

A Floristic Analysis Of Selected Parks In Lahore Pakistan

Abstract

The present study, is a first attempt to describe the flora of some selected parks of Lahore city. It provides information about the distribution of different plant species in Model Town Park, Gulshan-e-Iqbal Park, Nawaz Sharif Park, Shalimar Garden, Nasir Bagh and Lahore Zoo. Furthermore, the diameter at breast height (DBH) of selected trees has been measured. A total of 94 plant species were recorded belonging to 43 families. Fabaceae is the dominating family with 15 member species (16.5%), followed by Moraceae and Rosaceae with 8 and 5 species respectively. Lahore had number of green spaces in the past but rapid urbanization, development projects and construction of new transportation networks leads to deforestation and vegetation removal in the city. In order to address this issue, there is a need to monitor the spatial distribution of plant species by preparing databases and generating spatial maps on regular basis for plants conservation in the city.

Keywords: Floristic competition, Lahore, Species, Families, DBH, GIS.

Introduction

Plant's diversity ensures sustainability for all life forms and provides healthy ecosystem that comprises ecosystem services, biological resources and social benefits, help plants for better withstand and recover from disasters. The medicinal potential of plants helps to conserve biodiversity as some species are of high value for their medicinal properties. From biological resources at least 40 per cent of the world's economy and 80 per cent of the poor's needs are derived respectively (Saeed, 2003). A portion of landscape with relatively uniform dominant vegetation represents an ecosystem. Whereas a sensitive ecosystem is one that is fragile or rare due to air pollution, acid rain/eutrophication i.e. seven sensitive ecosystem (Wetland, Terrestrial herbaceous, Coastal bluff, Sparsely vegetated, Riparian, Older Forest and Woodland) exist in world. A study of floristic competition, composition and distribution is not only beneficial for botanists, geographers, environmentalists, and conservationists but also important for biochemists, chemists, biotechnologists and pharmacists due to their medicinal values.

Wild species of plants have been used traditionally by human societies as sources of drugs for thousands of years. Plants have been used for medicinal purposes (Buchman, 1980) and recognized as an effective way to discover future medicines with continuous advancements in their mode with the passage of time. The medicinal significance of plants and wild species is often considered as a

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substantial reason to conserve biodiversity. Every part of plant including root, stem, shoot, leaves, leaflets, buds, flowers, seed and bark are used in making medicines for mankind, reflects the importance of plant diversity. The need of indigenous medications has been realized with the increasing need of medicines and drugs to cure severe diseases (Chopra, 1974). The need of the hour is to collect indigenous plant material, identify, process and to utilize them for medicinal purposes. As a matter of fact, plant wealth in the shape of medicinal herbs in Pakistan has been brutally used by unauthorized drug collectors and as a result particular herbal species has been endangered due to anthropogenic activities (Alam and Ali, 2010).

Deforestation and forest degradation are immense problems in Pakistan with removal of natural vegetation cover of native forest to deplete the natural resources. About 4 billion ha was covered with forest as primary forest in 2015 but now 8000 species of trees are under threat of extinction (Rio Convention, 2012). Adverse impacts of deforestation are climatic changes, soil erosion, flooding, land degradation, land sliding and frequent events of floods as major disasters in Pakistan. (Tariq, 2015) The current situation regarding flora in Pakistan is alarming situation due to deforestation and forest degradation (Ian et al., 2002). It is the need of hour to do efforts by launching specific studies to combat this current hot issue.

In Lahore urban development projects has been taking its toll and causes serious damage to environment, adding Punjab government did not take it on board prior to launching development projects/schemes. Recently, civil society's organizations in Lahore wrote a letter to UNESCO for intervention in civil work of Lahore Orange Line Metro Train project as it was a threat to Shalimar Garden. However, with quick action taken by UNESCO, now things have been settled down. Apart from this issue, government is taking small initial steps in maintaining and conservation of ecosystem. According to Punjab Forest Department tree species with short rotation are being planted for industrial plantation. Furthermore, provincial area under tree cover have been calculated which is 6.85% of the total area.

