</i>	Desert agave	Asparagaceae	Shrub
31	<i>Agave americana</i>	Century plant	Asparagaceae	Herb
32	<i>Juniperus communis</i>	Juniperus	Cupressaceae	Shrub
33	<i>Pinus roxburghii</i>	Chir pine	Pinaceae	Tree
34	<i>Phoenix sylvestris</i>	Silver date palm	Arecaceae	Tree
35	<i>Bambusa vulgaris</i>	Bamboo	Poaceae	Tree
36	<i>Yucca aloifolia</i>	Aloe yucca	Asparagaceae	Shrub
37	<i>Jatropha curcas</i>	Physic nut	Euphorbiaceae	Tree
38	<i>Acacia concinna</i>	Shikakai	Fabaceae	Shrub/Small Tree
39	<i>Trachyspermumammi</i>	Ajwain	Apiaceae	Herb
40	<i>Vitex negundo</i>	Nirgundi	Lamiaceae	Shrub
41	<i>Araucaria heterophylla</i>	Norfolk Island pine	Araucariaceae	Tree
42	<i>Mangifera indica</i>	Aam	Anacardiaceae	Tree
43	<i>Kigelia pinnata</i>	Balam kheera	Bignoniaceae	Tree
44	<i>Albizia lebbek</i>	Siris	Fabaceae	Tree
45	<i>Aegle marmelos</i>	Bel	Rutaceae	Tree
46	<i>Ficus benghalensis</i>	Banyana tree	Moraceae	Tree
47	<i>Phyllanthus emblica</i>	Amla	Phyllanthaceae	Tree
48	<i>Lagerstroemia speciosa</i>	Pride of India	Lythraceae	Tree
49	<i>Rauwolfia serpentina</i>	Sarpagandha	Apocynaceae	Shrub
50	<i>Murrayakoenigii</i>	Curry patta	Rutaceae	Tree
51	<i>Psidium guajava</i>	Amrood	Myrtaceae	Tree
52	<i>Bauhinia accuminata</i>	Kachnar	Fabaceae	Tree
53	<i>Vachellianilotica</i>	Kikar	Fabaceae	Tree
54	<i>Azadirachta indica</i>	Neem	Meliaceae	Tree

Table7.- List of plants in the Palm Garden

Palm garden				
S. No	Scientific Name	Vernacular Name	Family	Plant Category
1	<i>Duranta erecta</i>	Sky flower	Verbenaceae	Shrub
2	<i>Roystonea regia</i>	Royal palm	Arecaceae	Tree
3	<i>Caryota mitis</i>	Toddy palm	Arecaceae	Tree
4	<i>Cycas revoluta</i>	Sago palm	Cycadaceae	Tree
5	<i>Hyophorbe indica</i>	Palmier batard	Arecaceae	Tree
6	<i>Oxalis dillenii</i>	Wood sorrel	Oxalidaceae	Herb
7	<i>Phoenix dactylifera</i>	Date palm	Arecaceae	Tree
8	<i>Zamia furfuracea</i>	Cardboard palm	Zamiaceae	Shrub
9	<i>Sterculia foetida</i>	Java olive	Malvaceae	Tree
10	<i>Albizia lebbek</i>	Woman's tongue tree	Fabaceae	Tree
11	<i>Latania lontaroides</i>	Latanier rouge	Arecaceae	Tree
12	<i>Anagallis arvensis</i>	Scarlet pimpernel	Primulaceae	Herb
13	<i>Washingtonia robusta</i>	Mexican fan palm	Arecaceae	Tree
14	<i>Bismarckia nobilis</i>	Bismarck palm	Arecaceae	Tree
15	<i>Acacia nilotica</i>	Gum Arabic tree	Fabaceae	Tree
16	<i>Trifolium repens</i>	White clover	Fabaceae	Herb
17	<i>Capsella bursa pastoris</i>	Shepherd's purse	Brassicaceae	Herb
18	<i>Dracaena draco</i>	Dragon tree	Asparagaceae	Tree
19	<i>Schefflera arboricola</i>	Dwarf umbrella tree	Araliaceae	Shrub
20	<i>Sonchus arvensis</i>	Sow thistle	Asteraceae	Herb
21	<i>Mazus</i>	Japanese mazus	Mazaceae	Herb
22	<i>Spergularia marina</i>	Salt sandspurry	Caryophyllaceae	Herb
23	<i>Jacaranda</i>	Blue jacaranda	Bignoniaceae	Tree
24	<i>Bombax ceiba</i>	Cotton tree	Bombacaceae	Tree
25	<i>Trachycarpus fortunei</i>	Chinese windmill palm	Arecaceae	Tree
26	<i>Mangifera indica</i>	Mango	Anacardiaceae	Tree
27	<i>Syagrus romanzoffiana</i>	Queen palm	Arecaceae	Tree
28	<i>Dypsis decaryi</i>	Triangle palm	Arecaceae	Tree
29	<i>Dalbergia sissoo</i>	Indian rosewood	Fabaceae	Tree
30	<i>Euphorbia lathyris</i>	Caper spurge	Euphorbiaceae	Herb
31	<i>Satureja montana</i>	Winter savory	Lamiaceae	Herb
32	<i>Juniperus communis</i>	Dwarf Juniper	Cupressaceae	Tree
33	<i>Lantana camara</i>	Red sage	Verbenaceae	Shrub
34	<i>Butea monosperma</i>	Palash	Fabaceae	Tree
35	<i>Saraca asoca</i>	Ashoka	Fabaceae	Tree
36	<i>Alstonia scholaris</i>	Devil tree	Apocynaceae	Tree
37	<i>Chukrasia tabularis</i>	Chukrasia	Meliaceae	Tree
38	<i>Ficus elastica</i>	India rubber tree	Moraceae	Tree
39	<i>Azadirachta indica</i>	Neem	Meliaceae	Tree
40	<i>Cassia fistula</i>	Amaltas	Fabaceae	Tree
41	<i>Mimusops elengi</i>	Spanish cherry	Sapotaceae	Tree

