INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print), 2222-5234 (Online)
http://www.innspub.net
Vol. 14, No. 3, p. 310-324, 2019

RESEARCH PAPER OPEN ACCESS

A comprehensive survey of floristic diversity evaluating the role of institutional gardening in conservation of plant biodiversity

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Key words: Mansehra, Floristic, inventory, Medicinal plants, habit.

http://dx.doi.org/10.12692/ijb/14.3.310-324 Article published on March 27, 2019

Abstract

Identification of flora is generally considered necessary around the globe, as it plays an important role to maintain the national reserves of the area. An inventory of the plant species in GPGC Mansehra, Khyber Pakhtunkhwa, Pakistan was made during fruiting and flowering seasons from 2017-2018.The human culture not necessarily decorate the floristic composition of an area but also preserves the biodiversity. In this context the study area was selected in order to investigate the cultural influences on the plant biodiversity. A total of 133 plant species belonging to 52 families were recorded. Habit wise classification showed 90 species were herbs, 25 species of trees and shrubs 19 plant species. The most leading family was Asteraceae with 16 plant species followed by Poaceae with 13 plant species, Solanaceae and Malvaceae with 7 plant species. Among vascular plants Angiosperms were dominated the area by contributing 120 plant species and gymnosperms with 4 plant species. Wild and dicot species are enriched as compared to cultivated and monocots. A sum of 74 medicinal plant species belonging to 37 families were documented. Biological spectrum showed that Therophytes (64%) were dominant followed by Hemicryptophytes (15%), Megaphanerophytes (12%), and Cryptophytes (5%), Geophytes (1%). According to the criteria of IUCN 14 plant species reported as threatened from study area being cultivated. The study aims to provide firsthand data and checklist of different plant species present in the area. This pioneer floristic information will provide a useful starting point for further ecological and bio-prospective researches and will serve as base line for the future researches.

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Introduction

District Mansehra is located in Hazara division of the Khyber Pakhtunkhwa Province, Pakistan. It is located 34.33 latitude and 73.20 longitude and it is situated at elevation of 1088 meters above sea level. The District spread over an area of 5959 km² and has been blessed with high mountains, lakes, beautiful valleys, plains and more especially the rich and harmonious combination of tall and stately fine trees, (Shah and Khan, 2006). Mansehra makes its boundary on the north to Kohistan and Battagram Districts, on the east to Muzaffarabad District of Azad Jammu & Kashmir, on the south to Abbottabad and Haripur districts and on the west to Shangla and Buner Districts. From the north east, Musa-ka-Musala a peak (4080 meters), which lies along the north eastern side of Konsh and Bhogarmang valleys (Mustafa, 2003). On the western side of Agror valley (Oghi) there is a famous black mountain range which runs northwards (Mustafa, 2003). The climate of the district is moist temperate with seasonal periods of rainfall, snow, and drought (Mustafa, 2003). District has two distinct seasons; the summer season which lasts from April to September and winter season which is from October to March.

Government College Mansehra was established in 1958. Initially it was an Intermediate college but in 1973 it was upgraded to Degree level. The college was upgraded to Postgraduate level in 1989. Pursuing the Education Policy imperatives when Government of Khyber Pakhtunkhawa launched B.S Program in 2010, this College was amongst the pioneers which took the initiative and started the BS program with full vigor and enthusiasm. This college has multiple grand buildings which have been beautified and renovated through special repair. The lawns, fountains, passages, orchids, rose gardens and playgrounds reflect a special look of the college campus. The college is located at a beautiful site just five kilometer away from the city and it is easily accessible. The spacious 132 kenal site of the college campus is lush green which has been subjected to special renovation and beautification. Floristic composition reflects the diversity of vegetation of an area and can be affected by many factors such as overgrazing, soil deterioration, deforestation and dependence of local people/pastoralists on plants. The identification of local plants along with description of an area is essential as it can provide particular species of the local area, growing season, species hardness, any new species establishing in the area and the effect of climatic conditions like over-grazing and drought on vegetation there (Ali, 2008).The knowledge of floristic composition is essential to understand the ecosystem of the area. Floristic diversity reflects the variety of vegetation of a specified geographical location, which provides a platform for proper identification and sustainable utilization of plants (Rafay *et al.,* 2013).

The knowledge of flora of any region is significant for the study of biodiversity and understanding of the prevailing environment (Thakur *et al.,* 2012). Such studies are not only a good source of botanical information of a geographic region but may also provide a suitable starting point for further comprehensive studies. Hence, floristic inventory is a taxonomic study of a major division of flora in a specified area (Panda *et al.,* 2014). The diversity and ecological characteristics of the plants of a particular area depend upon environmental conditions, including altitude and climate. Thus ecological characteristics, such as life form, leaf spectra and phenological pattern, can be used as indicators of prevailing environmental conditions. Flora refers to all plant life occurring in any particular geographic region at a specific geological period and includes the number of species.

In contrast the concept of life form was first introduced by Humboldt with the term vegetative form. It ranked next to floristic composition in ecological studies and is the outcome of the adaptation of plants to certain climatic conditions. The life form of a plant reflects the climate of the area and is also useful in comparing the geographical distribution of plant communities. Traditionally it was used in the description of vegetation structure at the community level. The most compact and

consistent classification of life form is that of Raunkiaer, which is based on the degree of presence and protection of perenating buds (Amjad *et al*., 2017). Ethnobotany is the science, which studies the relationship between a given society and its environment, particularly the plant world. Indigenous knowledge is as old as human civilization but the term ethnobotany was first coined by an American Botanist Harshburge, for the study of plants used by primitive and aboriginal people. Later scientists redefined ethnobotany by using modern ecological terms, and ethnobotany was described as "The study of direct interaction between human and plant population through its culture; each human population develops attitudes and beliefs and learns the use of plants, while human behavior has a direct impact on the plant communities with which they interact; the plant themselves also impose limitations on humans; these mixture interaction are the Hocking concluded in his work of 1950 that 84% of Pakistan's population was dependent on traditional medicines for all or most of their medicinal needs. Ethnomedicinal studies are of significant value to discover contemporary drugs from indigenous medicinal plant resources. There are appropriate sources of information about useful medicinal plant species, which can be targeted for management and domestication. The documentation of traditional knowledge of native plant species has contributed a number of vital drugs. Currently, 25% of herbal drugs in modern pharmacopeia are plant based and several synthetic drugs are manufactured by using chemical substances isolated from plants. The fundamental role of natural products in the development of new drugs has been reported. In recent era, the role of medicinal plant species in traditional health practice has diverted the attention of researchers towards ethno medicines (Qureshi *et al.,* 2008). No work has been done on floristic diversity and uses of medicinal plants from educational institutional previously from Pakistan. This study is aimed to analyze the floristic diversity and traditional knowledge of most commonly used medicinal plants of unique to study area. Moreover, it is first ever attempt to document the wild and ornamental flora of GPGC Mansehra.