Numerous researchers have worked on floristic composition in different areas of the world e.g. floristic description (Hussnain and Ishtiaq, 2009), life form, leaf size spectrum and ethnobotany of Samahni valley (A.K) Pakistan (Hussain and Ishtiaq, 2009), floristic composition and ecological characteristics of weeds of wheat fields in district Swabi, Pakistan (Sher et al., 2011). Hasannejad and Ghafarbi (2012) introduced new indices for flora studies in alfalfa fields of Tabriz, Iran, Kunwar and Sharma (2004) revealed quantitative analysis of tree species in two community forests of Dolpa, Nepal. Zafar et al. (2003) focused primarily on medicinal plants, their uses and exploitation in Rawalpindi district and maintained a dry and live herbarium of important medicinal plants of that area. Mubashir et al. (2015) chose four habitats in Srinagar, Kashmir i.e., graveyards, grasslands, orchards and wastelands to study the pattern of alien and native flora as well as their growth form and life span profile Sani, et al. (2014) compiled and studied floristic composition, life form of woody plants in Nigeria. He also calculated different variables associated with flora such as density, dominance and cover value.

The collection of information about natural flora, classification, management and their uses carries importance for ethno botanists. The researchers have to face the challenges not only for recording knowledge of the plants, but also applying the results of their studies to biodiversity conservation and community development (Malik et al., 1990). Diameter at breast height (DBH) is undoubtedly the most common and important tree measurement mainly because it is directly measured and many other attributes like trunk diameter, age of tree, tree growth, wood/tree volume and basal area can be estimated from it and tree related studies are incomplete without it (Synder, 2006, Gering, 1995). Its importance can be anticipated from the fact that several researchers worked on predicting DBH of trees that have been cut down (Corral-Rivas et al., 2007; [Weigel and Johnson, 1997](#); [Khatry Chhetri and Fowler, 1996](#); [Parresol, 1993](#); Bylin, 1982; [McClure, 1968](#); [Myers, 1963](#)).

The present study is carried out in 6 localities (parks) of Lahore to compare and measure presence of floral species and families in respected areas. Results shows that Fabaceae is clearly the most dominating family because of their wide variety in growth forms worldwide. Pakistan lies in the temperate zone where mostly herbaceous species of Fabaceae are recorded. Moraceae is the second dominating family, of which white mulberry named *Modus alba* (weedy) and paper mulberry named *Broussonetia papyrifera* (shrubby) is native to Asia. They could also be found around homes, in disturbed sites and along fence rows. According to results, third largest family is Rosaceae which has worldwide distribution range and found almost everywhere. This floral family has its economic, commercial and medicinal importance particularly in temperate zone. Its wood, fruit and petals can be used for multiple purposes. About 213 species of Rosaceae family are present in Pakistan.

Study Area

Lahore is the capital of Punjab province and is a second largest city of Pakistan (Fig. 1a, 1b). It is also called "City of Gardens" and is considered as an educational, cultural, political, economic, transportation and entertainment hub. It is located between 74° 20' 37" E and 31° 32' 59" N latitude and longitude respectively covering an area of 1,772 km². The climate of the study area is semi-arid, June and July are the hottest months with temperatures ranging between 40°C -48°C, the coldest months are December and January. The monsoon period in summer prolongs from June to August. January, February also receives rainfall. The six selected sites (Model Town Park, Gulshan-e-Iqbal Park, Nawaz Sharif Park, Shalimar Garden, Nasir Bagh and Lahore Zoo.) have thick versatile vegetation including very old fruit / tall ornamental trees since the time of Mughals regime, native trees (i.e. mango, almond, acacia, naeem etc), shrubs, herbs and seasonal flowering plants. This thick vegetation will help to observe the "Survival of the fittest" among various floral species in variable seasons as Pakistan enjoys four seasons (i.e. summer, autumn, winter and spring). Visits were made in selected areas during February-March, 2014 to identify different species of trees, to keep and compare taxonomic record and to observe the "Survival of the fittest" of specific vegetation.