42	<i>Cotinus coggygria</i>	Smoke bush	Anacardiaceae	Shrub/Small Tree
43	<i>Bauhinia variegata</i>	Orchid tree	Fabaceae	Tree
44	<i>Cycas circinalis</i>	Queen sago	Cycadaceae	Tree

Table8.- List of Avenue Trees

Avenue Trees					
S. No	Scientific Name	Vernacular Name	Family	Plant Category	Physiognomy
1	<i>Acacia auriculiformis</i>	Australian Kikar	Mimosaceae	Tree	Evergreen
2	<i>Acrocarpusfraxinifolius</i>	Mundani, Pink Cedar	Caesalpinaceae/ Fabaceae	Tree	Decideous
3	<i>Adina cordifolia</i>	Haldu, Karam	Rubiaceae	Tree	Decideous
4	<i>Albizzia lebbek</i>	Siris, Woman's-Tongue Tree	Mimosaceae	Tree	Decideous
5	<i>Albizzia odoratissima</i>	Black Siris	Mimosaceae	Tree	Decideous
6	<i>Albizzia procera</i>	White Siris	Mimosaceae	Tree	Decideous
7	<i>Alstoniascholaris</i>	Devil's Tree	Apocynaceae	Tree	Evergreen
8	<i>Anthocephalus cadamba</i>	Kadam	Rubiaceae	Tree	Decideous
9	<i>Artocarpus heterophyllus</i>	Jack Fruit	Moraceae	Tree	Evergreen
10	<i>Azadirachta indica</i>	Neem	Meliaceae	Tree	Evergreen
11	<i>Barringtonia acutangula</i>	Samundar-phal	Lecythidaceae	Tree	Evergreen
12	<i>Bauhinia purpurea</i>	Camel Hoof tree	Caesalpinaceae	Tree	Decideous
13	<i>Bauhinia variegata</i>	Kachnar	Caesalpinaceae	Tree	Decideous
14	<i>Bischofia javanica</i>	Red Cedar	Euphorbiaceae	Tree	Decideous
15	<i>Bougainvillea sp</i>	Bougainvillea	Nyctaginaceae	Shrub	Thorny and Scandent
16	<i>Callistemon viminalis</i>	Bottle Brush	Myrtaceae	Tree	Evergreen
17	<i>Cassia fistula</i>	Golden shower tree	Caesalpinaceae	Tree	Decideous
18	<i>Cassia javanica</i>	Siboosook	Caesalpinaceae	Tree	Decideous
19	<i>Cassia nodosa</i>	Pink Mohur	Caesalpinaceae	Tree	Decideous
20	<i>Cassia renigera</i>	Burmese Pink Cassia	Caesalpinaceae	Tree	Decideous
21	<i>Cassia siamea</i>	Kassod	Caesalpinaceae	Tree	Evergreen

