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Biological spectrum with some other ecological attributes of the flora and vegetation of the Salher fort of Maharashtra, India.

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Abstract

On the basis of current available information on the flora and vegetation of the Salher fort of Maharashtra, India, spectra on life form and some other ecological attributes were analyzed and reviewed in different sub-ecosystem of the investigated area. In this region, the vegetation expression was predominantly evergreen, although the tree flora has considerable elements of deciduous species. The floristic list of Salher fort of Maharashtra, India consists of 165 species belonging to 53 families, 46 dicotyledons (dicots) and 7 monocotyledons (monocots). Fabaceae was the dominating family in dicotyledons and Poaceae in Monocotyledons. According to the Raunkiaerian life form Phanerophytes (40.61%), Therophytes (48.48%), Hemicryptophytes (6.67%), Chamaephytes (3.03%) and Cryptophytes (1.21%) contribute in the establishment of vegetation structure in the study area. The leaf size spectra analyzed revealed that, microphylls (34.55%) followed by mesophylls (22.42%), nanophylls (16.36%), macrophylls (15.15%) leptophylls (9.10%), and megaphylls (2.42%) that construct the vegetation belt of the area. The biological spectrum of the high altitude was characterized by phanerophytes mainly representing nanophanerophytic followed by mesophanerophytic, megaphanerophytic and microphanerophytic species. The phanerophytes appears to be due to dry climate and high anthropogenic disturbance in the region.

Keywords: Biological spectrum, Salher fort, Leaf spectra, Life forms, Ecological attributes.

Introduction

The life form is an important physiognomic attributes that have been widely used in vegetation studies and also it indicates micro and macroclimate as well as human disturbance of a particular area. Life form in a community is generally defined as the sum of adaptation of plant to climate. Different systems have been revised by many ecologists for the description and classification of plant life forms. However, the system of Raunkiaer is the most and worldwide accepted, which is based upon the principle of position and degree of protection of the buds during the adverse climatic conditions. The study the floristic composition and life forms of different plants is important to find out phytoclimatic zones of the area.

According to this system, plant species can be grouped into five main classes: Phanerophytes, Chamaephytes, Hemicryptophytes, Cryptophytes and Therophytes. It is important to study the floristic composition and life forms of different plants to find out phytoclimatic zones of the area. In India, several workers have studied life forms and biological spectrum of different regions (Gupta and Kachroo, 1981;Ghildiyal and Srivastava, 1990; Nautiyal et al. 2001; Desai and Ant, 2012; Sharma et al. 2014) . In Maharashtra, only few workers have studied life forms and biological spectrum of different regions (Bharucha, et al, 1941; Cherion et al. 1972; Patil D.A. 1990; Jadhav J.T. 2002; Jadhav D.G. 2014). Besides, no work on life forms has so far been carried out in Nasik district, Maharashtra.

Study area:

The Nashik district is located between latitude 19^0 35' and 20^0 50' and longitudes 73^0 35' and extend over the area of 15,587 sq. km. It is bounded on the north-west by the Dangs and Surat district of Gujarat state on the north by Dhule district, on the east by Jalgaon and Aurangabad district, on the south by Ahmednagar and south-west by Thane district of Maharashtra state.Most of the mountains and forts in this tract is located on extreme part of Western Ghats. The hill ranges have direction either West-East or South-West or North-West except that of Sahyadris. The elevation varies from 600 to 1400 meters above Mean Sea Level. The hill slopes are usually steep and in many places precipitous. Salher is a place located near Waghamba in Satana tehsil in Nashik district. It is the site of the highest fort in the Sahyadri forts and the second highest peak at 1,567 metres (5,141 ft) after Kalsubai in Maharashtra and 32nd highest peak in Western Ghats. This was one of the celebrated forts of the Maratha Empire. The money acquired after raiding Surat was brought to this fort first on its way to the Maratha capital forts.