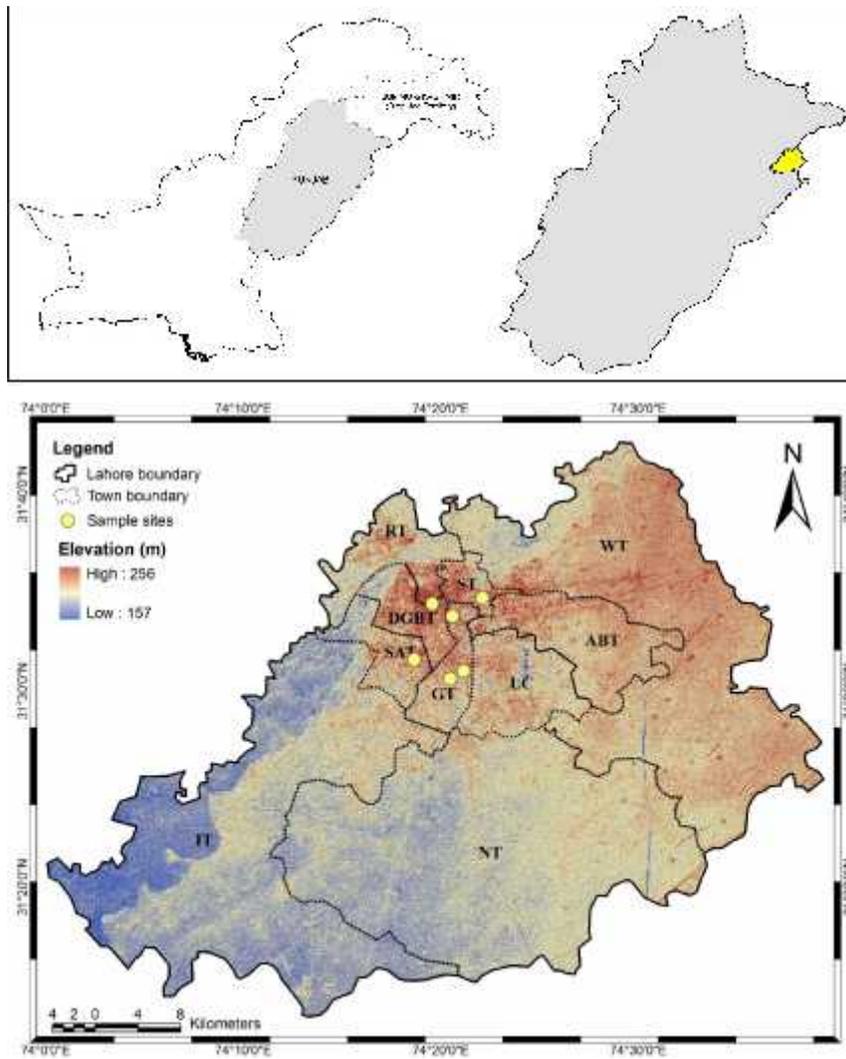


Figure 1: (a) Map showing location of study area in yellow colour. (b) Digital Elevation Model of study area showing elevation and location of sampling site.

Materials And Methods

The girth measurement was taken by wrapping a “[Measuring tape](#)” around a plane perpendicular to the axis of the trunk of trees at the correct height comprising minimum area of one canal with randomly distributed trees. Measuring tape directly reads diameter in given increments of desired unit of measurement (millimeters or inches). Many trees were with burls, bumps and knots along trunk region, girth measurement was then taken at the narrowest point below the odd growth and height of the girth was noted. Since the purpose of a girth measurement was to get a full measure of the tree’s trunk, measurements were taken at the narrowest point below any significant branching. While taking girth

measurement at a non-standard height the height was noted above the base of the tree. Dead branches, epicormic sprouts and suckers were ignored. Tree height and diameter at breast height (DBH) were measured of each tree. There was an imbalance in sample size due to missing values of trees height and DBH, a few of them were died or their tops were broken during the course of study.