Material and method

Field and data collection

The study was carried out in Government Post Graduate College, the commodious 132 kenal piece of ground of the college campus is lush greenish which has been themed to particular restoration and adornment. During field survey some materials was used; Field notebook, pencil, plant presser, polythene bags, newspaper, knife, trowel, gloves, twig cutter, digital camera, tags, cutter, questionnaire and herbarium sheet. The data collection done by simple field survey method which was conducted in flowering season Moon soon spring seasons of 2017-2018 for collection of diverse plant species. At the flowering stage the plants were collected. The students, teachers and local community from suburb of the study area were interviewed for ethno medicinal information of plants by using different questionnaires. The plants were arranged into life and leaf spectra classes after following Runkiaer (1934) and Hussain (1989).

Identification and preservation

The plants were properly dried, poisoned and mounted on Herbarium sheets. The plants were identified with the help of flora of Pakistan (Nasir and Ali, 1970– 1994; Ali and Qaisar, 1995– 2011) and deposited with Herbarium GPGC Mansehra.

Photography

The photography of plants was done with digital camera.

Data analysis

The data was statistically analyzed using MS Excel 2013.

Results and discussions

Floristic composition is a good floristic marker, because any kind of changing floristic compositions in different endogenous milieu show the existence of different ecological factors; leads to inter-and intra-specific diversity (Safidkon *et al*., 2003). Floristic study of any given area helps to evaluate the plant wealth and its potential values.

Table 1. Floristic diversity checklist of GPGC Mnasehra.

S.No.	Botanical Name	Families	Local Name	Habit
1	*Ailanthus altissima* (Mill.) Swingle	Simaroubaceae	Deravaa	T
2	*Adiantum capillus-veneris* L.	Adiantaceae	Kokva	H
3	*Alternanthera pungens* Kunth	Amaranthaceae	Taraka	H
4	*Amaranthus cannabinus* (L.) Sauer	Malvaceae	Ganhar	H
5	*Amaranthus viridis* L.	Amaranthaceae	Green amaranth.	H
6	*Araucaria columnaris* (G.Forst.) Hook.	Araucariaceae	Cook pine	T
7	*Artemisia absinthium* L.	Asteraceae	Chahuu	H
8	*Chrysopogon aucheri* (Boiss.) Stapf	Poaceae	Beknai boti	H
9	*Cedrus deodara* (Roxb. ex D.Don) G.Don	Pinaceae	Diyar	T
10	*Cycas revoluta* Thunb.	Cycadaceae	Sago palm	T
11	*Cannabis sativa* L.	Cannabaceae	Bhang	H
12	*Capsella bursa-pastoris* (L.) Medik.	Brassicaceae	Shepherd purse	H
13	*Chenopodium album* L.	Amaranthaceae	Bathwa	H
14	*Cichorium intybus* L.	Asteraceae	Kasni	H
15	*Citrus sinensis* (L.) Osbeck	Rutaceae	Malta	T
16	*Citrus limon* (L.) Osbeck	Rutaceae	Khatti	T
17	*Convolvulus arvensis* L.	Convolvulaceae	Field bindweed	H
18	*Conyza canadensis* (L.) Cronquist/erigron	Asteraceae	Malochai	H
19	*Cordyline fruticosa* Göpp.	Asteraceae	Good luck plant	S
20	*Cynodon dactylon* (L.) Pers.	Poaceae	Khabal	G
21	*Cyperus niveus* Retz.	Poaceae		H
22	*Cyperus rotundus* L.	Cyperaceae	Della	H
23	*Duchesnea indica* auct.	Cyperaceae	Mock strawberry	H
24	*Datura stramonium* L.	Solanaceae	Tatoora	H
25	*Dichanthium annulatum* (Forssk.) Stapf	Solanaceae	Marvel grass	H
26	*Diospyros lotus* L.	Ebenaceae	Amlok	T
27	*Dryopteris filix-mas* (L.) Schott	Ebenaceae		H
28	*Ducrosia anethifolia* (DC.) Boiss.	Apiaceae	Kugoo	H
29	*Eriobotrya japonica* (Thunb.) Lindl.	Rosaceae	Lokaath	T
30	*Euphorbia milii* Des Moul.	Euphorbiaceae	Dodhal	H
31	*Euphorbia prostrata* Aiton	Euphorbiaceae	Tadri booti	H
32	*Foeniculum vulgare* Mill.	Apiaceae	Saunf	H
33	*Juglans regia* L.	Juglandaceae	Khor	T
34	*Kalanchoe blossfeldiana* Poelln.	Juglandaceae	Flaming Katy	H
35	*Lactuca serriola* L.	Asteraceae	Hand	H
36	*Malva neglecta* Wallr.	Malvaceae	Sonchal	H
37	*Malva parviflora* L.	Malvaceae	Cheeseweed	H
38	*Malvastrum coromandelianum* (L.) Garcke	Malvaceae	Sweet broomweed	H
39	*Medicago sativa* L.	Malvaceae	Burclover	H
40	*Melia azedarach* L.	Meliaceae	Batkalar	T
41	*Mentha longifolia* f. zomborensis Topitz	Lamiaceae	Jungli podina	H
42	*Mentha spicata* L.	Lamiaceae	Podina	H
43	*Mirabilis jalapa* L.	Nyctaginaceae	Dodli booti	H
44	*Morus alba* L.	Moraceae	Chitta toot	T
45	*Morus nigra L.*	Moraceae	Kala toot	T
46	*Oxalis corniculata* L.	Oxalidaceae	Khat kurla	H
47	*Pinus roxburghii* Sarg.	Pinaceae	Cheer	T
48	*Plantago lanceolata* L.	Plantaginaceae	Chamchapathar	H
49	*Plantago major* L.	Plantagonaceae	3 patroo	H
50	*Platanus orientalis* L.	Platanaceae	Chennar	T
51	*Polygonum aviculare* L.	Polygonaceae	Rattro	H

