# FLORISTIC INVENTORY, ECOLOGICAL CHARACTERISTICS AND BIOLOGICAL SPECTRUM OF PLANTS OF PARACHINAR, KURRAM AGENCY, PAKISTAN

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#### Abstract

The present work was carried out to evaluate the floristic checklist and environmental distinctiveness of Plants of Parachinar, Kurram Agency across the year during 2014- 2015. A total of 283 species of 222 genera among 85 families were recorded. Asteraceae with (29 Sp.) was the most dominant followed by, Poaceae with (20 Sp.), Papilionaceae, Lamiaceae each with (19 Sp.), Brassicaceae (16 Sp.), Solanaceae (13 Sp.), Rosaceae (9 Sp.) and Polygonaceae (7 Sp.). While Euphorbiaceae, Caryophylaceae and Pinaceaeeach with (6 Sp.) were the co-dominant taxa. Rest of the families possessed either 5 or fewer species. Based on the habitat 252 (89.04%) species were grew in dry places as wild mesophytes and xerophytes. Seventeen species (6.00%) were cultivated while 11 species (3.88%) were aquatic. There were 18 spiny species (6.36%). Among the perennial, majority were evergreen. Three species (1.06%) namely *Cuscutareflexa, Periplocaaphylla* and *P. calophylla*were leafless. The leaf lamina was simple in 230 species (81.27%) and 50 species (17.66%) contained composite foliage. Therophytes107 (37.80%) and nanophanerophyte 47 species (16.66%) respectively were dominant life form groups. Leaf spectra revealed that nanophylls with 121 species (42.75%) and leptophylls with 89 (31.44%) were dominant leaf size classes. The vegetation was also characterized by microphylls and mesophylls but of least concern.

Key word: Ecological characteristics, Kurram agency, Floristic composition, Biological spectrum, Pakistan.

### Introduction

Parachinar is the main town and headquarter of the Kurram Agency, Pakistan. Parachinar is located at 33° 53' 51 North, 70° 60" East with an altitude of 1725 m (5659 feet) above the sea level. It lies at a distance of about 260 km North West of the Peshawar city. It is located on a neckline of Pakistani terrain south of Peshawar so as to projects into Paktia region of Afghanistan with the contiguous point in Pakistan to Kabul and confines on the Tora Bora. The inhabitant are mainly of Tori ethnic group of Patans and speaks Pashto. Parachinar is bounded by high mountains on all sides. The major range is Koh-e-Safaid or Spin Gharwith the peak of Sikramsar at 4,728 meters. It makes a natural boundary with Tora Bora mountain of Afghanistan. It covers with snow for major time of the year.

Flora is sum total of species in a specific habitat and ecosystem, which are peculiarity of an ecological period. The plants included the figure of species, as vegetation is the qualitative expression of plants of an area (Ali, 2008). Directory of plant resources by systematists is a universal performance all over the globe to cover information on the subject of vegetation (Qureshi et al., 2011). The flora of the road side was presented by (Aitchison, 1881-1882) which was a pioneer work regarding flora of Kurram Valley. By doing this exercise, precious information is gathered which might be utilized as an indication for further studies. As the planet is vastly uneven, thus a considerable variety of floras are existing range from pithy or ground flora to exploration (Badshah et al., 2010a). The average temperature of the area is semi-arid to temperate with a distinctive geography. Life form swarm of the current

research reflects moist and dry temperate region. This area has some chunky patches of oak and pine vegetation. Plant diversity, life style and dispersion of plants are linked with the altitude and precipitation variation. The scarceness of the flora shows rigorous consumption of the natural vegetation. Trees, shrubs and herb can be sustained if anthropogenic activity is lowered to an appropriate level. Owing non availability of the electricity and the natural gas its large population depends upon forest capital for all domestic purposes. Because of the profound browsing nearly all the pastures of Khyber Pakhtunkhwa have been ruined and require to restore and to make it sustainable. It is imperative to reveal that the local plant resources are inadequate to accomplish the necessities so enormous quantity of fuel and timber wood is rushed from North Waziristan. No literature is available on the flora of this area except that of (Badshah & Hussain, 2008; Shiwari et al., 2003 and Hussain et al., 2012) who worked on some traditional uses of local medicinal flora. Therefore the work at hand would play an important role to visualize floristic diversity and its environmental individuality.