Girths measurements of randomly selected trees were recorded along with DBH. Some useful observations (about the existing trees) related to different ethno botanical aspects were achieved from the native peoples. This was primarily done by carrying the colored photographs/videos of existing dominated trees in the observing areas to old men / sometimes women for the sake of their vernacular names and identification, for taxonomy services of a taxonomist was acquired also. All this was conducted mostly in Urdu (national language of Pakistan) or in Punjabi (native language) to make them understandable.

Tree's leaves, (if buds / flowers / seeds were present) then dried, pressed, preserved and taken to Institute of Agriculture, University of the Punjab for further verification of their vernacular and taxonomic names; along with their natural distribution, morphology and economic importance. Geographic Universal Transverse Mercator (UTM) coordinates system by using Arc GIS 9.3 software of selected sites were measured by using Magellan Global Positioning System (GPS) to digitized the Map of Lahore Municipal Authority (LMA) and then data regarding Lahore boundary were collected from Urban Unit Lahore (working under Government of the Punjab). Separate layers of GPS coordinates of selected sites, and the data about distribution of major families of trees of selected sites were further incorporated in the boundary map of Lahore to display results.

Results And Discussion

4.1 Floral Description

A total of 94 flora species and 43 families were found in six selected localities of Lahore given in the (Table 1 and 2); out of which 78 species were found in Model Town Park, 51 in Gulshan-e-Iqbal Park, 46 in Shalimar Garden, 53 in Nawaz Sharif Park, 58 in Nasir Bagh and 71 in Lahore Zoo. This information of floristic diversity is collectively represented in Table 2.

Out of 265 observed number of flora the significant highest number of trees existed in Lahore zoo, followed by Model town (54), Nasir Bagh (54), Nawaz Sharif Park (53), Gulshan-e-Iqbal (44) and the lowest in Shalimar Garden (36).

Table 1: Floristic List of Study Area

S #	Local Name	Botanical Name	Family
1	Aam	<i>Magnifera indica</i>	Anacardiaceae
2	Aaroo/Peach	<i>Prunus persica</i>	Rosaceae
3	Akhrot	<i>Juglans regia</i>	Juglandaceae
4	Almond	<i>Prunus dulcis</i>	Rosaceae
5	Amaltas	<i>Cassia fistula</i>	Fabaceae
6	Amla	<i>Phyllanthus emblica</i>	Euphorbiaceae
7	Arjun	<i>Terminalia arjuna</i>	Combretaceae
8	Ashoka	<i>Saraca indica</i>	Leguminoceae
9	Avocado	<i>Persea americana</i>	Laucerceae
10	Baid-e-Majnun	<i>Salix babylonica</i>	Salicaceae
11	Bakain	<i>Melia azedarach</i>	Meliaceae
12	Bamboo	<i>Dandroclamus citratus</i>	Poaceae
13	Banyan	<i>Ficus macrophylla</i>	Moraceae
14	Bel	<i>Aegle marmelos</i>	Rutaceae
15	Ber	<i>Zizyphus jujube</i>	Rhamnaceae
16	Bhera	<i>Terminalia bellirica</i>	Combretaceae
17	Bootle Neck Tree	<i>Sterculia rupestris</i>	Sterculiaceae
18	Bottle Brush	<i>Callistemon citrinus</i>	Myrtaceae
19	Budha Tree	<i>Chorisia apeciosa</i>	Bombaceae
20	Burghud	<i>Ficus benghalensis</i>	Moraceae
21	Burna	<i>Crataeava religiosa</i>	Capparaceae
23	Cassia Tree	<i>Cassia javanica</i>	Fabaceae
24	Cherry	<i>Prunus serotina</i>	Rosaceae
25	Chhiku	<i>Achras sapota</i>	Sapotaceae
26	Chinar	<i>Platanus orientalis</i>	Platanaceae
27	Chir	<i>Pinus roxburghii</i>	Pinaceae
28	Cypress	<i>Cupressus funebris</i>	Cupressaceae
29	Darris	<i>Darris robusta</i>	Fabaceae
30	Dhaak	<i>Butea frondosa</i>	Fabaceae
31	Dheu	<i>Artocarpus lakoocha</i>	Moraceae
32	Dhokra	<i>Anogeissus acuminata</i>	Combretaceae
33	Ditabark/Devil	<i>Alstonia scholaris</i>	Apocynaceae
34	Gab	<i>Diospyros peregrina</i>	Ebenaceae
35	Gamhar	<i>Trewia nudiflora</i>	Euphorbiaceae
36	Gold Mohr	<i>Delonix regia</i>	Fabaceae
37	Gul Nishter	<i>Erythrina suberosa</i>	Fabaceae
38	Gul-e-Cheen	<i>Plumeria rubra</i>	Apocynaceae
39	Gul-e-Fanoos	<i>Kigelia pinnata</i>	Bignoniaceae
40	Gul-e-Must	<i>Dillenia indica</i>	Dilleniaceae
41	Gul-e-Neelam	<i>Jacaranda minosifolia</i>	Fabaceae
42	Gulhar	<i>Benjaminia comosa</i>	Moraceae
43	Imli	<i>Tarminus indica</i>	Fabaceae
44	Jamun	<i>Syzygium cumini</i>	Myrtaceae
45	Jand	<i>Prosopis spicigera</i>	Fabaceae
46	Jungli Badam	<i>Terminalia catappa</i>	Combretaceae
47	Kachnar	<i>Bauhinia alba</i>	Caesalpiniaceae
48	Kafoor	<i>Cinnammomum camphora</i>	Laucerceae

