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RESEARCH ARTICLE

Floristic diversity, biological spectrum of lower Tanawal, KP, Pakistan

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Field surveys were carried out to evaluate the floristic diversity and biological spectrum of Lower Tanawal, District Abbottabad in different seasons during 2016-2018. This study area was divided into 80 stands on the basis of physiognomy of the vegetation. Life form classes and leaf spectra were classified following Raunkier's methodology. In total, 286 plant species belonging to 86 families were recorded, out of which herbaceous growth form dominated the study area with 187 species, followed by shrub with 54 species. Among all 86 families, Asteraceae was found to be the most dominant family with 25 species, followed by Fabaceae with 24 species and Rosaceae with 20 species. Based on life form classes, Therophytic life form was the leading class with 113 species (39.5104%), followed by Nanophanerophytes with 45 species (15.7342%). In leaf size spectra, Microphylls dominated the flora with 88 species (30.7692%), followed by Mesophyll with 81 species (28.3216%). This study shows the complete floristic composition that may be important as reference work for future ethnobotanical, ecological and conservational studies.

Key words: The floristic composition; Biological spectrum; Lower tanawal; Abbottabad; Pakistan

Introduction

Flora is a priceless donation of nature upon which the mankind always relies (Khan et al., 2013). Flora comprises the total plant species of any specific geographic region, which are characteristic of a geological period or in an ecosystem (Durrani et al., 2005). Nonetheless, the most useful source of botanical information of a particular area is its floristic checklists. Since, floristic composition is a decent floristic marker hence, any sort of changing floristic composition in various endogenous milieus highlights the presence of various environmental variables, prompting entomb and intra-variations (Safidkon et al., 2003). Floristic structure of a specific territory provides fundamental yet assorted information about the plant dissemination; and the motherland has diverse landscapes, topographies, and biological/ecological zones, which bolster distinctive floristic composition (Masroor, 2011). To contemplate the vegetation of a territory, it is essential to oversee the plants' life form, which is an indicator for both micro and macroclimate (Shimwell 1971). As leaf sizes and shapes (physiognomy) connects unequivocally with moisture and temperature from worldwide to neighborhood scales (Bailey and Sinott, 1915). Literature survey reveals that the study area is still virgin as no work has been done on biological spectrum in Pakistan (Shaheen et al., 2016). Thus, the present study was designed to document the floristic composition and biological spectrum of this unexplored area of the northern Pakistan.

Materials and Methods

Study area

The Lower Tanawal situated in District Abbottabad, Pakistan which lies between the latitudes 34° 12' .328 ,34° 15´ .761 North, 73° 09' 398", 73°.03´. 316 East. The area occupies the intervening area between the Mansehra basin in the north and the Haripur basin to the south, adjacent and NE of the Tarbela Dam reservoir. Lower Tanawal is located in District Abbottabad Khyber – Pakhtunkhwa province, located towards west of Abbottabad. The altitudinal range of Lower Tanawal is from 2396 feet at Chamhad to 6742 feet at Karagali. Lower Tanawal is a component of many small and big villages almost adjoining each other. Lower Tanawal is located in a beautiful valley which is surrounded by large forested mountains on three sides. The boundary of Lower Tanawal area start from the village Paswal which is away from Abbotabad on the distance of 10 km and same road near the Soban Gali leads to adjunct areas of Union Council Chamhad and at the end its boundary attached with the District Haripur. While on the other side the Lower Tanawal area is attached from the Sherwan side with Mansehra and from the NE it close with Tarbela lake. The climate of the lower Tanawal area is cold during winters and mild during summers with humid temperatures during June and July. During the winter, the temperature may drop to below 0°C and snowfall is common especially in January (Gazetteer of Hazara, 2000). The January and February is the coldest months and March and April are pleasant while May and June are hot & dry month (Muhammad Rafique ,1997) . Most rainfall occurs during the monsoon season in summer stretching from May to August and can sometimes cause flooding.

Field work and plant collection

Extensive field surveys were carried out during 2016 to 2018. The study area was visited frequently for collection of data. The tools used during field survey were Camera (Nikon Cooplix A-100), twig Cutter, trowel, newspaper, plant presser, and polythene bags. Data was recorded in the field note book and every specimen was tagged. Specimens of each plant species have been collected, dried and fixed on standard herbarium sheets. The plant specimens were identified with the help of available literature herbarium specimen and flora of Pakistan (Nasir & Ali 1970-1989). These specimens were then placed in Herbarium, Department of Botany Hazara University Mansehra, Pakistan.

Results

In total, 286 plant species belonging to 221 genera and 86 families were recorded from the study area (Table 1). Out of these 286 species, 281 species belonged to Angiosperms, followed by Pteridophytes with 4 species, single Gymnospermic species (Figure 1). Angiospermatophyta contains 82 families, Gymnosperm contain 1 families and Pteridophytes contains 3 families (Figure 2). In which Herbaceous growth form dominates the study area with 187 plant species followed by shrub with 54 plant species and 45 trees (Figure 3). Among all 86 families, Asteraceae was found to be the most dominant family with 25 plant species, followed by Fabaceae with 24 species followed by Rosaceae with 20 species, (Figure 4) Lamiaceae with 19 species, Poceae with 15 species respectively. (Table 1).

Table 1. List of plants species, biological spectrum of Lower Tanawal District Abbottabad, KP, and Pakistan.