22	<i>Chorisia speciosa</i>	Paina de seda	Bombacaceae	Tree	Decideous
23	<i>Chukrasiatubularis</i>	Indian redwood	Meliaceae	Tree	Decideous
24	<i>Crateva religiosa</i>	Barna	Capparidaceae	Tree	Decideous
25	<i>Cycas circinalis</i>	Sago-palm	Cycadaceae	Tree	Evergreen
26	<i>Dalbergia sissoo</i>	Shisham	Fabaceae	Tree	Decideous
27	<i>Delonix Regia</i>	Gulmohar	Caesalpinieae	Tree	Decideous
28	<i>Drypetes roxburghii</i>	Putranjiva	Euphorbiaceae	Tree	Evergreen
29	<i>Emblica officinalis</i>	Amla	Euphorbiaceae	Tree	Decideous
30	<i>Enterolobium timbouva</i>	Timbouva	Mimosaceae	Tree	Decideous
31	<i>Eucalyptus hybrid</i>	Safeda	Myrtaceae	Tree	Evergreen
32	<i>Eugenia jambolana</i>	Jamun	Myrtaceae	Tree	Evergreen
33	<i>Ficus benghalensis</i>	Banyan Tree	Moraceae	Tree	Evergreen
34	<i>Ficus benjamina</i>	Benjamin Tree	Moraceae	Tree	Evergreen
35	<i>Ficus infectoria</i>	Pilkhan	Moraceae	Tree	Decideous
36	<i>Ficus religiosa</i>	Peepal	Moraceae	Tree	Decideous
37	<i>Grevillea robusta</i>	Silver Oak	Proteaceae	Tree	Evergreen
38	<i>Heterophragma roxburghii</i>	Waras	Bignoniaceae	Tree	Decideous
39	<i>Jacaranda mimosifolia</i>	Mimosa leaved Jaracanda	Bignoniaceae	Tree	Decideous
40	<i>Kigelia pinnata</i>	Sausage tree	Bignoniaceae	Tree	Semidecious
41	<i>Koelreuteria apiculata</i>	Golden rain tree	Sapindaceae	Tree	Decideous
42	<i>Lagerstroemia flos-reginae</i>	Jarul	Lythraceae	Tree	Decideous
43	<i>Lagerstroemia indica</i>	Crape myrtle	Lythraceae	Shrub	Decideous
44	<i>Lagerstroemia parviflora</i>	Bakli	Lythraceae	Tree	Decideous
45	<i>Lagerstroemia thorelli</i>	Crape myrtle	Lythraceae	Tree	Decideous
46	<i>Litchi chinensis</i>	Litchi	Sapindaceae	Tree	Evergreen
47	<i>Madhuca indica</i>	Indian Butter Tree	Sapotaceae	Tree	Decideous
48	<i>Mangifera indica</i>	Mango	Anacardiaceae	Tree	Evergreen
49	<i>Millettia ovalifolia</i>	Moulmein Rosewood	Papilionaceae	Tree	Decideous
50	<i>Millingtonia hortensis</i>	Indian cork tree	Bignoniaceae	Tree	Decideous
51	<i>Mimusops elengi</i>	Mulsari	Sapotaceae	Tree	Evergreen
52	<i>Polyalthia longifolia</i>	Asoka Tree	Annonaceae	Tree	Evergreen
53	<i>Polyalthia suberosa</i>	Bara chali	Annonaceae	Shrub	Evergreen
54	<i>Pongamia pinnata</i>	Papri	Papilionaceae	Tree	Evergreen
55	<i>Populus nigra</i>	Black Poplar	Salicaceae	Tree	Decideous
56	<i>Pterospermum acerifolium</i>	Kanak-	Sterculiaceae	Tree	Evergreen

		champa			
57	<i>Roystonea regia</i>	Bottle palm	Arecaceae	Tree	Evergreen
58	<i>Salmaliamalabarica</i>	Silk-Cotton Tree	Bombacaceae	Tree	Decideous
59	<i>Sapiumsebiferum</i>	Makhan tree	Euphorbiaceae	Tree	Decideous
60	<i>Schleicheraleosa</i>	Lac Tree	Sapindaceae	Tree	Decideous
61	<i>Schleicheratrijuga</i>	Kusum	Sapindaceae	Tree	Decideous
62	<i>Spathodeacampanulata</i>	Flame tree	Bignoniaceae	Tree	Decideous
63	<i>Sterculia alata</i>	Buddha's coconut	Sterculiaceae	Tree	Decideous
64	<i>Swietenia mahagoni</i>	Mahogany	Meliaceae	Tree	Evergreen
65	<i>Tamarindus indica</i>	Tamarind	Caesalpiniaceae	Tree	Evergreen
66	<i>Tecoma argentea</i>	Golden bell	Bignoniaceae	Tree	Evergreen
67	<i>Tecomellaundulata</i>	Lahura	Bignoniaceae	Tree	Decideous
68	<i>Terminalia arjuna</i>	Arjun Tree	Combretaceae	Tree	Decideous
69	<i>Terminaliabellirica</i>	Behera	Combretaceae	Tree	Decideous
70	<i>Thespesia populnea</i>	Tulip or Portia Tree	Malvaceae	Tree	Evergreen
71	<i>Toona ciliata</i>	Red Cedar	Meliaceae	Tree	Decideous