52	*Polygonum plebeium* R.Br.	Polygonaceae	Common knotweed	H
53	*Populus* × acuminata Rydb.	Polygonaceae	Safeda	T
54	*Ricinus communis* L.	Euphorbiaceae	Gandi booti	H
55	*Rosa cymosa*	Euphorbiaceae	Elderflower rose	H
56	*Rosa indica* Lindl.	Rosaceae	Gulaab	S
57	*Rumex dentatus* L.	Rosaceae	Toothed dock	H
58	*Rumex dentatus* L.	Polygonaceae	Hoola	H
59	*Rumex hastatulus* Baldwin	Polygonaceae	Khatimal	H
60	Rumex nepalensis Spreng.	Polygonaceae		H
61	*Ranunculus muricatus* var. brasilianus DC.	Ranunculaceae	Dami booti	H
62	*Sambucus wightiana* Wall. ex Wight & Arn.	Caprifoliaceae	Jan mera	H
63	Solanum nigrum L.	Solanaceae	Kacha mach	H
64	*Solanum surattense* Burm. f.	Solanaceae	Yellow fruit nightshade	H
65	*Stellaria media* (L.) Vill.	Caryophillaceae	Bago booti	H
66	*Taraxacum officinale* (L.) Weber ex F.H.Wigg.	Asteraceae	Hand	H
67	*Thuja orientalis* L.	Cupressaceae	Cheelai	S
68	*Trifolium repens* L.	Papilionaceae	Shaftal	H
69	*Triticum aestivum* L.	Poaceae	Karak	H
70	Verbena officinalis L.	Verbenaceae	Charoo	H
71	*Veronica persica* Poir.	Plantoginaceea.	Akoor	H
72	*Veronica polita* Fr.	Scophulariaceae	Akoor	H
73	*Vicia faba* L.	Paplionaceae	Jangali mattar	H
74	*Xanthium strumarium* Lour.	Asteraceae	Bandar booti	S

The local plants identification and introduction of an area is very important to introduce the specific species of local area and their occurrence, growing seasons, finding new species and also the effect of climatic conditions like over-grazing, drought and temperature etc. on vegetation (Ali, 2008; Ahmad *et al.,* 2008). Many workers have contributed comprehensive floristic checklists of local flora in different regions (Baig *et al.*, 1998; Qureshi & Bhatti, 2008; Abdullahi *et al.,* 2009; Jabeen *et al.,* 2009; Shaheen & Qureshi, 2011; Udayakumar *et al.,* 2011; Qin *et al.,* 2012; Youcef *et al.,* 2012).

Due to presence of diverse topographic features and microhabitats, the selected study area has a great potential for flourishing a rich plant biodiversity.

Table 2. ICUN Category of the flora of the study area.

S.No.	Families	NO.	Botanical Name	IUCN Category
1	Compositeae	1	Gazania rigens (L.) Gaertn.	LC
		2	Cichorium intybus L.	LC
		3	Taraxacum officinale (L.) Weber ex F.H.Wigg.	LC
		4	Helianthus annuus L.	LC
2	Euphorbiaceae	5	Euphorbia milii Des Moul.	DD
3	Pinaceae	6	Pinus roxburghii Sarg.	LC
		7	Cedrus deodara (Roxb. ex D.Don) G.Don	LC
4	Polygoniacae	8	Polygonum plebeium R.Br.	Lc
5	Cupressaceae	9	Thuja orientalis L.	NT
6	Juglandacae	10	Juglans regia L.	NT
7	Platanaceae	11	Platanus orientalis L.	LC
8	Cycadaceae	12	Cycas revoluta Thunb.	LC
9	Dryopteridaceae	13	Dryopteris filix-mas (L.) Schott	Secure
10	Adiantaceae	14	Adiantum capillus-veneris L.	Secure

11	Polygoniacae	15	Polygonum plebeium R.Br.	LC
12	Araucariaceae	16	Araucaria columnaris (G.Forst.) Hook.	LC
13	Poaceae	17	Digitaria ciliaris (Retz.) Koeler	Secure
14	Solanaceae	18	Brugmansia affinis (Soff.) Moldenke	EW

Pakistan has an important geographical position with rich floral diversity. More than 6000 vascular plants have been reported in the region (Stewart, 1972). About 80% of the endemic flowering plants of Pakistan are restricted to the northern and western mountains (Ali & Qaiser, 1986).

Various floristic studies are reported from Pakistan and contributed in the local flora, Such as Parker (1956), Stewart (1972), Bhatti *et al.,* (1998-2001), Shah & Khan (2006), Qureshi (2008),Zaheer & Sardar,(2008), Haq *et al.,* (2010), Fazal *et al.*,(2010), Qureshi & Bhatti, (2010), Saeedet *et al.,* (2012), Waris *et al.,* (2013), Khan *et al.,* (2013), Ilyas *et al.,* (2013), Shaheen *et al.,* (2011), Shaheen *et al.,* (2012), Tanvir *et al.,*(2014)and Zulfiqar *et al.*,(2015) Pakistan has an important geographical position with rich floral diversity.

Table 3. Biological spectrum of wild Flora of GPGC Mansehra.

S.No.	Botanical Name	Family	Habit	Life Form
1	*Adiantum capillus-veneris* L.	Pteridaceae	Herb	GE
2	Alternanthera pungens Kunth	Amaranthaceae	Herb	TH
3	Ailanthus altissima (Mill.) Swingle	Simaroubaceae	Tree	MP
4	*Artemisia absintium* L.	Asteraceae	Herb	H
5	Borago officinalis L.	Polytrichaceae	Herb	TH
6	Brachiaria spp.	Poaceae	Herb	H
7	Chrysopogon aucheri (Boiss.) Stapf	Poaceae	Grass	TH
8	*Cardamine impatiens* L.	Cycadaceae	Shrub	MP
9	Centaurea iberica Trevir. ex Spreng.	Brassicaeae	Herb	H
10	*Cannabis sativa* L.	Rutaceae	Herb	NP
11	*Capsella bursa- pistoris* (L) Medik	Cannabinaceae	Herb	TH
12	Conyza canadensis (L.) Cronquist	Pinaceae	Tree	MP
13	*Chenopodium album* L.	Asteraceae	Herb	TH
14	*Cichorium intybus* L.	Amaranthaceae	Herb	Th
15	Cordyline fruticosa Göpp.	Asteraceae	Herb	H
16	*Convolvulus arvensis* L.	Asteraceae	Herb	TH
17	*Erigeron canadensis* L.	Convolvulaceae	Herb	TH
18	*Cynodon dactylon* (L.) Pers.	Myrtaceae	Tree	MP
19	*Cyperus* sp.	Poaceae	Herb	H
20	*Duchesnea indica* auct.	Cyperaceae	Herb	C
21	Datura stramonium L.	Solanaceae	Herb	TH
22	Dichanthium annulatum (Forssk.) Stapf	Solanaceae	Herb	TH
23	Digitaria ciliaris (Retz.) Koeler	Poaceae	Grass	H
24	Digitaria sanguinalis (L.) Scop.	Poaceae	Grass	H
25	Dryopteris filix-mas (L.) Schott	Ebenaceae	Tree	MP