S.No	Plant name	Family	Habit	Life form	Leaf Spectra
1	*Acacia mearnsii* De wild	Fabaceae	Tree	MIP	L
2	1. ***Acacia modesta* Wall.**	Fabaceae	Tree	MIP	Mi
3	*Acacia nilotica* (L.) Delile	Fabaceae	Tree	MIP	L
4	*Acer pseudoplatanus* L.	Sapindaceae	Shrub	NAP	Mes
5	*Achyranthes aspera*. L	Amaranthaceae	Herb	TH	Mi
6	*Adiantum capillus –veneris* L.	Pteridaceae	Herb	GE	Mi
7	*Aerva javanica* (Burm.f.) Juss. Ex Schult.	Amaranthaceae	Shrub	CH	Na
8	*Aesculus indica* (Wall. ex Cambess.) Hook	Sapindaceae	Tree	MEP	Mac
9	*Ajuga bracteosa* Wall. ex Benth	Lamiaceae	Herb	TH	Mes
10	*Albizia lebbeck* (L.) Benth.	Fabaceae	Tree	MEP	Mes
11	*Allium griffithianum* Boiss	Amaryllidaceae	Herb	GE	Na
12	*Alliaria petiolata* (M.Bieb.) Cavara & Grande	Brassicaceae	Herb	TH	Mi
13	*Allium stipitatum* Regel	Amaryllidaceae	Herb	GE	Mes
14	*Alnus nitida* (Spach) Endl.	Betulaceae	Tree	MEP	Mes
15	*Alternanthera pungens* Kunth.	Amaranthaceae	Herb	NAP	Mes
16	*Amaranthus viridis* L.	Amaranthaceae	Herb	TH	Mi
17	*Anagallis arvensis* L.	Primulaceae	Herb	TH	Na
18	*Anaphalis margaritacea* (L.) Benth. & Hook.f.	Asteraceae	Herb	GE	Na
19	*Anaphalis triplinervis* (Sims) Sims ex C.B.Clarke	Asteraceae	Herb	GE	Na
20	*Angelica arguta* Nutt.	Apiaceae	Herb	TH	Na
21	*Andrachne cordifolia* (Decne.) Müll.Arg	Euphorbiaceae	Shrub	NAP	Mi
22	*Androsace rotundifolia* Hardw.	Primulaceae	Herb	TH	Mi
23	*Anthriscus caucalis* M.Bieb.	Apiaceae	Herb	TH	Na
24	*Argemone Mexicana* L.	Papaveraceae	Herb	TH	Mi
25	*Ariesema flavum* Forssk.	Araceae	Herb	GE	Mac
26	*Aristida cyanantha* Steud.	Poaceae	Herb	TH	Mi
27	*Artemisia absinthium* L.	Asteraceae	Herb	H	Mes
28	*Artemisia scoparia* Waldst. & Kitam.	Asteraceae	Herb	CH	Na
29	*Arundo donax* L.	Poaceae	Shrub	GE	Mes
30	*Asparagus adscendens* Roxb	Asparagaceae	Herb	CH	L
31	*Asparagus officinalis* L.	Asparagaceae	Herb	CH	L
32	*Asphodelus tenuifolius* Cav.	Asphodelaceae	Herb	TH	Na
33	*Asplenium ceterach*.L	Aspleniaceae	Herb	GE	Mes
34	*Asplenium trichomanes* L.	Aspleniaceae	Herb	GE	Mi
35	*Astragalus leucocephalus* Bunge	Fabaceae	Herb	TH	Mes
36	*Barleria cristata* L.	Acanthaceae	Herb	CH	Mi
37	*Bauhinia variegate* L	Fabaceae	Tree	MIP	Mes
38	*Berberis lyceum* Royle	berberidaceae	Shrub	NAP	Na