Table 9.- List of Avenue Trees showing native range

S. No	Scientific Name	Native range
1	<i>Acacia auriculiformis</i>	Native of tropical Australia
2	<i>Acrocarpusfraxinifolius</i>	Indo- malaysian region
3	<i>Adina cordifolia</i>	Southern Asia
4	<i>Albizzia lebeck</i>	Tropical Asia
5	<i>Albizzia odoratissima</i>	Indian Subcontinent to South China
6	<i>Albizzia procera</i>	Southeast Asia and India
7	<i>Alstoniascholaris</i>	Southern china, Tropical asia and Australia
8	<i>Anthocephalus chinensis</i>	South and Southeast Asia
9	<i>Artocarpus heterophyllus</i>	India to Malaya Peninsula
10	<i>Azadirachta indica</i>	Burma, India And Srilanka
11	<i>Barringtonia acutangula</i>	Wetlands In Southern Asia
12	<i>Bauhinia purpurea</i>	Indo Malaysian region
13	<i>Bauhinia variegata</i>	India and China
14	<i>Bischofia javanica</i>	Indo Malaysian region
15	<i>Bougainvillea sp</i>	Brazil And Peru
16	<i>Callistemon viminalis</i>	East Coast of Australia
17	<i>Cassia fistula</i>	Indian Subcontinent and Southeast Asia
18	<i>Cassia javanica</i>	China,Combodia and Indonesia
19	<i>Cassia nodosa</i>	China,Combodia and Indonesia
20	<i>Cassia renigera</i>	Upper Burma
21	<i>Cassia siamea</i>	South and Southeast Asia

22	<i>Chorisia speciosa</i>	Brazil and Argentina
23	<i>Chukrasia tabularis</i>	Bangladesh, Cambodia, China and India
24	<i>Crateva religiosa</i>	China to Tropical Asia
25	<i>Cycas circinalis</i>	Southern India and Srilanka
26	<i>Dalbergia sissoo</i>	Indian Subcontinent and Southern Iran
27	<i>Delonix Regia</i>	Madagascar
28	<i>Drypetes roxburghii</i>	Southeast Asia and Indian Subcontinent
29	<i>Emblica officinalis</i>	India
30	<i>Enterolobium timbouva</i>	Brazil to Paraguay
31	<i>Eucalyptus hybrid</i>	Australia
32	<i>Eugenia jambolana</i>	Indian Subcontinent and Southeast Asia
33	<i>Ficus benghalensis</i>	Indian Subcontinent
34	<i>Ficus benjamina</i>	India to Northern Australia
35	<i>Ficus infectoria</i>	Indian Subcontinent
36	<i>Ficus religiosa</i>	Southeast Asia, Southwest China and India
37	<i>Grevillea robusta</i>	Eastern Australia
38	<i>Heterophragma roxburghii</i>	South India to Bangladesh
39	<i>Jacaranda mimosifolia</i>	Southern Brazil And Northwestern Argentina
40	<i>Kigelia pinnata</i>	Tropical Africa
41	<i>Koelreuteria apiculata</i>	China and Korea
42	<i>Lagerstroemia flos-reginae</i>	Tropical Asia
43	<i>Lagerstroemia indica</i>	Indian Subcontinent And Southeast Asia
44	<i>Lagerstroemia parviflora</i>	Indian Subcontinent
45	<i>Lagerstroemia thorelli</i>	Tropical Southern Asia
46	<i>Litchi chinensis</i>	South China and Malaysia
47	<i>Madhuca indica</i>	India, Srilanka and Myanmar
48	<i>Mangifera indica</i>	Burma And India
49	<i>Millettia ovalifolia</i>	Lower Burma and Siam
50	<i>Millingtonia hortensis</i>	South Asia And Southeast Asia
51	<i>Mimusops elengi</i>	India And Srilanka
52	<i>Polyalthia longifolia</i>	India
53	<i>Polyalthia suberosa</i>	India to China
54	<i>Pongamia pinnata</i>	Asia and Australia
55	<i>Populus nigra</i>	Europe, Southwest and Central Asia
56	<i>Pterospermum acerifolium</i>	Southeast Asia, India to Burma
57	<i>Roystonea regia</i>	Mexico, Caribbean and Florida
58	<i>Salmalia malabarica</i>	Australia
59	<i>Sapium sebiferum</i>	China
60	<i>Schleichera oleosa</i>	India, Burma and Thailand
61	<i>Schleicheratrijuga</i>	Indian Subcontinent
62	<i>Spathodea campanulata</i>	Tropical African Forest
63	<i>Sterculia alata</i>	East Himalaya to China
64	<i>Swietenia mahagoni</i>	Caribbean
65	<i>Tamarindus indica</i>	Eastern Africa