26	*Echinochloa crus-galli* (L.) P.Beauv.	Euphorbiaceae	Herb	TH
27	*Eragrostis cilianensis* (All.) Janch.	Poaceae	Grass	TH
28	Erigeron canadensis L.	Poaceae	Grass	TH
29	Euphorbia helioscopia L.	Asteraceae	Herb	TH
30	*Euphorbia prostrata* Aiton	Euphorbiaceae	Herb	MP
31	Ficus benjamina L.	Apiaceae	Herb	TH
32	Ipomoea purpurea (L.) Roth	Asteraceae	Shrub	TH
33	*Imperata cylindrica* (L.) Raeusch	Convolvulaceae	Herb	TH
34	*Lactuca serriola* L.	Lamiaceae	Herb	NP
35	Medicago lupulina L.	Asteraceae	Herb	H
36	Malva parviflora L.	Marchantiaceae	Herb	TH
37	Mentha longifolia f. zomborensis Topitz	Malvaceae	Herb	TH
38	Muscari neglectum Guss. ex Ten.	Lamiaceae	Herb	H
39	*Malvastrum coromandelianum* (L.) Garcke	Malvaceae	Herb	TH
40	*Medicago polymorpha* L.	Malvaceae	Herb	C
41	Medicago sativa L.	Papilionaceae	Herb	TH
42	*Mentha spicata* L.	Moraceae	Tree	MP
43	Mirabilis jalapa L.	Nyctaginaceae	Shrub	NP
44	*Oenothera rosea* L'Hér. ex Aiton	Onagraceae	Herb	TH
45	*Oxalis corniculata* L.	Oxalidaceae	Herb	TH
46	Parthenium hysterophorus L.	Asteraceae	Herb	TH
47	*Phalaris minor* Retz.	Poaceae	Tree	H
48	*Plantago lanceolata* L.	Plantaginaceae	Herb	TH
49	*Plantago major* L.	Pinaceae	Tree	MP
50	Polygonum plebeium R.Br.	Polygonaceae	Herb	TH
51	*Parthenium hysterophorus* Adans.	Asteraceae	Herb	TH
52	*Polygonum aviculare* L.	Asteraceae	Herb	TH
53	*Polygonum plebeium* R.Br.	Polygonaceae	Herb	TH
54	*Pteris cretica* L.	Salicaceae	Tree	MP
55	*Ricinus communis* L.	Pteridaceae	Herb	TH
56	Ranunculus muricatus var. brasilianus DC.	Rosaceae	Shrub	TH
57	Rumex nepalensis Spreng.	Ranunculaceae	Herb	TH
58	*Ranunculus muricatus* L.	Ranunculaceae	Herb	TH
59	*Rumex dentatus* L.	Ranunculaceae	Herb	TH
60	*Salvia splendens* Sellow ex Schult.	Polygonaceae	Herb	H
61	*Sambucus wightiana* Wall. ex Wight & Arn.	lamiaceae	Herb	TH
62	*Saussurea costus (Falc.) Lipsch.*	Adoxaceae	Herb	TH
63	Sisymbrium irio L.	Leguminosae	Herb	TH
64	Solanum nigrum L.	Brassicaceae	Herb	TH
65	*Solanum surattense* Burm. f.	Solanaceae	Herb	TH
66	Solanum americanum Mill.	Solanaceae	Herb	TH

67	*Sonchus oleraceus* (L.) L.	Solanaceae	Herb	C
68	*Sorghum halepense* (L.) Pers.	Asteraceae	Herb	TH
69	*Stellaria media* (L.) Vill.	Asteraceae	Herb	TH
70	*Taraxacum officinale* (L.) Weber ex F.H.Wigg.	Caryophyllaceae	Herb	TH
71	*Trifolium repens* L.	Leguminosae	Herb	TH
72	*Veronica persica* Poir.	Plantaginaceae	Herb	C
73	*Verbena tenuisecta* Briq.	Verbenaceae	Herb	TH
74	*Verbena officinalis* L.	Verbenaceae	Herb	TH
75	*Veronica polita* Fr.	Verbenaceae	Herb	TH
76	*Vicia faba* L.	Fabaceae	Herb	TH
77	Withania somnifera (L.) Dunal	Solanaceae	Shrub	TH
78	Xanthium strumarium Lour.	Asteraceae	Herb	TH

Key: TH=Therophytes ,C=Cryptophytes, H=Hemicryptophytes, MP=Megaphenerophytes.

Floristic diversity, as described by Ali *et al.* (2016), is the sum of all plants present in any geographic area, both wild and cultivated, which reflects the prevailing climatic conditions, edaphic characteristics, anthropogenic pressure and other natural stresses. Floristic inventory of plant species comprised of total 133 plant species belonging to 52 families. Habit wise herbs (90 species,62%) are more dominant than trees (25 species,17%) followed by shrubs (19 species,13%).

Grasses also commanding the area comprising about (11 species, 7%).

Table 4. Pioneer inventory of GPGC Mansehra.

S.No.	FAMILIES	S.NO	BOTANICAL NAMES	HABIT	LOCAL NAMES	Angio/Gymno	W/C	D/M
1	Compositae	1	Sonchus oleraceus (L.) L.	herb	Sow thistle	Angiosperm	wild	dicot
		2	Gazania rigens (L.) Gaertn.	shrub	Treasure flower	Angiosperm	cultivated	dicot
		3	Parthenium hysterophorus L.	shrub	Gandi booti/Lawani booti	Angiosperm	wild	dicot
		4	Parthenium hysterophorus Adans.	shrub		Angiosperm	wild	dicot
		5	Tagetes patula L.	herb	French marigold	Angiosperm	cultivated	dicot
		6	Cichorium intybus L.	herb	Blue weed	Angiosperm	wild	dicot
		7	Erigeron canadensis L.	shrub	Horse weed	Angiosperm	wild	dicot
		8	Taraxacum officinale (L.) Weber ex F.H.Wigg.	herb	Dandelion	Angiosperm	wild	dicot
		9	Helianthus annuus L.	shrub	Suraj mukhi	Angiosperm	cultivated	dicot
		10	Xanthium strumarium Lour.	shrub	Rough cocklebur	Angiosperm	wild	dicot
2	Solanaceae	11	Solanum nigrum L.	shrub	Kachmach	Angiosperm	wild	dicot
		12	Solanum americanum Mill.	shrub	Glossy nightshade	Angiosperm	wild	dicot
		13	Withania somnifera (L.) Dunal	shrub	Patakha	Angiosperm	wild	dicot
		14	Cestrum nocturnum L.	shrub	Raat ki rani	Angiosperm	cultivated	dicot
		15	Brugmansia affinis (Soff.) Moldenke	shrub	Golden angel's trumpet	Angiosperm	cultivated	dicot
3	Poaceae	16	Dichanthium annulatum (Forssk.) Stapf	grass	Sheda grass	Angiosperm	wild	dicot
		17	Sorghum halepense (L.) Pers.	grass	Johnson grass	Angiosperm	wild	monocot
		18	Cynodon dactylon (L.) Pers.	grass	Khabal	Angiosperm	wild	monocot
		19	Brachiaria	grass	Signalgrass	Angiosperm	wild	monocot
4	Polygoniacae	20	Rumex nepalensis Spreng.	herb	Hola	Angiosperm	wild	dicot
		21	Rumex dentatus L.	herb	Toothed dock	Angiosperm	wild	dicot
5	Malvaceae	22	Malvastrum coromandelianum (L.) Garcke	shrub	False mallow/clock plant	Angiosperm	wild	dicot
		23	Malva parviflora L.	herb	Cheese weed	Angiosperm	wild	dicot
		24	Alcea rosea L.	herb	Taraaka/kandyari booti	Angiosperm	cultivated	dicot
		25	Alternanthera pungens Kunth	herb	Khaki burr	Angiosperm	wild 19	dicot