39	*Biden pilosa* L.	Asteraceae	Herb	H	Mes
40	*Boerhavia diffusa* L.	Nyctaginaceae	Herb	CH	Mi
41	*Bothriochloa ischaemum* (L).Keng.	Poaceae	Herb	H	Mi
42	*Bromus tectorum* L.	Poaceae	Herb	H	L
43	*Broussonetia papyrifera* L .	Moraceae	Tree	MEG	Mac
44	*Buddleja asiatica* Lour .	Buddlejaceae	Shrub	NAP	Mi
45	*Caesalpinia pulcherrima* (L). Sw	Fabaceae	Tree	MIP	Mi
46	**2. *Calamintha hydaspidis* (Falc.t ex Benth.) Hedge**	Lamiaceae	Herb	TH	Mi
47	*Calamintha nepeta* L.	Lamiaceae	Herb	TH	Mi
48	*Calamagrostis acutiflora* (Schrad.) DC.	Poaceae	Herb	GE	Mes
49	*Campanula leucoclada* Boiss.	Campanulaceae	Herb	TH	Na
50	*Cannabis sativa* L.	Cannabaceae	Herb	TH	Mi
51	*Canna indica* L.	Cannabaceae	Shrub	CH	Meg
52	*Capsella bursa* Raf.	Brassicaceae	Herb	TH	Mi
53	*Cardamine hirsuta* L.	Brassicaceae	Herb	TH	Mac
54	*Carduus nutans* L.	Asteraceae	Herb	TH	Mes
55	*Carissa opaca* Stapf ex Haines	Apocynaceae	Shrub	NAP	Mi
56	*Caryopteris odorata* (D.Don) B.L.Rob	Verbenaceae	Herb	TH	Mi
57	*Carthamus oxyacantha* M.Bieb.	Asteraceae	Herb	TH	Mi
58	*Cedrela serrata* Royle	Meliaceae	Tree	MEG	Na
59	*Celtis australis* L.	Cannabaceae	Tree	MEP	Mi
60	*Chenopodium album* L.	Chenopodiaceae	Herb	TH	Na
61	*Chenopodium ambrosioides* L.	Chenopodiaceae	Herb	TH	L
62	*Chenopodium vulgare* L.	Chenopodiaceae	Herb	TH	Mi
63	*Chrysopogon serrulatus* Trin.	Poaceae	Herb	H	L
64	*Cichorium intybus* L.	Asteraceae	Herb	TH	Mes
65	*Cirsium falconeri* (Hook.f.) Petr.	Asteraceae	Herb	TH	Mes
66	Cissampelos pareira L.	Menispermaceae	Herb	TH	Na
67	*Citrullus colocynthis* (L.) Schrad.	Cucurbitaceae	Herb	H	Mi
68	*Clematis grata* Wall.	Ranunculaceae	Herb	MIP	Mes
69	*Clematis graveolens* Lindl.	Ranunculaceae	Herb	NAP	L
70	*Colebrookea oppositifolia* Sm	Lamiaceae	Shrub	NAP	Mes
71	*Commelina virginica* L.	Commelinaceae	Herb	TH	Na
72	*Convolvulus arvensis* L.	Convolvulaceae	Herb	TH	Na
73	*Conyza Canadensis* L.	Asteraceae	Herb	TH	Na
74	*Cornus macrophylla* Wall.	Cornaceae	Tree	MEP	Mes
75	*Coronopus didymus*(L) sm.	Brassicaceae	Herb	TH	L
76	*Cotinus coggygria* scop.	Anacardiaceae	Shrub	NAP	Na
77	*Cotoneaster integerrimus* L.	Rosaceae	Shrub	NAP	Na
78	*Cotoneaster melanocarpus* Fisch. ex A.Blytt	Rosaceae	Shrub	NAP	Na
79	*Cotoneaster nummularius* Fisch. & C.A.Mey.	Rosaceae	Shrub	NAP	Na
80	*Crotalaria rotundifolia* J.F.Gimel	Fabaceae	Herb	TH	Na
81	*Cuscuta reflexa* Roxb.	Cuscutaceae	Herb	NAP	L
82	*Cydonia oblonga* Mill.	Roaceae	Tree	H	Mi
83	Cynodon dactylon (L)pers	Poaceae	Herb	CH	Na
84	*Cyclospermum leptophyllum* (Pers.) Sprague	Apiaceae	Herb	TH	L
85	*Cyperus iria* L.	Cyperaceae	Herb	H	Mi
86	*Cyperus niveus* Retz	Cyperaceae	Herb	H	Mi
87	*Cyperus esculentus* L.	Cyperaceae	Herb	H	L
88	*Daphne mucronata* Royle	Thymelaeaceae	Shrub	NAP	Na
89	*Debregeasia salicifolia* D.Don	Urticaceae	Shrub	MIP	Mes
90	*Delbergia sisso* Roxb	Fabaceae	Tree	MEP	Mi
91	*Delphinium grandiflorum* L.	Ranunculaceae	Herb	H	Mes
92	*Delphinium roylei* Munz	Ranunculaceae	Herb	H	Mi
93	*Deschampsia cesiptosa* L	Poaceae	Herb	NAP	Mi

94	*Desmodium elegan* DC	Fabaceae	Shrub	NAP	Mes
95	*Desmodium gangeticum* L	Fabaceae	Shrub	NAP	Mes
96	*Desmodium tortuosum* (Sw.) DC.	Fabaceae	Shrub	NAP	Mi
97	*Dicliptera bupleuroides* Nees	Acanthaceae	Herb	TH	Mi
98	*Digera muricata* (L).Mart.	Amaranthaceae	Herb	TH	Mi
99	*Diospyros lotus* L	Ebenaceae	Tree	MEP	Mes
100	*Dodonaea viscosa* (L) Jacq	Sapindaceae	Shrub	NAP	Mi
101	*Duchesnea indica* (Jacks.) Focke	Rosaceae	Herb	CH	Mes
102	*Dryopteris marginalis* (L)A.Gray.	Dryopteriaceae	Herb	GE	Mes
103	*Echinops echinatus* Roxb	Asteraceae	Shrub	CH	Mes
104	*Elaeagnus umbellata* Thumb	Elaeagnaceae	Shrub	NAP	Mi
105	*Eleusine indica* (L).Gaertn.	Poaceae	Herb	H	L
106	*Eremostachys superba* Royle.ex.Benth.	Lamiaceae	Herb	MEP	L
107	*Eriobotrya japonica* (Thunb.)Lindl	Rosaceae	Tree	MEP	Mac
108	*Eryngium billardieri* L.	Umbelliferae	Herb	H	Na
109	*Eucalyptus globulus* Labill	Myrtaceae	Tree	MEP	Mi
110	*Euphorbia hirta* L.	Euphorbiaceae	Herb	TH	Mi
111	*Euphorbia peplus* L.	Euphorbiaceae	Herb	TH	L
112	*Ficus benghalensis* L.	Moraceae	Tree	MEG	Mes
113	*Ficus palmata* Forssk	Moraceae	Tree	MIP	Mes
114	*Ficus recemosa* L.	Moraceae	Tree	MIP	Mes
115	*Fumaria indica* (Hausskn.) Pugsley	Fumariaceae	Herb	TH	L
116	*Galium aparine* L.	Rubiaceae	Herb	TH	Na
117	*Galium circaezans* Michx	Rubiaceae	Herb	TH	Na
118	*Galium spurium* L.	Rubiaceae	Herb	TH	L
119	*Galium triflorum*Michx	Rubiaceae	Herb	TH	Na
120	*Gentiana argentea* (Royle ex D.Don) Royle ex D.Don	Gentianaceae	Herb	H	Na
121	*Geranium ocellatum* Jacquem. ex Cambess.	Geraniaceae	Herb	CH	Mi
122	*Geranium rotundifolium* L.	Geraniaceae	Herb	GE	Mes
123	*Geranium robertianum* L.	Geraniaceae	Herb	GE	Na
124	*Grewia optiva* J.R.Drumm. ex Burre	Tiliaceae	Tree	MIP	Mes
125	*Gymnosporia royleana* Wall. ex M.A.Lawson	Celastraceae	Shrub	NAP	Mi
126	*Hedera helix* L.	Araliaceae	Herb	NAP	Mes
127	*Heliotropium bacciferum* Forssk	Boraginaceae	Herb	GE	L
128	*Heracleum sphondylium* L.	Apiaceae	Herb	H	Mes
129	*Hypericum foliosum* Aiton	Hypericaceae	Shrub	TH	Mi
130	*Hypericum perforatum* L.	Hypericaceae	Shrub	TH	Na
131	*Imperata cylindrica* L.	Poaceae	Herb	H	Mi
132	*Impatien glandulifera* Royle	Balsaminaceae	Herb	TH	Mi
133	*Indigofera heterantha* Brandis	Fabaceae	Shrub	NAP	Mi
134	*Indigofera linifolia* (L.F.)Retz.	Fabaceae	Herb	CH	L
135	*Ipomoea carnea* Jacq.	Convolvulaceae	Shrub	TH	Mac
136	*Ipomoea purpurea* (L.) Roth	Convolvulaceae	Herb	TH	Mi
137	*Isodon rugosus* (Wall. ex Benth.) Codd	Lamiaceae	Shrub	NAP	Mi
138	*Jasminum humile* L.	Oleaceae	Herb	NAP	Mi
139	*Juglans regia* L.	Juglandaceae	Tree	MEG	Mes
140	*Justicia adhatoda* L.	Acanthaceae	Shrub	NAP	Mes
141	*Justicia pectoralis*(Jacq)	Acanthaceae	Herb	TH	Na
142	*Kickxia ramosissima*(Wall)	Scrophulariaceae	Herb	TH	Mes
143	*Lactuca indica* L.	Asteraceae	Herb	TH	Mes
144	*Lactuca serriola* L.	Asteeaceae	Herb	TH	Mi
145	*Lamium album* L.	Lamiaceae	Herb	TH	Mi
146	*Lannea coromandelica*(Houtt).Merr	Anacardiaceae	Tree	MEG	Mi
147	*Lantana camara* L.	Verbenaceae	Shrub	NAP	Na
148	*Lappula barbata* (M.Bieb.) Gürke	Boraginaceae	Herb	TH	L
149	*Lathyrus aphaca* L.	Fabaceae	Herb	CH	Na
150	*Launaea procumbens* (Roxb.) Ramayya &	Asteraceae	Herb	CH	Mi