66	<i>Tecoma argentea</i>	American Tropics and Subtropics
67	<i>Tecomellaundulata</i>	Oman, Southwest Iran
68	<i>Terminalia arjuna</i>	India And Srilanka
69	<i>Terminaliabellirica</i>	Bangladesh. Bhutan and India
70	<i>Thespesia populnea</i>	Old World Tropic
71	<i>Toona ciliata</i>	Indo- malaysia to Australia



Dillenia indica L. (A) Tree (B) Branch with leaves (C) Fruit



Cycas revoluta (A) Plant body (B) Leaves (C) Flowers



Beaucarnea gracilis Lem. Whole Plant



Echinocactus grusonii hildm (Whole Plant)



Duranta erecta (L) (A) Plant (B) Flowers (C) Fruits



Anagalis arvensis (A) Plant (B) Leaves (C) Fruit

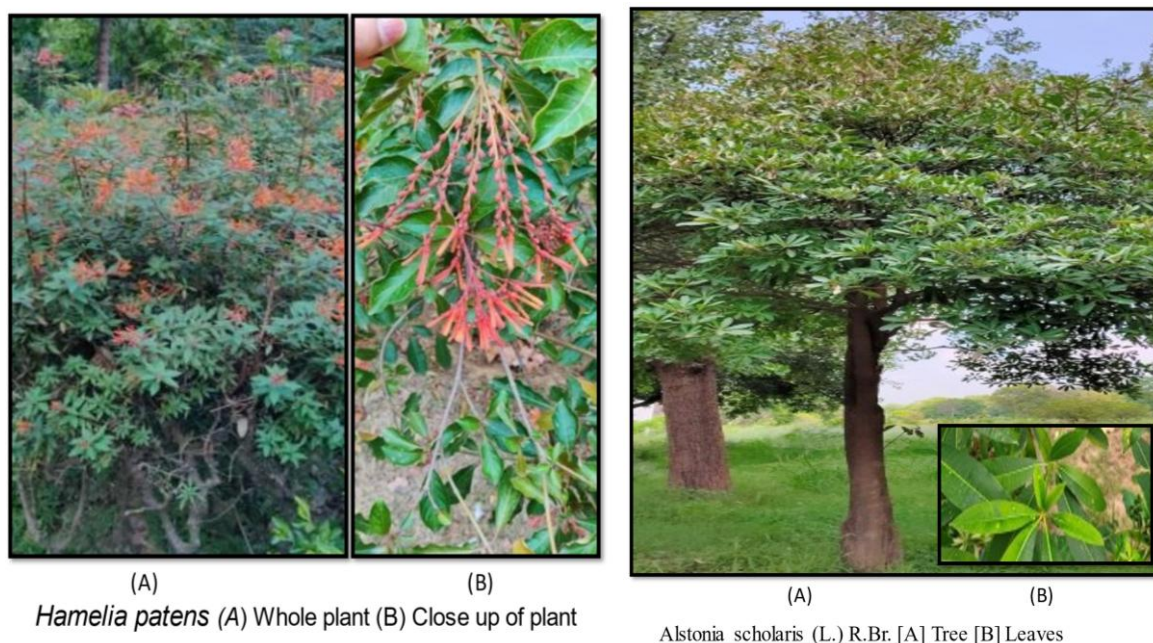


Figure 2. Some of the non-native plants, along with their leaves, flowers, and fruit, if any, were present at the time of the study.