		26	Amaranthus viridis L.	herb	Kanaar	Angiosperm	cultivated	dicot
		27	Amaranthus cannabinus (L.) Sauer	herb	Salt marsh pigweed	Angiosperm	cultivated	monocot
6	Euphorbiacae	28	Ricinus communis L.	shrub	Arhand/kashtarel/castor oil plant	Angiosperm	wild	dicot
		29	Euphorbia helioscopia L.	herb	Sun spurge	Angiosperm	wild	dicot
		30	Euphorbia milii Des Moul.	herb	Dodhal/chandni booti	Angiosperm	cultivated	
7	Asparagaceae	31	Beaucarnea recurvata Lem.	tree		Angiosperm	cultivated	monocot
		32	Cordyline fruticosa Göpp.	tree	Good luck plant	Angiosperm	cultivated	monocot
		33	Muscari neglectum Guss. ex Ten.	herb	Grape hyacinth	Angiosperm	wild	
8	Leguminosae	34	Medicago sativa L.	herb	Burclover/ lucerne	Angiosperm	wild	dicot
		35	Senegalia modesta (Wall.) P.J.H. Hurter	tree	Phulai	Angiosperm	cultivated	dicot
		36	Medicago polymorpha L.	herb	Toothed bur clove	Angiosperm	wild	dicot
9	Cyperacae	37	Cyperus rotundus L.	grass	Medi della	Angiosperm	wild	dicot
		38	Cyperus niveus Retz.	herb	Della	Angiosperm	wild	dicot
10	Convolvulaceae	39	Ipomoea purpurea (L.) Roth	herb	Purple morning glory	Angiosperm	wild	dicot
		40	Convolvulus arvensis L.	herb	Field bindweed	Angiosperm	wild	dicot
11	Verbenaceae	41	Verbena officinalis L.	herb	Mosquito plant/holy herb	Angiosperm	wild	dicot
		42	Verbena tenuisecta Briq.	herb	Moss verbena	Angiosperm	wild	dicot
12	Cannabacae	43	Cannabis sativa L.	herb	Bhang	Angiosperm	wild	dicot
13	Brassicacae	44	Sisymbrium irio L.	herb	Wild mustard	Angiosperm	wild	dicot
		45	Capsella bursa-pastoris (L.) Medik.	herb	Shephered purse	Angiosperm	wild	dicot
14	Rosaceae	46	Rosa indica Lindl.	shrub	Gulab	Angiosperm	cultivated	dicot
		47	Rosa cymosa	shrub	Elderflower rose	Angiosperm	cultivated	dicot
15	Pinaceae	48	Pinus roxburghii Sarg.	tree	Chir pine	Gymnosperm	cultivated	
		49	Cedrus deodara (Roxb. ex D.Don) G.Don	tree	Deodar	Gymnosperm	cultivated	
16	Lamiaceae	50	Salvia sclarea L.	herb	Clary sage	Angiosperm	cultivated	dicot
		51	Mentha longifolia f. zomborensis Topitz	herb	Podina	Angiosperm	wild	dicot
17	Chenopodiacae	52	Chenopodium album L.	herb	Hathu	Angiosperm	wild	dicot
18	Nyctaginaceae	53	Mirabilis jalapa L.	herb	4 o clock	Angiosperm	wild	dicot
20	Polygoniacae	54	Polygonum plebeium R.Br.	herb	Knotweed	Angiosperm	wild	dicot
21	Cupressaceae	55	Thuja orientalis L.	shrub	Oriental thuja	Gymnosperm	cultivated	
22	Rubiacae	56	Phyllis nobla L.	shrub		Angiosperm	cultivated	dicot
23	Juglandacae	57	Juglans regia L.	tree	Walnut/khor	Angiosperm	cultivated	dicot
24	Moracae	58	Ficus benjamina L.	tree	Weeping fid	Angiosperm	wild	dicot
26	Ebenacae	59	Diospyros lotus L.	tree	Amlok	Angiosperm	cultivated	dicot
27	Fabacae	60	Medicago lupulina L.	herb	Black medick	Angiosperm	wild	dicot
28	Lythraceae	61	Lagerstroemia indica L.	tree	Crepe myrtle	Angiosperm	cultivated	dicot
29	Liliaceae	62	Gagea lutea (L.) Ker Gawl.	herb	Yellow Star-of-Bethlehem	Angiosperm	cultivated	dicot
30	Oxalidacae	63	Oxalis corniculata L.	herb	Sleeping beauty/khatkurla	Angiosperm	wild	dicot
31	Ranunculacae	64	Ranunculus muricatus var. brasilianus DC.	herb	Buttercup	Angiosperm	wild	dicot
32	Cactaceae	65	Cactus abnormis Willd.	shrub		Angiosperm	cultivated	dicot
34	Simaroubaceae	66	Ailanthus altissima (Mill.) Swingle	tree	Tree of heaven	Angiosperm	wild	dicot
35	Meliaceae	67	Azadirachta indica A.Juss.	tree	Neem	Angiosperm	cultivated	dicot
36	Platanaceae	68	Platanus orientalis L.	tree	Oriental Plane/channar	Angiosperm	cultivated	dicot
37	Salicaceae	69	Populus × acuminata Rydb.	tree	Safeda	Angiosperm	cultivated	dicot
38	Cycadaceae	70	Cycas revoluta Thunb.	tree	Sago palm	gymnosperm	cultivated	
39	Myrtaceae	71	pasidium guajava	tree	Amrood/guava	Angiosperm	cultivated	dicot
		72	Corymbia citriodora (Hook.) K.D.Hill & L.A.S.Johnson	tree	Lemon eucalyptus	Angiosperm	cultivated	dicot
40	rutaceae	73	Citrus sinensis (L.) Osbeck	tree	Lemon	Angiosperm	cultivated	dicot
		74	Citrus limon (L.) Osbeck	tree	Khatti/lime	Angiosperm	cultivated	dicot
41	Dryopteridaceae	75	Dryopteris filix-mas (L.) Schott	fern	Worm fern	------	wild	
42	Pteridaceae	76	Pteris cretica L.	fern	Ribbon fern	------	wild	