According to a legend, Lord Parshuram did his Tapascharya at Salher Fort. After winning the earth and giving it as donation, he made land for himself to live in, by pushing the sea back with his arrows, right from this place. The twin fort Salota (4986 feet) is very near to Salher. An ancient and historically significant place like this is also famous for its battles during the reign of Chatrapati Shivaji Maharaj. Salher Fort was under Shivaji maharaj in 1671. The Mughals attacked the fort in 1672. Almost one lakh soldiers fought in this war. Many soldiers died in this battle but finally Shivaji Maharaj won the battle of Salher. Of all the face to face battles between the Mughals and Shivaji Maharaj's troops, the battle of Salher takes first place. Such a big battle was not won before. The bravery and strategy used by the Maratha troops in the battle spread far and wide and increased Shivaji Maharaj's fame further. After winning Salher, the Marathas also captured Mulher and established their reign over the Baglan region. In the 18th century the Peshwas occupied this fort and later by the British. The Marathas defeated the Mughals at the Battle of Salher in 1672.

Materials and Methods

The results embodied in this work are based on collection from 2007 to 2010 through well-planned explorationon. Numbers of extensive explorations of 3-5 days duration were made on the Salher fort. More emphasis has given on intensive rather than extensive explorations. Sampling was done to prepare a complete herbarium for future reference. All the collected specimens have been processed for herbarium by dry method as per the routine herbarium techniques recommended by Santapau (1955) and Jain and Rao (1976). Specimens were critically examined in the laboratory with the help of relevant floras and available revisions, monographs and other related literature. All the plant species were classified on the basis of life forms as defined by Raunkier to determine the phytoclimate of the area (Table 2). In view of the above applications for Raunkiaerian concepts, the presentation endeavour was initiated with an aim to (1) ascertain variation of life forms in different plant communities of different climatic zones and (2) elucidate the relationship between vegetation and an elevational role of anthropogenic activities and environmental factors on the observed trends.

Biological spectrum of the flora based on the life form was prepared by following Raunkiar (1934), life form classes as follows:

Therophytes: Annual seed bearing plants which complete their life cycle in one year and over winter; the unfavourable season by means of seeds or spores.

Geophytes: Perennating buds located below the surface of soil including plants with deep rhizomes, bulbs, tubers and corms, etc.

Hydrophytes: Submerged hydrophytes are those rooted in the muddy substratum. The above ground or upper parts die at the end of growing season.

Hemicrytophytes: Herbaceous perennial in which aerial portion of plant dies at the end of growing season, leaving a perennating bud at or just beneath the ground surface.

Chamaeophytes: Perennating buds located close to the ground surface (below the height of 25 cm). They include herbaceous, low woody trailing, low stem succulents and cushion plants.

Phanerophytes: They are shrubby and tree species whose perennating buds are borne on aerial shoot reaching a height of at least 25 cm or more above the ground surface (Table 1).

After having assigned a life form to all the plants Raunkiarian spectra was calculated as follows:

$$\text{Biological Spectrum} = \frac{\text{Number of species falling in particular life form class}}{\text{Total number of all the species for the community / stand}} \times 100$$

Leaf size classes: The leaf size knowledge helps in understanding physiological process of plants and plant communities and it is useful in classifying the associations. Plants were classified into Raunkiarian leaf sizes (Table 1).

Raunkiaer spectrum was calculated as follows:

$$\text{Leaf Size Spectra} = \frac{\text{Number of species falling in particular leaf size class}}{\text{Total number of all the species for the community / stand}} \times 100$$

Table 1: Showing Raunkiarian Leaf size and phanerophyte classes of the flora and vegetation.