49	Kaghzi Tut	<i>Broussonetia papyrifera</i>	Moraceae
50	Kamila	<i>Mallotus philippinensis</i>	Euphorbiaceae
51	Khair	<i>Acacia catechu</i>	Fabaceae
52	Kharak	<i>Celtis australis</i>	Cannabaceae
53	Kiker	<i>Acacia nilotica</i>	Fabaceae
54	Kunk Champa	<i>Pterospermum acrofluim</i>	Sterculiaceae
55	Kussum	<i>Schleichera oleosa</i>	Sapindaceae
56	Lasura	<i>Cordia oblique</i>	Boraginaceae
57	Litchi	<i>Naphelium litchi</i>	Sapindaceae
58	Locat	<i>Eriobotrya japonica</i>	Rosaceae
59	Magnolia	<i>Magnolia grandiflora</i>	Magnoliaceae
60	Mahogoni Tree	<i>Swietenia mahogoni</i>	Meliaceae
61	Mahwa	<i>Bassia latifolia</i>	Sapotaceae
62	Maple	<i>Acer negundo</i>	Aceraceae
63	Molsari	<i>Mimusops elengi</i>	Sapotaceae
64	Mulbery	<i>Morus alba</i>	Moraceae
65	Nag Phali	<i>Heterophargama adenopyllum</i>	Bignoniaceae
66	Najor	<i>Bursera serrata</i>	Burseraceae
67	Nashpati/Pear	<i>Pyrus communis</i>	Rosaceae
68	Neem	<i>Azadirachta indica</i>	Meliaceae
69	Oncoba	<i>Oncoba sipnosa</i>	Flacourtiaceae
70	Palm Trees	<i>Arecaceae</i>	Arecaceae
71	Papaya	<i>Carica papaya</i>	Caricaceae
72	Paper Bark	<i>Melaleuca leucadendron</i>	Myrtaceae
73	Parkinsonia	<i>Parkinsonia aculeate</i>	Fabaceae
74	Phulai	<i>Acacia modesta</i>	Fabaceae
75	Pilkhan	<i>Ficus virens</i>	Moraceae
76	Popular	<i>Populus alba</i>	Salicaceae
77	Putajan	<i>Putranjiva roxburghii</i>	Euphorbiaceae
78	Rubber	<i>Ficus elastic</i>	Moraceae
79	Rukh-e-Zard	<i>Acacia retinodes</i>	Fabaceae
80	Samundar Phal	<i>Barringtonia acutangula</i>	Lecythidaceae
81	Shah balut	<i>Grevillea robusta</i>	Protaceae
82	Shahtut	<i>Morus macroura</i>	Moraceae
83	Shareen	<i>Prosopis julifera</i>	Fabaceae
84	Shisham	<i>Dalbergia sisso</i>	Fabaceae
85	Simal	<i>Salmalia malabarica</i>	Bombaceae
86	Sohanjana	<i>Moringa oleifera</i>	Moringaceae
87	Sufaida	<i>Eucalyptus camaldulensis</i>	Myrtaceae
88	Sumbul	<i>Bombax malabaricum</i>	Malvaceae
89	Talwar Phali	<i>Oroxylum indicum</i>	Bignoniaceae
90	Taxodium	<i>Taxodium mucronatum</i>	Taxodiaceae
91	Teak	<i>Tectona grandis</i>	Verbenaceae
92	Toon	<i>Cedrela toona</i>	Meliaceae
93	Ulta Ashok	<i>Polyalthia longifolia</i>	Annonaceae
94	White Siris	<i>Albizia procera</i>	Mimosaceae