The majority of the investigated plant species are angiosperms. The family with the largest frequency of plant species over the entire study is Fabaceae, followed by Apocynaceae. Plants from the Fabaceae family have been used as decorative plants for many years (Zhestkova & Uromova, 2016). This family is frequently utilised in the design and planting of all sorts, from little gardens to big parks and roadside green spaces, due to their enormous variety of heights, forms, foliage, and flower colours (Ahmad et al., 2016; Mirza Hasanuzzaman, 2020). Due to their aesthetic value, they are planted in the majority of Chandigarh. They are extensively used in the food, textile, cosmetic, and pharmaceutical industries. They possess intriguing medicinal qualities, and their ethnopharmacological properties have also been studied by various researchers (Asfaw & Abebe, 2021; Maroyi, 2023). Families with a frequency of more than 10 genera are displayed in figure No 12. and for a better understanding of plant morphology, some of the non-native plant species identified throughout the entire collection are depicted in picture number 1.

According to habit, 43% of the total plant species seen on the P.G.C.G. college campus in sector 42 are trees, 34% are shrubs, 21% are herbs, and 2% are climbers (figure no. 3). 44% of the plants at Panjab University are trees, 40% are shrubs, 8% herb, 4% are Ferns and 4%

are climber (figure no. 4). Out of all the plant species evaluated in the residential area parks based on habit, sector 33 Terrece Garden has 42% trees, 40% shrubs, 16% herbs and 2% climber (figure no.5). In Leisure Valley Park, 64% of the plants are trees, 18% are shrubs, 15% are herbs, and 3% are climbers (figure no.6). Out of the total plant species evaluated in the two chosen gardens, the botanical garden has 48% trees, 33% shrubs, 17% herbs, and 2% grasses (figure no.7). 68% of the plants in the palm garden are trees, 11% are shrubs, and 21% are herbs (figure no.8). When roadside plantations are analysed based on their habit, 96% of them are trees, and 4% are shrubs, along various paths like the Uttar Marg, Vigyan Path, Madhya Path, Dakshin Path, and Santhi Path (figure no.9).The physiognomy of avenue trees was also analysed, and it demonstrated that the majority of plant species (61%) are deciduous in nature, followed by evergreens(figure no.10).

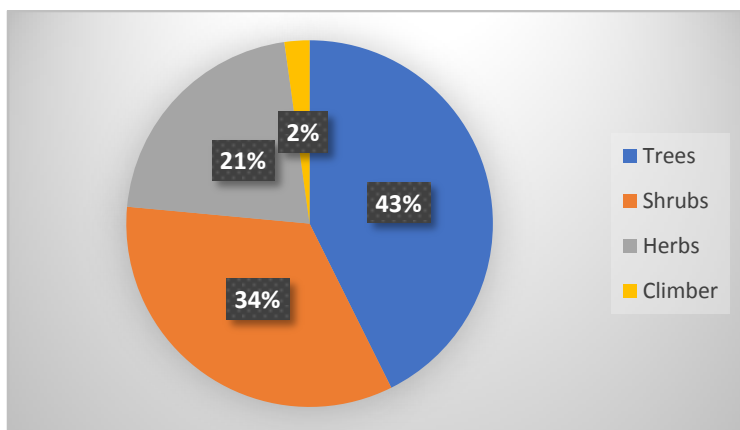


Figure 3. -Assessment of habit-wise distribution of plant species in the PGGCG

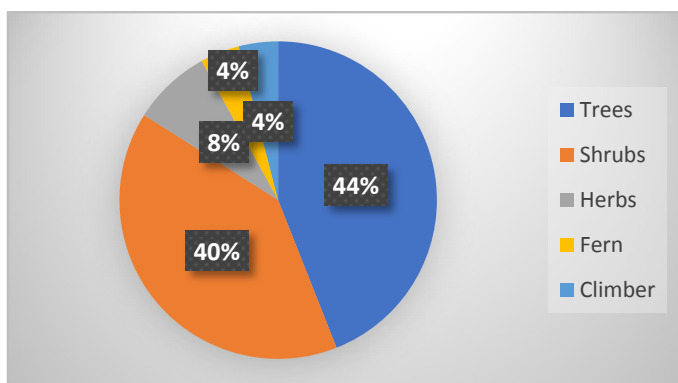


Figure 4.-Assessments of habit-wise distribution of plant species in the Panjab University

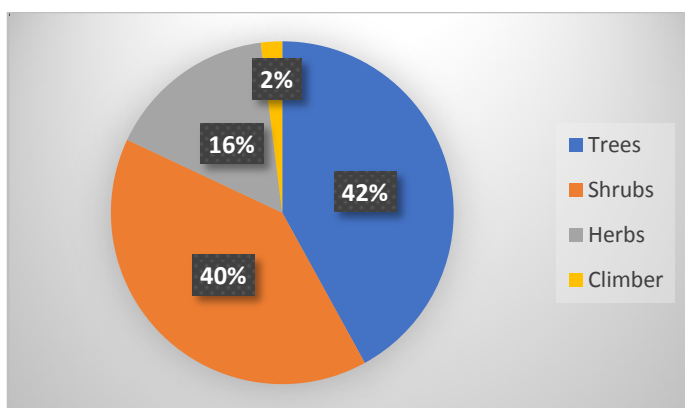


Figure 5. -Assessment of habit-wise distribution of plant species in the Terrace Garden