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151	*Lepidium didymium* L.	Brassicaceae	Herb	TH	L
152	*Leptodermis virgata* Edgew. ex Hook.f.	Rubiaceae	Shrub	CH	Na
153	*Lespedza juncea* Linn.f	Fabaceae	Herb	TH	L
154	*Linum corymbulosum* Rchb	Linaceae	Herb	TH	Na
155	*Limonium echioides* (L.) Mill.	*plumbaginaceae*	Herb	TH	Na
156	*Lonicera quinquelocularis* Hard.	Carprifoliaceae	Shrub	NAP	Mi
157	*Malvastrum coromandelianum* (L.) Garcke	Malvaceae	Herb	TH	Mes
158	*Mallotus philippensis* (Lam) Muell.Arg.	Euphorbiaceae	Shrub	MIP	Mes
159	**3. *Malva neglecta* Wallr.**	Malvaceae	Herb	CH	Mi
160	*Marrubium vulgare* L.	Lamiaceae	Herb	CH	Mi
161	*Melia azedarach* L.	Meliaceae	Tree	MIP	Mes
162	*Medicago denticulata* Willd.	Fabaceae	Herb	TH	Na
163	*Medicago polymorpha* L.	Fabaceae	Herb	TH	Na
164	*Melilotus indicus*(L).All.	Fabaceae	Herb	TH	Na
165	*Mentha arvensis* L.	Lamiaceae	Herb	GE	Mi
166	*Menthe longifolia*(L)Huds.	Lamiaceae	Herb	GE	Mi
167	*Micromeria biflora* (Buch.-Ham. ex D.Don) Benth.	Lamiaceae	Herb	TH	L
168	*Mirabilis jalapa* L.	Nyctaginaceae	Herb	CH	Mes
169	*Morus alba* L.	Moraceae	Tree	MIP	Mes
170	*Morus nigra* L.	Moraceae	Tree	MIP	Mes
171	*Myrsine Africana* L.	Primulaceae	Shrub	NAP	Na
172	*Nasturtium officinale* R.Br.	Brassicaceae	Herb	TH	Na
173	*Nanorrhinum acerbianum* (Boiss.) Betsche	Plantaginaceae	Herb	TH	Na
174	*Nannorrhop ritchiana*(Griff) .Aitchison.	Arecaceae	Shrub	MIP	Mes
175	*Nepeta cataria* L.	Lamiaceae	Herb	CH	Mi
176	*Nepeta ciliaris* Benth	Lamiaceae	Herb	TH	Mi
177	*Notholirion thomsonianum*(Royle)stapf	Liliaceae	Herb	GE	Mi
178	*Oenothera rosea* L.	Onagraceae	Herb	TH	Na
179	*Olea ferruginea* Royle.	Oleaceae	Tree	MIP	Na
180	*Onosma hispida* Wall. ex G. Don	Boraginaceae	Herb	TH	Mic
181	*Opuntia ovata* Pfeiff.	Cactaceae	Shrub	NAP	Mac
182	*Origanum vulgare* L.	Lamiaceae	Herb	TH	Na
183	*Otostegia limbata*(Benth).Boiss	Lamiaceae	Shrub	NAP	Mi
184	*Oxalis corniculata*(L)	Oxalidaceae	Herb	TH	Na
185	*Parthenium hysterophous* L.	Asteraceae	Herb	TH	Mes
186	*Pennisetum orientale* .Rich	Poaceae	Herb	TH	Mi
187	*Pentanema vestitum* Wall .ex. DC	Asteraceae	Herb	H	Mes
188	*Periploca aphylla*.Decne.	Apocynaceae	Shrub	NAP	Mac
189	*Perilla frutescens*(L) Britton.	Lamiaceae	Herb	TH	Mi
190	*Phleum alpinum* L.	Poaceae	Herb	H	Na
191	*Phleum arenarium* L.	Poaceae	Herb	H	Na
192	*Pimpinella stewartii* Nasir	Apiaceae	Herb	TH	Na
193	*Pinus roxburghii* Sarg.	Pinaceae	Tree	MEG	Na
194	*Pistacia integerrima* J.L.Stewart.ex.Brands.	Anacardiaceae	Tree	MEP	Mac
195	*Plantago lanceolata* L.	Plantaginaceae	Herb	TH	Mi
196	*Plumbago zeylanica* L.	plumbaginaceae	Herb	TH	Mi
197	*Poa balfourii* auct .	Poaceae	Herb	TH	Na
198	*Poa poiformis* Labill	Poaceae	Herb	TH	L
199	*Polygala abyssinica* R.Br.ex.Fresen.	Polygalaceae	Herb	CH	Na
200	*Polygala vulgaris* L.	Polygalaceae	Herb	H	Mi
201	*Polygonum plebeium* R.Br.	Polygonaceae	Herb	H	L
202	*Polygonum viviparum* L.	Polygonaceae	Herb	TH	L
203	*Populous alba* L.	Salicaceae	Tree	MEG	Mes
204	*Potentilla rivalis* Nutt. ex Torr. & A.Gray	Rosaceae	Herb	TH	Mi
205	*Prunus amricana* Marsh	Rosaceae	Tree	MIP	Mi
206	*Prunus domestica* L.	Rosaceae	Tree	MIP	Mes
207	*Prunus persica*(L).Batsch.	Rosaceae	Tree	MIP	Mi
208	*Psidium guajava* L.	Myrtaceae	Tree	MIP	Mes
209	*Punica granatum* L.	Punicaceae	Tree	MIP	Na