The significant highest dominant number of floral specie out of 265 in all observed study areas is Fabaceae (76) family followed by Moraceae (29), Malvaceae (21), Meliaceae (19), Myrtaceae (18),

Bignoniaceae (16), Combretaceae (15) and Sapotaceae (11). Whereas significantly equal number of these both families “Apocynaceae (9) and Rosaceae (9)” was observed in studied areas. Similarly significant equal distribution of four families “Rhamnaceae (7), Sapindaceae (7), Euphorbiaceae (7) and Lamiaceae (7) were observed in all studied areas. Significantly the lowest number of family “[Capparaceae](#)” (4) was observed respectively.

Shalimar Garden is the ancient place in Lahore, built in Moughal Regime about 300 years ago, yet the garden is encircled by congested populated areas and thick vegetation was ruined due to extensive visits of local and by the Horticulture Authority to decorate it according to new fashion for foreigners. Similarly seasons has great effects on plants in the form of high storms, heavy rains and highest temperature. Termite is also a reason to withers the trees in Lahore as this garden is situated near to River Ravi (Mubin et al 2015). Lahore Zoo and Nasir Bagh are also historical parks built in The British Regime about 100 years ago yet both are visited extensively by the natives and visitors who come from far away areas too. These both are also encircled by densely populated areas, the traffic is thick and smoke is damaging the flora including the seasons which have been changed due to the global warming. These observation are consistent with Nemat et al. (2015) and Joshua and Ali. (2011).

Table 2: Different plant families in selected parks.

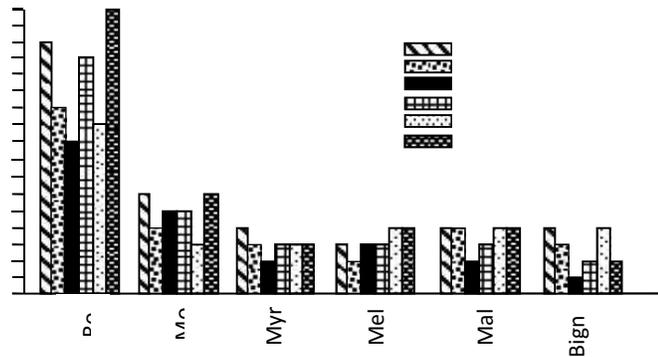
Family	No. of Species					
	Model Town Park	Gulshan-e-Iqbal Park	Shalimar Garden	Nawaz Sharif Park	Nasir Bagh	Lahore Zoo
Fabaceae	15	11	9	14	10	17
Moraceae	6	4	5	5	3	6
Myrtaceae	4	3	2	3	3	3
Apocynaceae	1	1	1	2	2	2
Meliaceae	3	2	3	3	4	4
Rosaceae	1	2	4	-	1	1
Malvaceae	4	4	2	3	4	4
Rhamnaceae	1	1	1	1	1	2
Sapindaceae	3	-	1	1		2
Bignoniaceae	4	3	1	2	4	2
Combretaceae	3	2	2	2	3	3
Sapotaceae	2	2	2	1	3	1
Salicaceae	1	1	2	1	2	3
Euphorbiaceae	2	1	-	1	1	2
Capparaceae	1	-	-	-	2	1
Lamiaceae	2	1	1	1	1	1

Note: Only the families with two or more representatives are shown. (-) symbol shows absence of a species.