	adiantaceae	77	Adiantum capillus-veneris L.	fern	Kokava/maidenhair fern	------	wild	
43	Agaricaceae	78	Agaricus campestris L.	mushroo ms	Gilled mushroom	------	wild	
44	polyporaceae	79	Polyporus phyllostachydis Sotome T. Hatt. & Kakish. sp. nov.	fungi		------	wild	
		80	Fomes fomentarius(L.)Fr.	fungi		------	wild	
45	Funariaceae	81	*Funaria hygrometrica* Hedw.	bryophyte	Bonfire moss	------	wild	
46	Marchantiacea e	82	*Marchantia polymorpha* L.	bryophyte	Liverworts	------	wild	
47	Polytrichaceae	83	*Polytrichum strictum* Menzies ex Brid.	bryophyte	Bog haircap moss	------	wild	
48	Boraginaceae	84	Borago officinalis L.	herb	Star flower	Angiosperm	wild	dicot
49	Compositae	85	Conyza canadensis (L.) Cronquist/erigron	herb	Canadian horseweed	Angiosperm	wild	dicot
50	Poaceae	86	Chrysopogon aucheri (Boiss.) Stapf	grass		Angiosperm	wild	monocot
51	Solanaceae	87	Datura stramonium L.	herb	Devil's snare	Angiosperm	wild	dicot
52	apiaceae	88	Ducrosia anethifolia (DC.) Boiss.	herb		Angiosperm	wild	dicot
53	Rosaceae	89	*Duchesnea indica* auct.	herb	Potentilla indica	Angiosperm	wild	dicot
54	Rosaceae	90	Eriobotrya japonica (Thunb.) Lindl.	tree	Lokat	Angiosperm	cultivated	dicot
55	Euphorbiacae	91	*Euphorbia prostrata* Aiton	herb	Prostrate spurge	Angiosperm	wild	dicot
56	Moracae	92	Ficus palmata Forssk.	tree	Punjab fig	Angiosperm	wild	dicot
57	apiaceae	93	Foeniculum vulgare Mill.	herb	Moti saunf	Angiosperm	cultivated	dicot
58	Moracae	94	Morus alba L.	tree	White mulberry	Angiosperm	cultivated	dicot
59	Moracae	95	*Morus nigra L.*	tree	Toot	Angiosperm	cultivated	dicot
60	Malvaceae	96	*Malva neglecta* Wallr.	herb	Common mallow	Angiosperm	cultivated	dicot
61	Lamiaceae	97	*Mentha spicata* L.	herb	Garden mint	Angiosperm	wild	dicot
62	Meliaceae	98	Melia azedarach L.	tree	Darake	Angiosperm	cultivated	dicot
63	*Papaveraceae*	99	*Papaver somniferum* L.	herb	Post/breadseed poppy	Angiosperm	cultivated	dicot
64	*Plantaginaceae*	100	*Plantago major* L.	herb	White man's foot	Angiosperm	wild	dicot
65	Plantaginaceae	101	Plantago lanceolata L.	herb	Lamb's tongue	Angiosperm	wild	dicot
66	Polygoniacae	102	*Polygonum aviculare* L.	herb	Birdweed	Angiosperm	wild	dicot
67		103	Polygonum plebeium R.Br.	herb	Common knotweed	Angiosperm	wild	dicot
68	Solanaceae	104	*Solanum surattense* Burm. f.	herb	Surattense nightshade	Angiosperm	wild	dicot
69	adoxaceae	105	*Sambucus wightiana* Wall. ex Wight & Arn.	herb	*Sambucus*	Angiosperm	wild	dicot
70	Leguminosae	106	Trifolium repens L.	herb	White clover	Angiosperm	wild	dicot
71	*Plantaginaceae*	107	*Veronica persica* Poir.	herb	Birds eye	Angiosperm	wild	dicot
72	onagraceae	108	*Oenothera rosea L'Hér. ex Aiton*	herb	Rose of Mexico	Angiosperm	wild	dicot
73	caryophillaceae	109	*Stellaria media* (L.) Vill.	herb	Chickweed	Angiosperm	wild	dicot
74	Brassicacae	110	*Cardamine impatiens* L.	herb	Narrow-leaved bitter-cress	Angiosperm	wild	dicot
75	*Xanthorrhoeac eae*	111	*Aloe vera* (L.) Burm.f.	herb	Koor ghandal	Angiosperm	cultivated	dicot
76	Poaceae	112	Triticum aestivum L.	herb	Bread wheat	Angiosperm	cultivated	monocot
77	Compositae	113	*Artemisia absinthium* L.	herb	Chahuu	Angiosperm	wild	dicot
78	Araucariaceae	114	*Araucaria columnaris* (G.Forst.) Hook.	tree	Araucaria		cultivated	
79	Polygoniacae	115	*Rumex dentatus* L.	herb	Toothed dock	Angiosperm	wild	dicot
80	Leguminosae	116	*Vicia faba* L.	herb	Broad bean	Angiosperm	wild	dicot
81	*Plantaginaceae*	117	*Veronica polita* Fr.	herb	Grey Field-speedwell	Angiosperm	wild	dicot
82	Liliaceae	118	*Tulipa clusiana* DC.	herb	Lady tulip	Angiosperm	cultivated	monocot
83	Lamiaceae	119	*Salvia splendens* Sellow ex Schult.	shrub	Sage	Angiosperm	wild	dicot
84	*proteaceae*	120	*Grevillea robusta* A.Cunn. ex R.Br.	tree	Southern silky oak	Angiosperm	cultivated	dicot
85	*Crassulaceae*	121	Kalanchoe blossfeldiana Poelln.	herb	Christmas kalanchoe	Angiosperm	cultivated	dicot
86	Moracae	122	Ficus elastica Roxb. ex Hornem.	tree	Rubber plant	Angiosperm	cultivated	dicot
87	Poaceae	123	*Phalaris minor* Retz.	herb	Dammi booti	Angiosperm	wild	monocot
88	Poaceae	124	*Imperata cylindrica* (L.) Raeusch	grass	Kunai grass	Angiosperm	wild	monocot
89	Poaceae	125	*Echinochloa crus-galli* (L.) P.Beauv.	grass	Cockspur grass	Angiosperm	wild	monocot
90	Poaceae	126	*Eragrostis cilianensis* (All.) Janch.	grass	Candy grass/gray lovegrass	Angiosperm	wild	monocot
91	Poaceae	127	Digitaria ciliaris (Retz.) Koeler	grass	Finger-grass	Angiosperm	wild	monocot