#### **Materials and Methods**

Recurrent data was collected for the whole year. Specimens were dried and sealed. Plants were recognized in the light of existing flora of Pakistan (Ali &Qaisar, 1995-2009 and Nasir & Ali, (1971-2007). An inclusive alphabetical list beside families was prepared. Life form and leaf size classifications were made after Badshah *et al.* (2013); Hussain*etal.* (2006); Hussain (1989) and Raunkiaer (1934). The plants specimens were submitted to the herbarium, Department of Botany for future record (Ali, 2008).

## **Results and Discussion**

Flora and its ecology: Natural plants wealth is restricted by gardening, excessive browsing, human activities and natural disaster. Parachinar, Kurram Agency comprised of 283 species distributed among 85 families (Table 1.) representing 10 Gymnosperms, 36 Monocotts and 241 Dicot respectively. Asteraceae (29 Sp.), Poaceae (20 Sp.), Papilionaceae, Lamiaceae each with (19 Sp.), Brassicaceae (16 Sp.) Solanaceae (13 Sp.), Rosaceae (9 Sp.), Polygonaceae (7 Sp.) and Euphorbiaceae, Caryophylaceae and Pinaceae (6 Sp. each) were the leading groups. The other groups possessed either 5 or fewer species. Durrani et al. (2005) and Marwat&Qureshi (2000) also noted that these families were wide spreading in their respective areas. Kotli Hill also represented these families as a prominent flora during monsoon (Malik & Malik 2004). Similarly Mustuj Valley of district Chitral was also found to be prosperous with similar taxa (Hussain, 2015). Our results are constantly agreed indigenously by (Ali & Qaiser, 1995-2015) and as well as abroad by (Eilu et al., 2004; Antije et al., 2003; Muthuramkumar et al., 2006 and Asteraceae, and Mendez, 2005) as Poaceea, Lamiaceaehavebeen nominated dominant taxain the present situation. Asteraceae and Poaceae owing wide ecological amplitude make them to be diversified in the ecosystem.

The floristic list of Nara desert Qureshi & Bhatti (2008b), Bhatti et al. (2001), Parveen et al. (2008) and Qureshi & Bhatti (2005) also came up with abundant species in Asteraceae and Poaceae which equally strengthen the present conclusion. Five species in Solanum was declared as the principal genus. Similarly, Euphorbia, Aristida, Plantago, Heliotropium with 4 (species each). While *Pinus*, Juncus, Chenopodium, Amaranthus, Artemisia, Heliotropium and Polygonum possessed three species each. Rest of the taxa obsessed 1 or two type (Table 1). Ali & Qaisar, 2009; Nasir & Ali, 1971-2007; Ferraz et al., 2004; Stewart, 1972; Pinheiro et al., 2006 and Durrani et al., 2005 also reported that these genus is well represented in Pakistan. Distinctive variation in seasons and environmental setting is greatly apparent in the country. Usually summer and spring contain more species to winter and autumn as summer is pleasant while winter is severe cold in this region. Spring possessed 224 species (79.15%), summer 198 species (69.96%), autumn 120 species (42.40%) and winter 114 species (40.28%) (Table 2). Seasonal variation has certainly shaped 4 feature of the vegetation viz: perennial a sort of common among the habitat and seasons, woody plants and shrubs as a constant flora. The inconsistency in various features was mainly due to the seasonal, rhizomatous and some periodic irregular short season growing plants. Literature have also revealed that summer and spring aspect have much more diversity (Ahmad et al., 2009c, Badshah et al., 2010 and Durrani et al., 2010) which is in line with our findings. The flora mostly was composed of xeric plants that further agreeing to results made by Gimenez et al. (2004) and Musila et al. (2003). Only 17 taxa (6.00%) were cultivated for various purposes, 11 species (3.88%) were classified as hydrophytes and 3 species (1.06%) were found both in damp and arid situation. There were 18 spiny species (6.36%) which also showed xeric natureof the area. Most of the perennial were evergreen with an exception of fewer deciduous. A total of 230 species (81.27%) possessed simple lamina, 3 taxa (1.06%) were without leaves and the left over 50 species (17.66%), were composite and grooved. Absence of leaves and spiny adaptation indicated ruthless surroundings. The presence of aphyllous flora indicated the dryness and less rainfall in the present atmosphere. Sher & Khan (2007), Badshah *et al.* (2006), Durrani *et al.* (2005, 2010,) and Badshah *et al.* (2013) too observed parallel conduct from Udigram Swat and other parts of Pakistan. Floral diversity is the sign of high friendly environmental condition and lack of interference.