Whereas Nawaz Sharif Park and Model Town Park both built about 15 years ago and thinly populated organized areas encircle them, the visits are done only by the natives, therefore flora is secured except the seasonal influence. The flora in Model Town Park comprised of 78

plant species and 37 families. Five families Fabaceae (15 species), Moraceae (6 species), Myrtaceae, Malvaceae and Bignoniaceae (4 species each) comprised 32 % of plant species in this park. Three floral families have three and two representatives each and remaining twenty seven families have one specie each. 51 species and 26 families of flora make up the floristic base of Gulshan-e-Iqbal Park in which Fabaceae is the dominant family with 11 species followed by Moraceae and Malvaceae (4 species each); Myrtaceae and Bignoniaceae (3 species each).

In Shalimar Garden, total a total of 46 species with 24 families were found. The floristic family pattern of Shalimar Garden revealed that Fabaceae (9 species), Moraceae (5 species), Rosaceae (4 species) and Meliaceae (3 species) comprised 26.1% of species diversity. Other families with two species each were five in number and fifteen families



with only one specie were found in this locality. The flora in Nawaz Sharif Park comprised of 53 species and 27 families. Only two species are worth mention i.e., Fabaceae (14 species) and Moraceae (5 species), and only these two species constitute 35.9% flora of this locality. Three floral families have three and two representative species each and nineteen families have only one specie each. 58 species and 29 families were found in Nasir Bagh during this survey.

Among families, Fabaceae is the only one with specie number in double (10 species). Meliaceae, Marvaceae and Bignoniaceae are floristic families with four species each. In this way, these four families comprised 24.1% flora in this locality. Other four families have three species each, three families with four species each and seventeen families have only one specie each. In Lahore zoo, 71 floral species and 33 families were found and the family pattern in this locality showed that Fabaceae is the most dominant with seventeen species, followed by Moraceae (6 species), Meliaceae and Malvaceae (4 species each). In this way, they comprised 38% flora in Lahore zoo. The remaining three families have three species representation, five families with two species each and twenty one families in this locality represents only one specie each (Figs. 3, 4).

Among 43 recorded families in six selected localities of Lahore, Fabaceae is the most dominant one with 15 species (contributing 16.5% of the total flora of study area) followed by Moraceae with 8 species (constitutes 8.8% of flora of Lahore). Rosaceae is third in ranking with 5 species (5.5%) and Comretaceae, Euphorbiaceos, Meliaceae and Myrtaceae have 4 species (4.4%) each. Three families Bignoniaceos, Sapotaceae and Salicaceae have 3 species (constitutes 3.3% flora) each; and Apocynaceae, Bombaceae, Laucerceae, Sapindaceae, and Sterculiaceae have 2 species each i.e., contributing 2.2% flora of study area; while other 28 families have only one species each (Fig. 4).