210	*Pyrus pashia* Buch.-Ham. ex D.Don	Rosaceae	Tree	MIP	Mi
211	*Pyrus pyrifolia*(Burm).Nak.	Rosaceae	Tree	MIP	Mes
212	*Pyrus communis* L.	Rosaceae	Tree	MIP	Mes
213	*Quercus incana* Bartram	Fagaceae	Tree	MEG	Mes
214	*Randia tetrasperma* (Wall. ex Roxb.) Benth.	Rubiaceae	Shrub	TH	Na
215	*Ranunculus muricatus* L.	Ranunculaceae	Herb	TH	Mi
216	*Ranunculus parviflorus* L.	Ranunculaceae	Herb	TH	Mi
217	*Reinwardtia trigyna* Planch.	Linaceae	Herb	NAP	Na
218	*Rhamnus virgata* Roxb.	Rhamnaceae	Shrub	MIP	Mi
219	*Rhynchosia tomentosa*(L)Hook & Arn.	Fabaceae	Herb	NAP	L
220	*Ricinus communis* L.	Euphorbiaceae	Tree	MIP	Mac
221	*Rosa brunonii* L.	Rosaceae	Shrub	NAP	Na
222	*Rosa moschata*(Herrm)	Rosaceae	Shrub	MIP	Mes
223	*Robina pseudoacacia* L	Fabaceae	Tree	MEG	Mes
224	*Rubia cordifolia* L.	Rubiaceae	Herb	TH	Na
225	*Rubia manjith* Roxb	Rubiaceae	Herb	TH	Na
226	*Rubus ellipticus* Sm.	Rosaceae	Shrub	NAP	Mes
227	*Rubus fruticosus* L.	Rosaceae	Shrub	NAP	Mes
228	*Rubus sanctus* Schreb.	Rosaceae	Shrub	NAP	Mi
229	*Rumex dentatus* L.	Polygonaceae	Herb	GE	Mes
230	*Rumex hastatus* D.Don.	polygonaceae	Herb	NAP	Mes
231	*Rumex nepalensis* Spreng	Polygonaceae	Herb	GE	Mes
232	*Salix acmophylla* Boiss	Salicaceae	Tree	MIP	Mi
233	*Salvia coccinea* Buc'hoz ex Etl.	Lamiaceae	Herb	CH	Mi
234	*Salvia moorcroftiana* Wall. ex Benth.	Lamiaceae	Herb	CH	Mes
235	*Sapindus mukorossi* Gaertn	Sapindaceae	Tree	MEG	Mes
236	*Saussurea heteromalla* D.Don	Asteraceae	Herb	TH	Mi
237	*Scabiosa candollei* Wall.	Dipsaceae	Herb	H	Mes
238	*Scabiosa ochroleuca* L.	Caprifoliaceae	Herb	TH	Na
239	*Scandix pectin –veneris* L.	Apiaceae	Herb	TH	Mi
240	*Scilla griffithii* Hochr.	Hyacinthaceae	Herb	GE	Na
241	*Scrophularia dentata* Royle .ex.Bentham.	Scrophulariaceae	Herb	TH	Na
242	*Sedum sarmentosum* Bunge	Crassulaceae	Herb	GE	Na
243	*Senecio aquaticus* Hill.	Asteraceae	Herb	TH	Mes
244	*Sida cordata* (Burm.f.) Borss.Waalk	Malvaceae	Herb	TH	Mi
245	*Sisymbrium irio* L.	Brassicaceae	Herb	TH	Na
246	*Silene conoidea* L.	Caryophyllaceae	Herb	TH	Na
247	*Smilax -bona-nox* L.	Smilacaceae	Herb	TH	L
248	*Smilax china* L.	Smilacaceae	Herb	TH	Na
249	*Smilax rotundifolia* L.	Smilacaceae	Herb	TH	Na
250	*Solanum erianthum* D.Don	Solanaceae	Herb	TH	Mes
251	*Solanum incanum* L.	Solanaceae	Herb	CH	Mes
252	*Solanum nigrum* L.	Solanaceae	Herb	TH	Mes
253	*Solanum surattense* Burm. f.	Solanaceae	Herb	CH	Mes
254	*Sonchus asper* (L).Hill	Asteraceae	Herb	CH	Mi
255	*Sonchus oleracus* (L.)Hill	Asteraceae	Herb	MIP	Mes
256	*Sorbaria tomentosa* (Lindl.) Rehder	Rosaceae	Shrub	MIP	Mes
257	*Stachys emodi*.Hedge.	Lamiaceae	Herb	TH	Mi
258	*Spiraea vaccinifolia* D.Don	Rosaceae	Shrub	NAP	Mi
259	*Stellaria alsinoides* Boiss	Caryophyllaceae	Herb	TH	L
260	*Stellaria media* (L)Vill.	Caryophyllaceae	Herb	CH	Na
261	*Strobilanthes efloraofindia* C.B.Clarke	Acanthaceae	Herb	TH	Na
262	*Strobilanthes oliganthus*(Miq)	Acanthaceae	Herb	TH	Na
263	*Symplocos recemosa* Roxb	Symplocaceae	Tree	TH	Mes
264	*Tagetes minuta* L.	Asteraceae	Herb	TH	Mes
265	*Taraxacum officinale* L	Asteraceae	Herb	TH	Mes
266	*Tricholepis angustifolia*-DC	Asteraceae	Herb	TH	Mi
267	*Trichodesma indicum*(L)R.Br	Boraginaceae	Herb	TH	Na
268	*Tridax procumbens* L.	Asteraceae	Herb	H	Mi
269	*Trifolium repen* L.	Fabaceae	Herb	GE	Na
270	*Ulmus villosa* Brandes.ex.gamble	Ulmaceae	Tree	MEG	Mi
271	*Verbena officinalis* L	Verbenaceae	Herb	TH	Mi
272	*Veronica stewartii* Pennel	Plantaginaceae	Herb	TH	Na
273	*Verbena tenuisecta* Briq.	Verbenaceae	Herb	TH	Na
274	*Verbascum Thapsus* L.	Scrophulariaceae	Herb	H	Mes
275	*Viburnum cotinifolium* D.Don	Caprifoliaceae	Shrub	MIP	Mes