Leaf Size Classes		Phanerophytes	
Type	**Leaf area (Sq. mm.)**	**Type**	**Length (m)**
Leptophyll	Up to 25	Megaphanerophytes	30 or above
Nanophyll	25 – 225	Mesophanerophytes	7.5 to 30
Microphyll	225 to 2025	Nanophanerophytes	0.25 to 7.5
Mesophyll	2025 to 18225		
Macroph yll	18225 to 164025		
Megaphyll	Larger than 164025		

Results

The floristic list of Salher fort of Maharashtra, India consists of 165 species belonging to 53 families, 46 dicotyledons (dicots), 7 monocotyledons (monocots). Fabaceae (25 Spp.) and Asteraceae (11 spp.) was the dominating familes. These were followed by Euphorbiaceae (9 spp.), Rubiaceae (6 spp.), Lamiaceae (6 spp.), Lythraceae (5 spp.) and Acanthaceae (5 spp.) in dicotyledons and Poaceae (12 spp.) and Cyperaceae (6 spp.) in Monocotyledons in the study area. The remaining families had one or two species. According to the Raunkiaerian life form Therophytes (48.48%), Phanerophytes (40.61%), Hemicryptophytes (6.67%), Chamaephytes (3.03%) and Cryptophytes (1.21%) contribute in the establishment of vegetation structure in the study area. In leaf size spectra, the analysis revealed that microphylls (34.55%) followed by mesophylls (22.42%), nanophylls (16.36%), macrophylls (15.15%) leptophylls (9.10%), and megaphylls (2.42%) construct the vegetation belt of the area respectively (Tables 3). The biological spectrum of the high altitude was characterized by phanerophytes mainly representing nanophanerophytic followed by mesophanerophytic, megaphanerophytic and microphanerophytic species. The phanerophytes appears to be due to dry climate and high anthropogenic disturbance in the region. The comparison with Raunkiaer's normal spectrum depicts Thero-phanerophytic type of phytoclimate. This indicates dry climate and high anthropogenic disturbance in the region.

Table 2. Showing Floristic list, habit, life forms and leaf size spectra of the flora and vegetation of. Salher fort.

Sr. No.	Species	Habit	Life Form	Leaf Spectra
1	RANANCULACEAE			
1	*Clematis gouriana* Roxb. ex. DC.	C	PH	Lepto
2	DILLENIACEAE			
2	*Dillenia pentagyna* Roxb.	T	PH	Meso
3	MENISPERMACEAE			
3	*Cyclea peltata* (Lam.) Hook. f.	C	PH	Micro
4	*Tinospora cordifolia* Willd.	C	PH	Micro
4	PAPAVERACEAE			
5	*Cardamine trichocarpa* Hochst.	H	TH	Nano
5	FLACOURTIACEAE			
6	*Casearia graveolens* Dalz.	T	PH	Micro
6	POLYGALACEAE			
7	*Polygala erioptera* DC.	H	TH	Nano
7	PORTULACACEAE			
8	*Portulaca tuberosa* Roxb.	H	TH	Nano
8	MALVACEAE			
9	*Kydea calycina* Roxb.	T	PH	Micro
10	*Pavonia zeylanica L.*	S	PH	Nano
11	*Sida spinosa* L.	H	TH	Nano
12	*Urena lobata* L.	S	PH	Micro
9	BONBACACEAE			
13	*Bombax ceiba* L.	T	PH	Meso
10	STERCULIACEAE			
14	*Firmiana colorata* Roxb.	T	PH	Meso
15	*Sterculia guttata* Roxb.	T	PH	Meso
11	TILIACEAE			
16	*Grewia serrulata* DC.	T	PH	Meso
17	*Triumfetta pilosa* Roth.	H	HM	Meso
12	LINACEAE			
18	*Linum mysurense* Heyne ex Bth.	H	TH	Micro
13	MALPIGHIACEAE			
19	*Aspidopteris cordata* Heyne.	C	PH	Meso
14	ZYGOPHYLLACEAE			
20	*Fagonia schweinfurthii* Hadidi	H	TH	Lepto
15	BALSAMINACEAE			
21	*Impatiens acaulis* Arn.	H	TH	Nano
22	*Impatiens balsamina* L.	H	TH	Micro
16	CELASTRACEAE			
23	*Celastrus paniculatus* Willd.	C	PH	Micro
17	VITACEAE			
24	*Ampelocissus latifolia* Roxb.	C	PH	Macro
25	*Cissus pallida* (Wight & Arn.) Planch.	S	PH	Macro
18	LEEACEAE			
26	*Leea macrophylla* Roxb.	H	TH	Mega
19	ANACARDIACEAE			
27	*Rhus mysorensis* G. Don,	S	PH	Meso
28	*Spondias pinnata* (L.f.)	T	PH	Meso