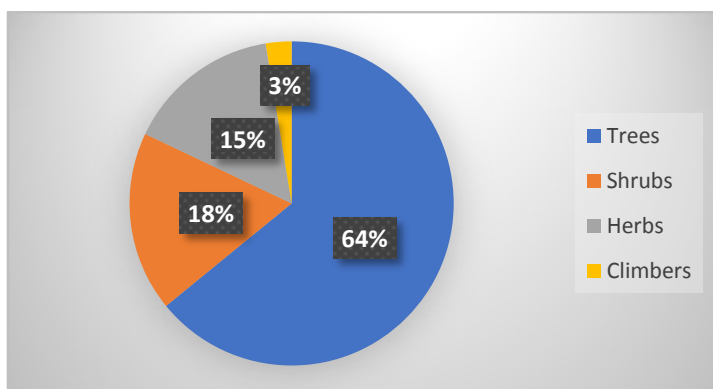


Figure 6.-Assessment of habit-wise distribution of plant species in the Leisure valley

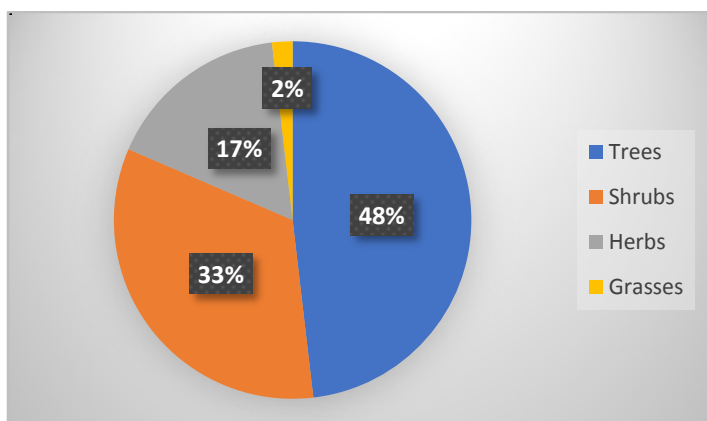


Figure 7. -Assessment of habit-wise distribution of plant species in the Botanical Garden

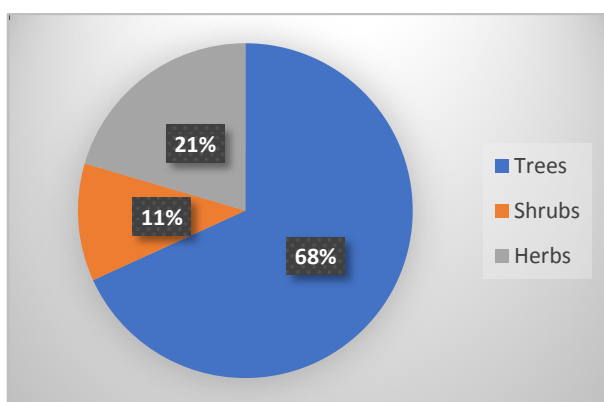


Figure 8.-Assessment of habit-wise distribution of plant species in the Palm Garden

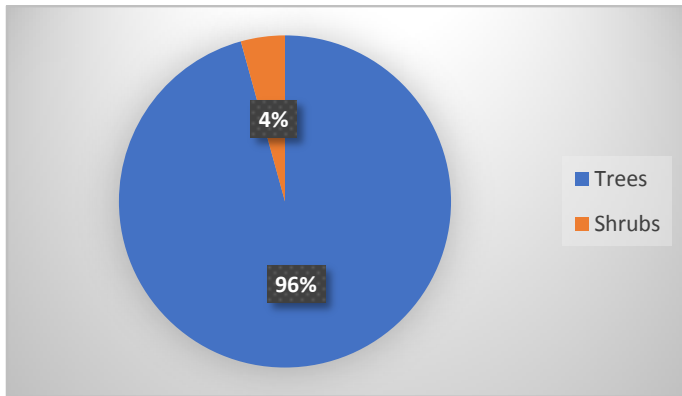


Figure 9.-Assessment of habit-wise distribution of plant species in the Avenue trees