276	*Vicia hirsuta*(L)Gray.	Fabaceae	Herb	TH	Na
277	*Vicia sativa* L.	Fabaceae	Herb	TH	Na
278	*Viola Odorata* L	Violaceae	Herb	TH	Mes
279	*Vitex negundo* L.	Verbenaceae	Shrub	NAP	Mes
280	*Vitis vinifera* L.	Vitaceae	Herb	NAP	Mes
281	*Woodfordia fruticosa*(L.)Kurz.	Lythraceae	Shrub	NAP	Mes
282	*Xanthium strumarium* L.	Asteraceae	Shrub	TH	Mes
283	*Zanthoxylum armatum* Dc.	Rutaceae	Shrub	MIP	Mes
284	*Ziziphus oenopila* L.	Rhamnaceae	Shrub	CH	Na
285	*Ziziphus nummularia* (Burm.f.) Wight & Arn.	Rhamnaceae	Shrub	NAP	Mi
286	*Ziziphus jujuba* Mill.	Rhamnaceae	Shrub	NAP	Mi

TH=Therophytes,MEP=Mesophenrophytes,MEG=Megaphanerophytes,MIP=Microphenerophytes,HC=Hemicryptophytes, NAP=Nanophanerophytes, GE=Geophytes, CH=Chemeophytes, Mi=Microphyll, Mes=Mesophyll, L=Leptpphyll, Na=Nanophyll, Mac=Macrophyll, Meg=Megaphyll.

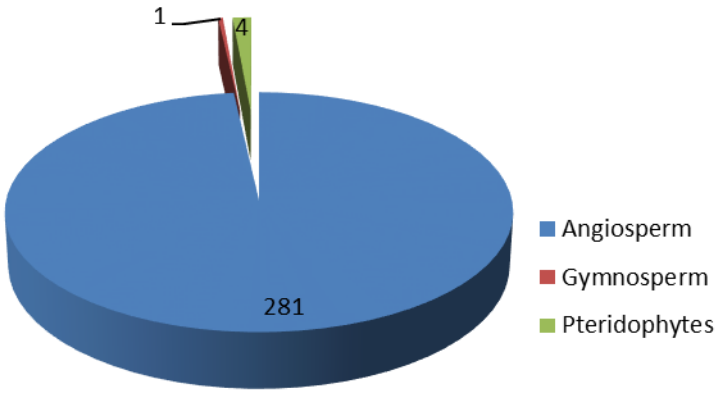

Figure 1. Division of plant species recorded from study area.

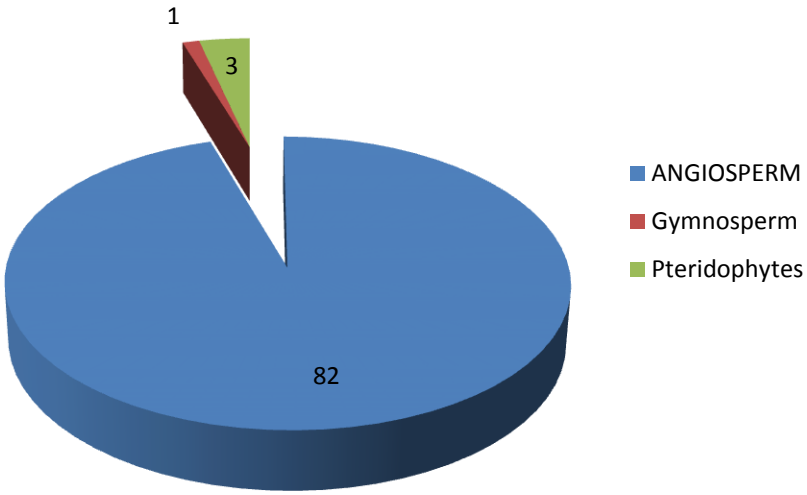

Figure 2. Angiosperm, gymnosperms and pteridophytes families of plant species recorded from study area.