20		FABACEAE			
	29	*Alysicarpus bupleuriformis* (L.) DC.	H	CH	Micro
	30	*Alysicarpus longifolius* Wight & Arn.	H	TH	Micro
	31	*Alysicarpus tetragonolobus* Edgew.	H	TH	Nano
	32	*Butea superba* Roxb.	C	PH	Micro
	33	*Canavalia africana* Dunn.	C	PH	Meso
	34	*Clitoria ternatea* L.	C	HM	Micro
	35	*Crotalaria calycina* Shrank,	H	TH	Micro
	36	*Crotalaria mysorensis* Roth.	H	TH	Micro
	37	*Crotalaria retusa* L.	H	TH	Meso
	38	*Dalbergia horrida* Dennst.	S	PH	Lepto
	39	*Derris scandens* (Roxb.)	C	PH	Nano
	40	*Desmodium procumbens* (Mill.) Hutch.	H	TH	Nano
	41	*Desmodium velutinum* (Willd.) DC.	S	PH	Micro
	42	*Flemingia strobilifera* (L.) Ait.	S	PH	Micro
	43	*Geissaspis cristata* Wight & Arn.	H	TH	Nano
	44	*Indigofera hendecaphylla* Jacq.	H	TH	Nano
	45	*Macrotyloma uniflorum* Verdc.	C	PH	Micro
	46	*Mucuna pruriens* (L.) DC.	S	PH	Meso
	47	*Pycnospora lutescens* (Poir.) Schindl.	H	TH	Lepto
	48	*Rhynchosia rothii* Bth.	S	PH	Nano
	49	*Smithia salsuginea* Hance.	H	TH	Lepto
	50	*Smithia sensitiva* Ait.	H	TH	Micro
	51	*Taverniera cuneifolia* (Roth.) Arn.	H	TH	Micro
	52	*Tephrosia villosa* (L.) Pers.	H	TH	Lepto
	53	*Vigna khandalensis* Sant.	S	PH	Meso
21		CAESALPINIACEAE			
	54	*Bauhinia malabarica* Roxb.	T	PH	Micro
	55	*Caesalpinia bunduc* (L.) Roxb.	S	PH	Lepto
	56	*Cassia fistula* L.	T	PH	Nano
	57	*Cassia mimosoides* L.	H	TH	Lepto
22		MIMOSACEAE			
	58	*Acacia nilotica* (L.) Willd.	T	PH	Lepto
	59	*Prosopis cineraria* (L.) Druce,	T	PH	Lepto
	60	*Samania saman* (Jacq.) Merr.	T	PH	Lepto
23		COMBRETACEAE			
	61	*Terminalia bellirica* (Gaertn.) Roxb.	T	PH	Macro
	62	*Terminalia chebula* Retz.	T	PH	Mega
24		LITHRACEAE			
	63	*Lagerstroemia parviflora* Roxb.	T	PH	Macro
	64	*Rotala densiflora* Roth. Ex R. & S.	H	TH	Nano
	65	*Rotala indica* (Willd.) Koehne.	H	TH	Nano
	66	*Rotala rotundifolia* Buch.-Ham.	H	CH	Lepto
	67	*Woodfordia fruticosa* (L.) Kurz	S	PH	Nano
25		BEGONIACEAE			
	68	*Begonia crenata* Dryand.	H	TH	Meso
	69	*Begonia picta* J.E. Sm.	H	TH	Macro
26		APIACEAE			
	70	*Ammi majus* L.	H	TH	Nano
	71	*Pinda concanensis* Dalz.	H	TH	Nano