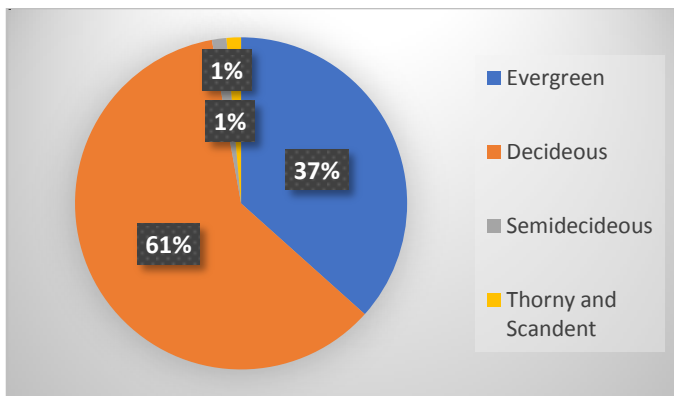


Figure 10.- Physiognomy of plants at Avenue Trees Site

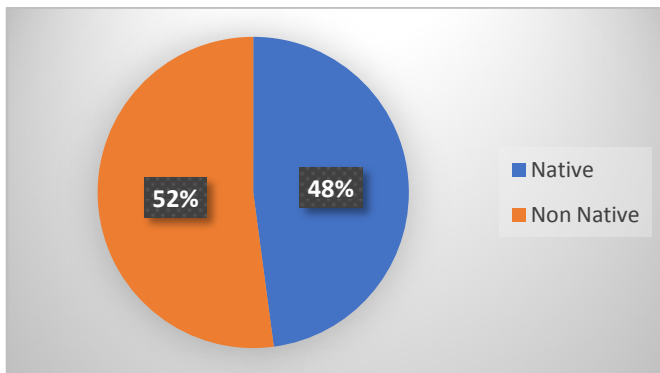


Figure 11.-Status of avenue trees as native and non-native

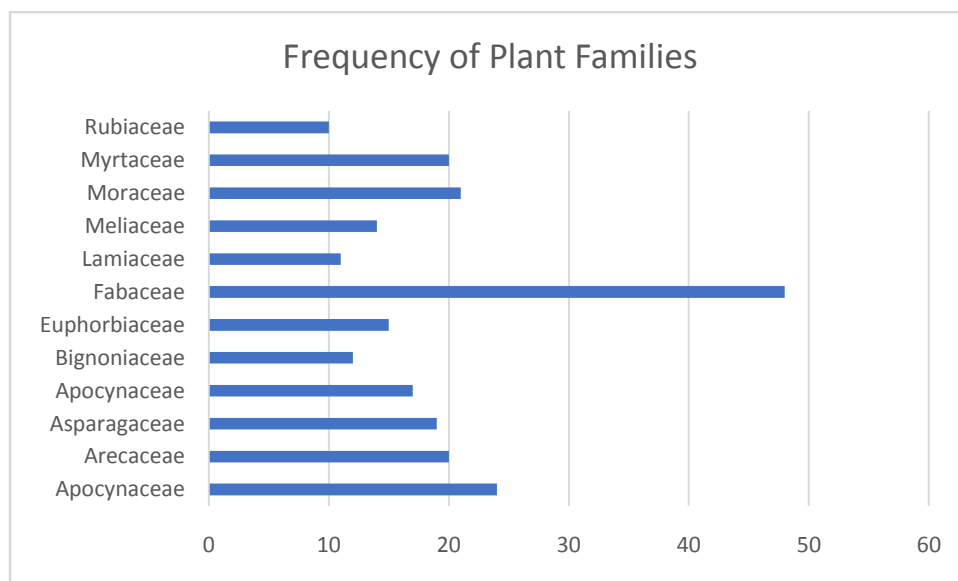


Figure 12.- Plant families with higher number of species in the Chandigarh area

Conclusion

It will take skilful management of plant populations in urban area to safeguard the future of urban biodiversity. By improving the habitat quality of current urban green space through coordinated and diverse management of urbangardens, venue trees, parks, and other urban natural areas, the first step is to increase the biodiversity potential. Even though the majority of the plantations are not local species, their physiognomy supports the environment here, and they are thriving and can be employed in plantations nearby. Diverse stakeholders, including ecologists, managers, developers, students, and citizens, should be encouraged to join collaborative networks to share data, engage in interdisciplinary research, and discuss urban biodiversity management, design, and planning in order to preserve floral biodiversity in urban areas. The resilience of cities and the health of their residents ultimately depend on floral biodiversity. More extensive research is required to calculate the current and future needs for green space in order to improve the urban biodiversity.

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