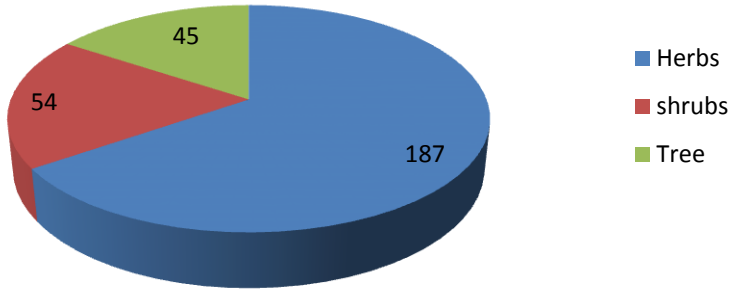

Figure 3. Growth habit of plant species recorded from the study area.

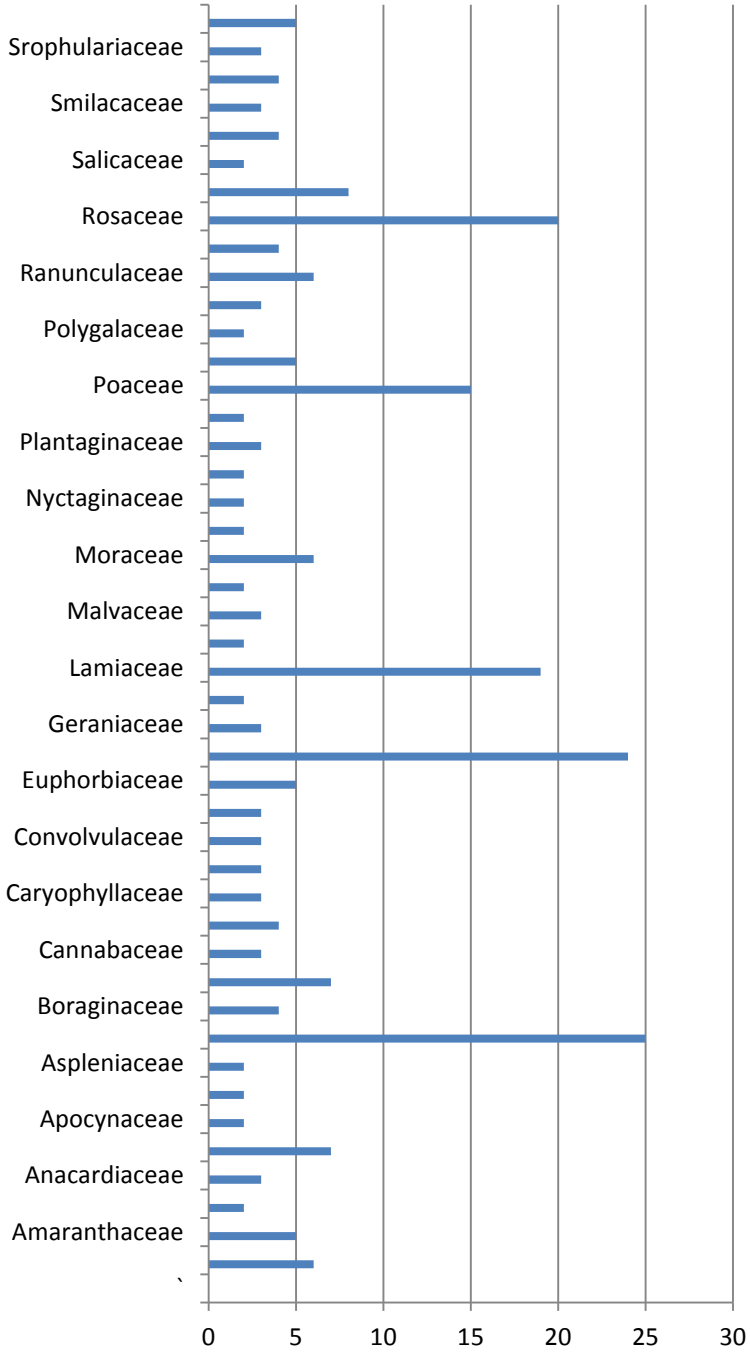

Figure 4. Distribution of plants family having two or more than two plant species.

Life form classes and leaf spectra were determined by Raunkier's method By using this method seven life form classes are observed in which Therophytes was most dominant with 113 species (39.5104%),followed by Nanophanerophytes with 45 species (15.7342%),then Microphanerophytes with 32 species (11.188%), Chamaeophytes with 27 species (9.4405%),Hemicryptophytes with 25 species (8.7412%) Geophytes with 22 species (7.69%) followed by Megaphanerophytes and Mesophanerophytes with 11 species (3.8461%) each (Figure 5). In leaf size spectra, Microphyll are dominants with 88 species (30.7692%) followed by Mesophyll with 81 species (28.32%) Nanophyll with 77 species (26.9230%) Leptophyll with 29 species (10.13%) Macrophyll with 10 species (3.49%) and Megaphyll with 1 species (0.3496%) (Figure 6).