92	Poaceae	128	*Avena sativa L.*	grass	Oats	Angiosperm	cultivated	monocot
93	Compositae	129	*Saussurea costus (Falc.) Lipsch.*	herb	Kuth	Angiosperm	wild	dicot
94	Compositae	130	Lactuca serriola L.	herb	Milk thistle	Angiosperm	wild	dicot
95	Compositae	131	*Cosmos sulphureus Cav.*	herb	Ellow cosmos	Angiosperm	cultivated	dicot
96	Compositae	132	Centaurea iberica Trevir. ex Spreng.	herb	Iberian star-thistle	Angiosperm	wild	dicot
97	Poaceae	133	Digitaria sanguinalis (L.) Scop.	herb	Hairy finger-grass	Angiosperm	wild	monocot

Among Pteridophytes, Adiantaceae, Dryopteraceae, Pteridaceae represented by 1 species each (Fig.1).

A total of 133 plant species Compositae (asteraceae) is the dominant family with 16 genera of 16 plant species (12.03%) is recorded. Poaceae is the second largest family comprising about 13 plant species (9.77%) with 13 genera. Solanaceae and Malvaceae is on 3rd largest families of the study area having 7 plant species (5.26%),followed by polygonaceae (2 genera) and lamiaceae(4 genera) with 5 plant species (3.75%), Preceded by Euphorbiaceae has 4 plant species with 2 genera (3.00%).

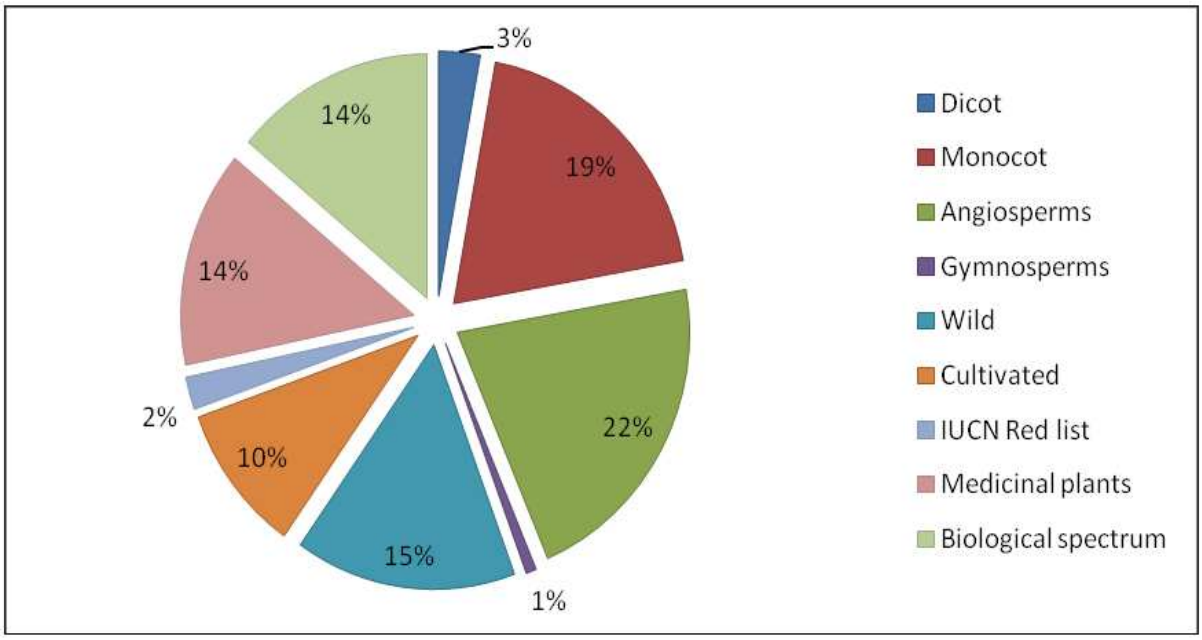

Fig.1. Floristic diversity of the GPGC Mansehra.

Based on plant growth habit wise 17.48% were recorded as trees, followed by shrubs 13.28%, herbs 62.93% including grass plains species abandoned lands and mismanaged lawns. Some of plant species were used as ornamentals, while some shrubs were use in fencing around fields some were utilized as green manure. Majority is dominated by herbs 62%.

Angiosperms dominates the area by 120 (90%) plant species whereas gymnosperms represented by only 4(3%) plant species.

Study area keeping a range of diverse flora which was roughly wild. The area was dominated by wild plant species in which 86 plant species (64.66%) were documented. The use of wild plants in the context of limited interaction with nature requires prior identification, while in the case of cultivated plants this can be omitted. Cultivated plant species were 55 (35.33%).

Traditionally, the angiosperms were subdivided into two classes, Liliopsida (the monocots) and Magnoliopsida (the dicots) (Cronquist, 1988). Monocots and Dicots are the primary groups of flowering plants. Monocots are recessive with 16 plant species (12.03%) whereas dicots dominating the area with 108 plant species.