27	RUBIACEAE			
72	*Gardenia latifolia* Soland.	T	PH	Macro
73	*Hymenodityon orixense* (Roth.) Mabb.	T	PH	Macro
74	*Meyna laxiflora* Robyns.	T	PH	Meso
75	*Neanotis lancifolia* Hook. f.	H	TH	Micro
76	*Pavetta crassicaulis* Bremek	S	TH	Macro
77	*Tamilnadia uliginosa* (Retz.) Tirv. & Sastre.	T	PH	Macro
28	ASTERACEAE			
78	*Blumea mollis* D.Don.	H	TH	Micro
79	*Caesullia axillaris* Roxb.	H	CH	Micro
80	*Conyza sumatrensis* Retz.	H	TH	Micro
81	*Cyathocline purpurea* Buch-Ham.	H	TH	Nano
82	*Gnaphalium polycaulon* Pers.	H	TH	Nano
83	*Launaea intybacea* (Jacq) Beauv.	H	TH	Nano
84	*Phyllocephalum scabridum* DC.	H	TH	Meso
85	*Senecio bombayensis* Balakr.	H	TH	Micro
86	*Siegesbeckia orientalis* L.	H	TH	Meso
87	*Tricholepis radicans* (Roxb.) DC.	H	TH	Lepto
88	*Zinnia peruviana* (L.) Syst.	H	TH	Micro
29	MYRSINACEAE			
89	*Embelia basaal* (R. & S.) A. DC.	S	TH	Nano
30	SAPOTACEAE			
90	*Manikara hexandra* (Roxb.) Dub.	T	PH	Meso
91	*Mimusops elengi* L.	T	PH	Macro
31	ASCLEPIADACEAE			
92	*Ceropegia hirsuta* Wight.	H	PH	Micro
93	*Ceropegia sahyadrica* Ansari & Kulk.	H	TH	Meso
94	*Leptadenia reticulata* (Retz.) Wight & Arn.	S	PH	Meso
95	*Tylophora dalzelii* Hook. f.	C	PH	Macro
32	CONVOLVULACEAE			
96	*Convolvulus arvensis* L.	H	HM	Nano
97	*Ipomoea companulata* L.	S	PH	Macro
98	*Ipomoea eriocarpa* R. Br.	H	TH	Micro
99	*Ipomoea mauritiana* Jacq.	S	CH	Macro
33	SOLANACEAE			
100	*Solanum virginianum* L.	H	CH	Micro
101	*Withania somnifera* (L.) Dunal.	H	TH	Macro
34	SCROPHULARIACEAE			
102	*Sopubia delphinifolia* (L.) G. Don.	H	TH	Nano
103	*Striga densiflora* (Bth.) Bth. Comp.	H	TH	Nano
35	MATRYNIACEAE			
104	*Martynia annua* L.	H	TH	Mega
36	ACANTHACEAE			
105	*Carvia callosa* (Wall.) Bremek.	S	PH	Meso
106	*Haplonthodes tentaculata* R.B. Mujumdar.	H	TH	Meso
107	*Hygrophylla serpyllum* (Nees) T. And.	H	TH	Nano
108	*Lepidagathis cuspidata* Nees.	S	PH	Micro
109	*Thelepaepale ixiocephala* Bremek.	S	PH	Meso
37	VERBENACEAE			
110	*Gmelina arborea* Roxb.	T	PH	Mega
111	*Vitex negundo* L.	S	PH	Meso