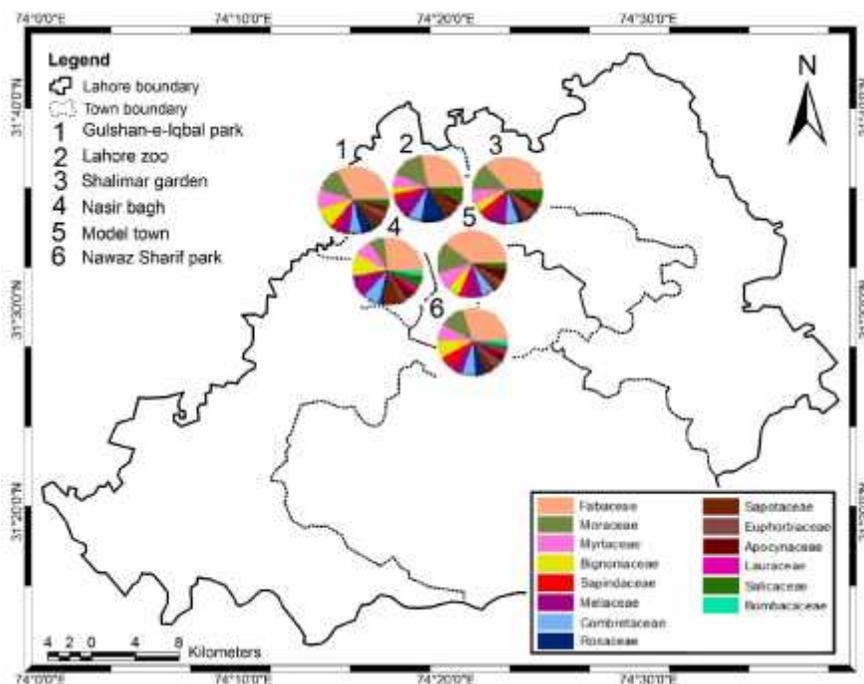


Figure 4: Distribution of major families in selected sites of Lahore.

4.2 Diameter at breast height

The diameter at breast height of selected measured trees in six localities of Lahore showed great variation, not only in comparison of each other's but also among different trees in the same location. The largest girth recorded was 251.7 inch in Nawaz Sharif Park while the lowest value was 29.3 inch in Shalimar garden (Fig. 7).

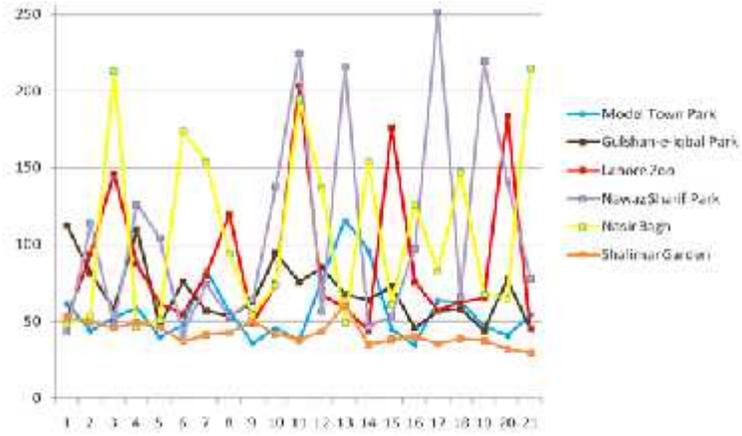


Figure 5: Distribution of Diameter at Breast Height (DBH) of some selected trees



Figure 6: Distribution of tree in different size classes

CONCLUSION

The present study shows that total 94 plant species are present in selected sites of Lahore belonging to 43 families, among which Fabaceae is the dominating family with 15 members (16.5%), followed by Moraceae and Rosaceae with 8 and 5 species respectively. Model Town Park is attributed to the variety of factors because it is the largest park as compared to other parks in Lahore. The presence of 94 floral species and 43 families indicate a fairly diverse vegetation cover which should be given certain level of protection for sustainability. The precious plant wealth is in danger in Lahore with rapid rate of urbanization which causes deforestation. The growing preference of using alien in place of native flora in urban areas has intensified the urbanization-mediated invasions. It is also a matter of fact that knowledge and effort to prevent loss of plant wealth is on initial stage. Still there is time to take revolutionary steps to educate people to abide by the rules and regulations.

This study is first effort to record data related to number of floral species and families in the parks of Lahore. Previous researches can display an overall picture of floral conditions and generate hypothesis about it but they cannot get specific results at micro level data at local scale. Its significance increases with the use of ArcGIS spatial statistical tools which can be used for future research for producing local scale predictive risk model for estimating deforestation because of urban sprawl and increasing road networks. Furthermore, study might be explored at other districts and/or localities within Lahore as this effort is an initial step in collecting micro level data of floral species.

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