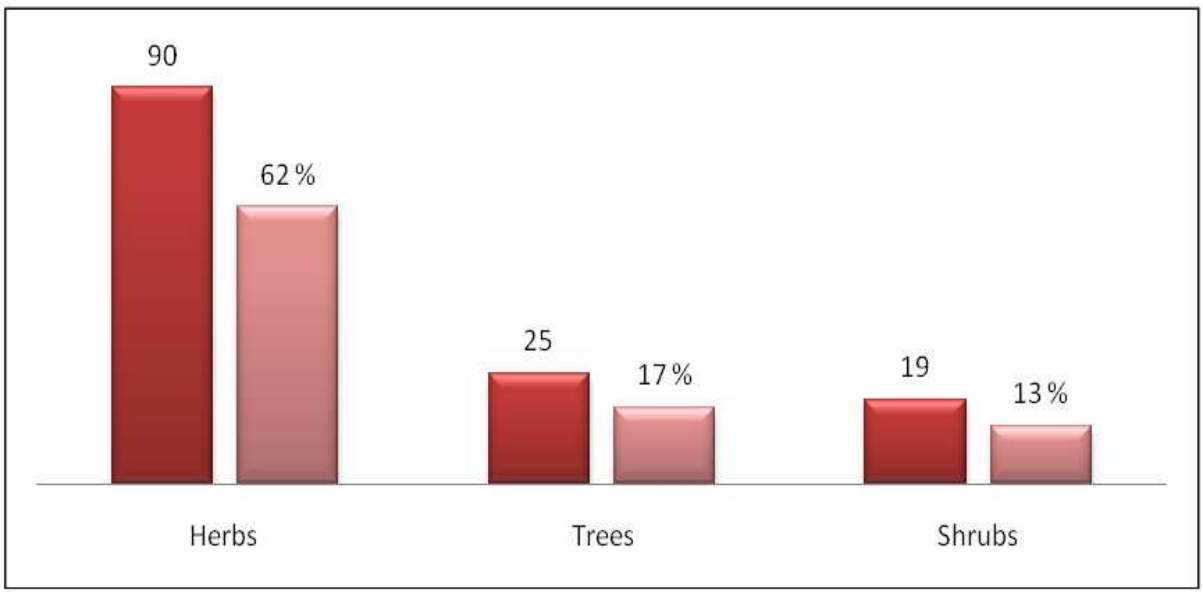

Fig. 2. Habit wise classification of the flora of GPGC Mansehra.

Juglans regia, Diospyrus lotus, Pasidium guajava,Corymbia citriodora,Citrus sinensis,Citrus limon, Eriobotrya japonica, Morus alba, Morus nigra are fruit yielding are some edible fruits. Our results are consistent with the postulates of Dutra *et al.*,(2015) showing that families such as Asteraceae, Poaceae, Malvaceae, Solanaceae, followed by Polygonaceae, Lamiaceae and Euphorbeaceae contribute with a large number of species in the whole vegetation.

This shows that environmental variations, in this specific case altitude, significantly influence in the distribution of species of the genus in question.

Asteraceae were dominant families with 16 plant species each, has lower relative importance with some favourable climatic conditions and due to cultivated plants that are conserved in the campus. Shaheen *et al.*,(2016), Iqbal *et al.*,(2015) and Ijaz *et al.*,(2016) also reported Asteraceae as the most leading family.

The Poaceae is second largest family with 13 wild plant species which indicates that some environmental factors are suitable for the grasses to grow which make them to grow in the area. Our findings are in agreement with a report of Stewart (1972) that these families were well represented in Pakistan, some other studies also indicated that these families were major families in the flora of Pakistan (Nasir & Ali, 1971-94; Ali & Qaiser, 1995-2004). According to plant habit, herbaceous growth habit with 90 species was the most d ominant one.

Our findings are congruent with many researchers of allied, neighboring and national regions (Ijaz, 2014; Ijaz *et al.,* 2015; Khattak *et al.*,2015; S.M. Khan *et al.*,2015; K.U. Khan *et al.*,2015; Shah *et al.*,2015; Ahmad *et al.*,2016 and Rahman *etal.*,2016).

The medicinal plant species (81.20%) belonging to 37 families.

IUCN affirmed some plants according to their conservation status. Some of those plant species are conserved in the study area being cultivated, there are 14 plant species reported *Euphorbia milli* is data deficient , whereas *Pinus roxburgi* ,*Cycas revoluta*, *Araucariacolumnaris* rumored least concern. *Polygonum plebeium is also grown wild. Thuja orientalis*, is near threatened. It means that the study area have environmental conditions favourable and if threatened plants are cultivated they may be conserved and further use.

The species of a community can be grouped in to several life forms on the basis of general appearance and growth.

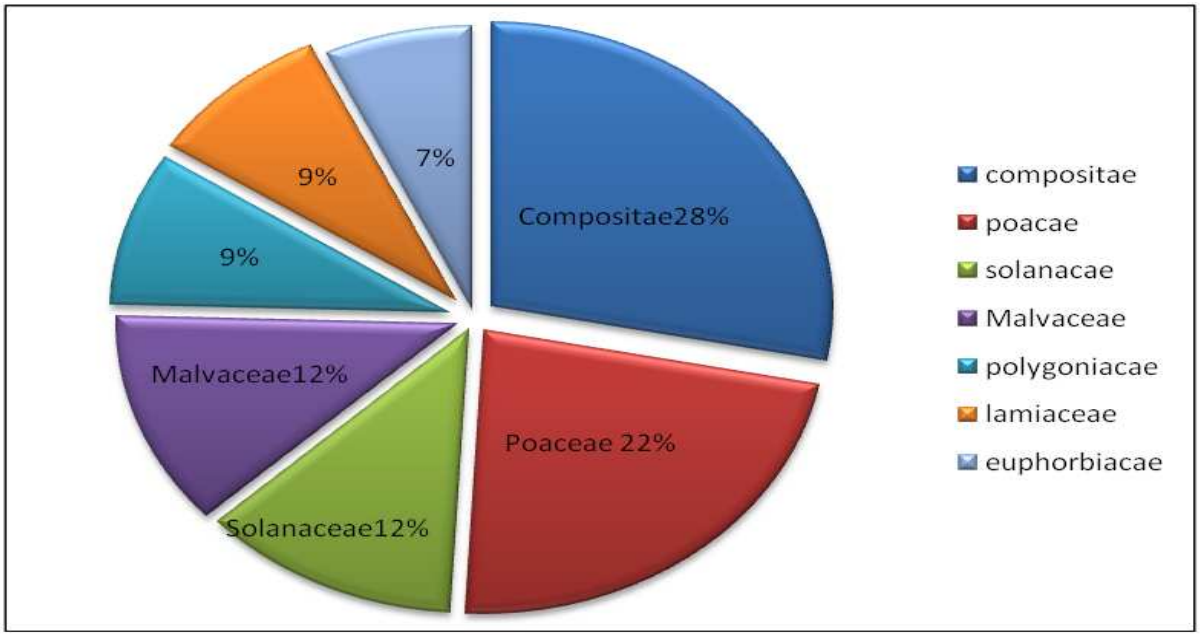

Fig. 3. Dominant families of the study area.

The leading life form were therophytes 64.38% dominating the area with 47 plant species, Hemicryptophytes was 11 with percentage of 15.06%, followed by Megaphenerophyte having 9 plant species contributing 12.32%, Cryptophytes with 4 species imparting 5.47%, Geophytes with single specie 1.36%. The biological spectrum of the life form classes in the adjacent site were calculated out and represented in the table 4.3 and Fig 4.1.7. Results show that the percentage of Therophytes and Hemicryptophytes was high in the adjacent site during the seasons in the consecutive years of study.

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