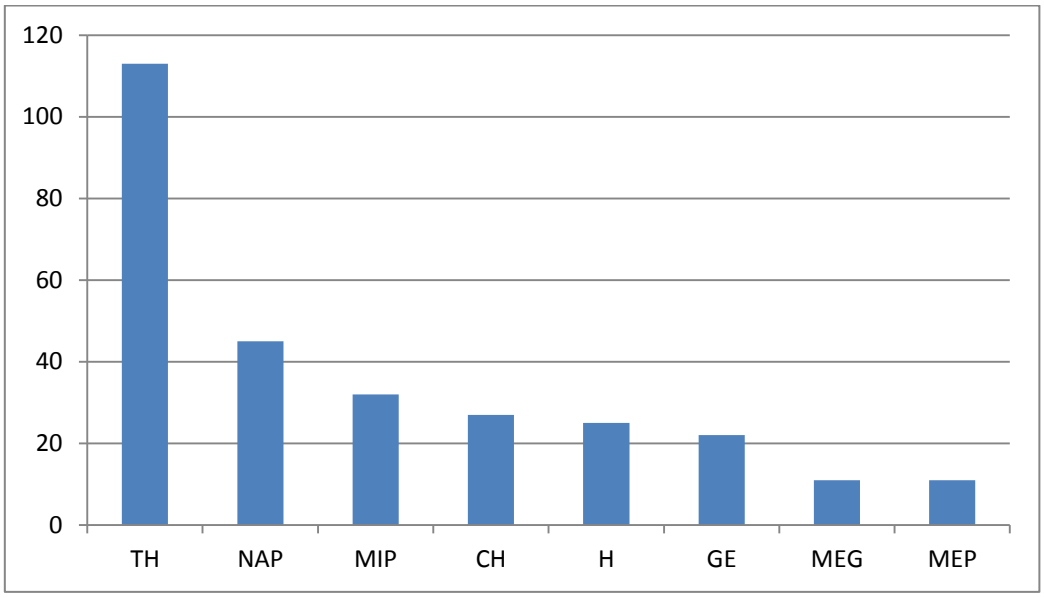

Figure 5. Graphical representation of life form classes of Lower Tanawal.

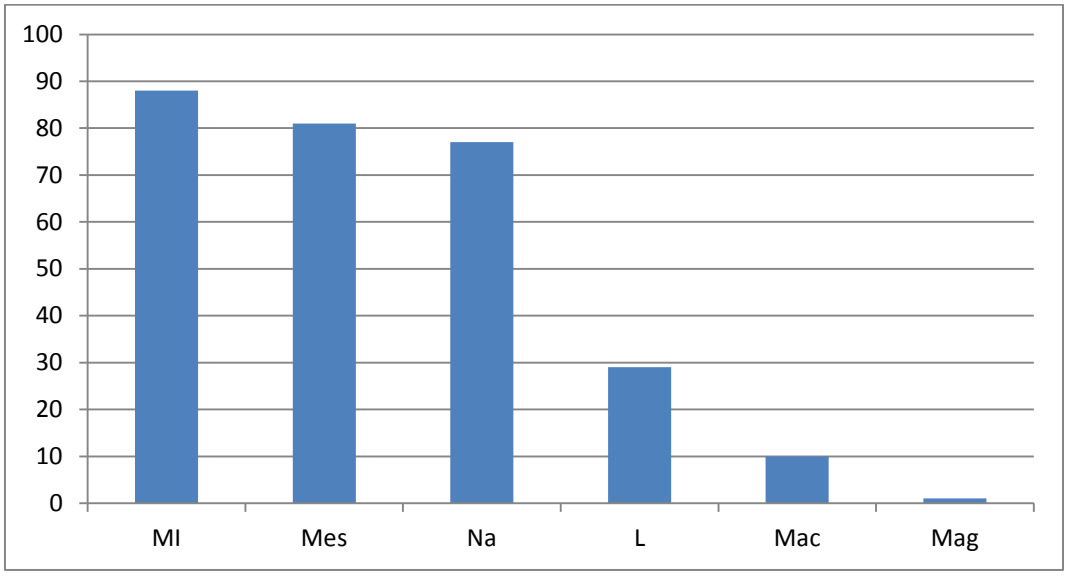

Figure 6. Graphical representation of leaf spectra of Lower Tanawal.

Discussion

This research study reveal that previously no such study has been conducted on floristic composition of Lower Tanawal as well as no proper documentation is present on floristic composition of Lower Tanawal. Thus, our study provides complete checklist of flora of Lower Tanawal. Biological Spectra indicate the prevailing environmental condition of any area (Hussain *et al.* 2015). Life form classes are very important to determine the plant communities in a study area. Disturbance such as deforestation, extensive grazing and fire and biotic pressure effect plant life form, phenology. In our study area biological spectrum showed that out of 286 Species Therophytes was most dominant with 113 species (39.5104%),followed by Nanophanerophytes with 45 species (15.7342%),then Microphanerophytes with 32 species (11.188%), Chamaephytes with 27 species (9.4405%), Hemicryptophytes with 25 species (8.7412%).Geophytes with 22 species (7.6923%),followed by Megaphanerophytes & Mesophanerophytes with 11 species (3.8461%)each (Figure 5). Therophytes was dominant life form which indicates disturbed environmental conditions in the study area, and biotic pressure on vegetation which increase the short live species. Our findings are in agreement with Saxena et al. (2004); Farag (2014) and Ali *et al.* (2016) which show that biotic pressure effect the vegetation. As Costa et al. (2007) reported that therophytes are dominant life form in South Eastern Brazil which is similar to our finding. Fazal *et al.* (2010) dominancy of therophytes show degraded and unfavorable environmental condition. Our results are agreed with the finding of Al Yemen's and Sher (2010). In leaf size spectra, Microphyll are dominants with 88 species (30.7692%), followed by Mesophyll with 81 species

(28.3216%), Nanophyll with 77 species (26.9230%), Leptophyll with 29 species (10.1398%), Macrophyll with 10 species (3.4965%), and Megaphyll with 1 species (Figure 6).

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