38	LAMIACEAE			
112	*Anisochilus carnosus* (L.) Wall.	H	TH	Meso
113	*Anisomeles malabarica* R. Br. ex Sims.	S	PH	Meso
114	*Colebrookea oppositifolia* Sm. Exot.	S	PH	Macro
115	*Hyptis suaveolens* (L.) Poit.	S	PH	Macro
116	*Nepeta hindostana* Haines.	H	TH	Meso
117	*Orthrosiphon pallidus* Royle ex Bth.	H	TH	Micro
39	AMARANTHACEAE			
118	*Alternanthera pungens* Kunth.	H	TH	Micro
119	*Alternanthera sessilis* (L.) R. Br.	H	TH	Micro
40	POLYGONACEAE			
120	*Polygonum plebium* R. Br.	H	TH	Micro
41	ELAEAGNACEAE			
121	*Elaeagnus conferta* Roxb.	S	PH	Micro
42	LORANTHACEAE			
122	*Viscum articulatum* Burm. f.	S	PH	Micro
43	EUPHORBIACEAE			
123	*Acalypha ciliata* Forssk.	H	TH	Micro
124	*Baliospermum montanum* Muell.-Arg.	S	PH	Micro
125	*Bridelia retusa* (L.) Spreng.	S	PH	Meso
126	*Euphorbia fusiformis* Buch.-Ham.	H	HM	Meso
127	*Glochidion ellipticum* Wight.	T	PH	Macro
128	*Homonoia riparia* Lour.	S	PH	Micro
129	*Mallotus philippensis* (Lam.) Muell.-Arg.	T	PH	Macro
130	*Phyllanthus urinaria* L.	H	TH	Lepto
131	*Trewia polycarpa* Bth.	T	PH	Macro
44	URTICACEAE			
132	*Boehmeria macrophylla* Hornem.	S	PH	Macro
133	*Gigardinia diversifolia* (Link) Friis.	H	HM	Macro
134	*Laportea interrupta* (L.) Chew.	H	TH	Macro
45	MORACEAE			
135	*Ficus amplissima* J. E. Sm.	T	PH	Macro
136	*Streblus asper* Lour.	T	PH	Meso
46	CERATOPHYLLACEAE			
137	*Ceratophyllum demersum* L.	H	CR	Lepto
47	ORCHIDACEAE			
138	*Dendrobium aqueum* Lindl.	H	TH	Meso
139	*Dendrobium barbatum* Lindl.	H	TH	Macro
140	*Habenaria marginata* Coleb.	H	TH	Meso
48	TACCACEAE			
141	*Tacca leontopetaloides* (L.) O. Ktze.	H	HM	Meso
49	LILIACEAE			
142	*Drimia indica* (Roxb.) Jessop.	H	TH	Meso
143	*Gloriosa superba* L.	H	HM	Meso
144	*Iphigenia indica* (L.) A. Gray	H	TH	Micro
50	COMMELINACEAE			
145	*Commelina paleata* Hassk.	H	TH	Micro
146	*Murdannia nudiflora* (L.) Brenan.	H	TH	Nano
51	ARACEAE			
147	*Arisaema tortuosum* (Wall.) Schott.	H	TH	Micro

52	CYPERACEAE			
148	*Cyperus alutatus* Kern.	H	TH	Micro
149	*Cyperus nutans* Kern.	H	HM	Micro
150	*Fimbristylis complanata* (Retz.) Link.	H	HM	Micro
151	*Juncellus laevigatis* (L.) C.B.CI.	H	CR	Micro
152	*Kyllinga brevifolia* Rottb.	H	TH	Micro
153	*Rhynchospora wightiana* (Nees) Steud.	H	TH	Micro
53	POACEAE			
154	*Anthraxon lanceolatus* Hochst.	H	TH	Meso
155	*Arundinella metzii* Hochst.	H	TH	Micro
156	*Coix gigantea* Koen.	H	TH	Meso
157	*Dichanthium foveolatum* (Del.) Roberty.	H	TH	Micro
158	*Dinebra retroflexa* (Vahl.) Panz.	H	TH	Micro
159	*Eragrostiella bifaria* (Vahl.) Bor.	H	HM	Micro
160	*Eragrostis viscosa* (Retz.) Trin.	H	TH	Micro
161	*Ischaemum rugosum* Salisb.	H	TH	Macro
162	*Paspalidium flavidum* (Retz.) A. Camus.	H	HM	Micro
163	*Themeda quadrivalvis* (L.) O. Ktze.	H	TH	Micro
164	*Triplopogon ramosissimus* Bor.	H	TH	Micro
165	*Urochloa panicoides* P. Beauv.	H	TH	Meso

H = Herb; C = Climber; S = Shrub; T = Tree; : PH =Phanerophytes; CH = Chamaephytes; HM = Hemicryptophytes; CR = Cryptophytes; TH = Therophytes; Le = Leptophyll; Na= Nanophyll; Mi=Microphyll; Me= Mesophyll; Ma=Macrophyll and Meg= Megaphyll.

Table 3. Showing number and percentage of life forms and leaf size spectra of Salher fort. Number in percentage (in parenthesis).

Life Form		**Leaf Spectra**	
Phanerophytes	67 (40.61%)	Leptophyll	15 (9.10%)
Chamaephytes	5 (3.03%)	Nanophyll	27 (16.36%)
Hemicryptophytes	11(6.67%)	Microphyll	57 (34.55%)
Cryptophytes/Geophytes	2 (1.21%)	Mesophyll	37 (22.42)
Therophytes	80 (48.48%)	Macrophyll	25 (15.15%)
		Megaphyll	4 (2.42%)

Discussion

Biological spectra are useful in comparing geographically widely separated plant communities and these physiognomic features of the ecosystem are regarded as indicators of biotic interaction, climate and habitat deterioration. According to Raunkiaer (1934), the climate of a region is characterized by life form, while the biological spectrum of the region exceeds the percentage of the same life form. However, due to biological disturbance, the proportion of life forms may be altered. Biological spectrum may be materially changed due to introduction of therophytes like annual weeds, biotic influences like grazing, deforestation and trampling, etc. They have been widely used in understanding the flora and community/ vegetation structure in relation to prevailing environmental conditions. The overall vegetation of the study area is dominated by therophytes followed by phanerophytes, hemicryptophytes, chaemophytes and geophytes. The predominance of therophytes indicates a disturbed environmental condition. Anthropogenic activities including overgrazing, overharvesting and developmental form reduces the macro element of the vegetation. The same is true in this study as macro elements such as trees have been removed for earning livelihood, terrace cultivation and as a fuel wood source. This facilitates the dominance of other life form classes. The biological spectrum obtained in the present study reflects the existing environmental conditions.

Raunkiaerian life form spectra failed to explain the numerical status of plants in the field, whereas quantitative characters such as density, frequency and canopy cover are more useful parameters in depicting the existing quantitative vegetation structure and related climatic conditions. Leaf size spectra indicated that micro-mesophyllous species were dominating the area. It was observed that plants suffer from adverse conditions such as poor soil development and strong winds. The present study shows that leptophylls were high at the foot hills, while microphylls and nanophylls were present in high altitudes. Species with large leaves occur in warmer climates while smaller leaves are characteristic of dry climates and degraded habitats. The size of leaves alone could not be used to identify specific leaf zone or climates. Other features of plants such as habit and root system might also play important role.

Conclusion

The phyto-spectrum of the Salher fort shows variation from the normal biological spectrum of Raunkiaer (1934). The higher percentage of therophyte is recorded in the study area because of the general terrain of the district is typical of the Deccan plateau. Therophytes were found to be more adaptive and survive in adverse season. The dominance of therophytes indicates the biotic interference includes deforestation, intensive utilization of land for cultivation, over grazing, increase in human habitation while phanerophytes provide good evidence that their abundance is fact of an expression of monsoon climate.

Comparison of the percentage of the life form classes of the Salher fort with Raunkiaer normal spectrum indicates that Therophytes is the largest life form class and their percentage is more than 3 times higher than (48.48%) that of the normal biological spectrum (14%). The Phanerophytes forms the second highest class with (40.61%), which is somewhat equal to that of the normal spectrum. The leaf size spectra analyzed revealed that, microphylls (34.55%) followed by mesophylls (22.42%), nanophylls (16.36%), macrophylls (15.15%) leptophylls (9.10%), and megaphylls (2.42%) that construct the vegetation belt of the area (Table 3). Thus, the area has a Thero-phanerophytic type of phytoclimate, which indicate hot and dry climate. Therophytes (annuals) are drought evaders in the sense that the whole plant is shed during the unfavourable conditions. It clearly indicates that the anthropogenic and natural factors are operating together and reducing the chances of formation of new and original life from vegetation structure.

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