**Biological spectrum and cyclic inequality:** The life form shows the general outlook of the flora and vegetation, which is resulted due to various life phases in coalition with the location. It plays key role in the detection of environmental amplification of plant life. Raunkiaer (1934) proposed a consistent Life form categorization that determines the location and level of safety to parenting bloom in critical or unpleasant state. It was depicted that as whole therophytes (107 Sp., 37.80%) and nanophanerophytes (47 Sp., 16.60%) dominatedthe flora. Geophyte (37 Sp., 13.07%), hemicryptophytes (37 Sp., 13.07%), chamaephytes (30 Sp., 10.60%) and microphanerophytes (22 Sp., 7.77%) subsequently found in the area. *Viscum album* and *Cuscutareflexa* were merely parasitical plants (Table 2).

Three major phytoclimates of life form have been established on the earths which include therophytic in phanerophytic the deserts, in tropics, and hemicryptophytic in most of the temperate zone (Raunkiaer, 1934). Life forms change owing to biotic interaction as farming practices, browsing and grazing, trampling, deforestation and with change in climate. spectrum Recurring of biological showed nanophanerophytic as dominant with 40 species (33.33%) during autumn. Therophytic 21 species (17.50%) microphanerophytes18 species (15.00%), Chamaephytes with 16 species (13.33%) and hemicryptophytes with 14 species (11.66%) were next in abundance. Geophytes with 8 species (6.66%) and parasite with 3 species (2.50%) were rare life form classes in fall (Table 3).In winter the same trend was found as nanophanerophytes with 40 species and therophytes with 23 species dominated.During spring therophytes with 70 species (31.25%) emerged as dominant due to favorable temperature. Nanophanerophytes with 47 species (20.98%),chamaephytes 30 species (13.39%), geophytes 27 species (12.05%), hemicryptophytes 26 species (11.60%) and microphanerophytes 21 species (9.35%), were next important classes. Similarly, in summer there were 55 species (27.77%) of therophyte, 45 (22.72%) nanophanerophyte, 28 (14.14%) hemicryptophytes, 24 (12.12%) geophytes, 22 (11.11%) chamaephytes and 21 (10.60%) microphanerophytes (Table 3).

	Table 1. Floristic index, seasonal dissimilarity, biological and leaf size spectra.	ndex, seasonal di	ssimilarit	y, biologi	cal and le	af size spec	ctra.	-		
S. No.	Division / Family / Species	Habitat	V	W Seasonality	S	Sm	L. form	L. size	Lamina	Spinescence
	A. Gymnosperms									
	1. Taxaceae	1					;	;	đ	
Ι.	Taxus fuana Nan Li & K.K. Mill	D	+	+	+	+	Mp	Z	N	
<i>د</i>	Abies nindrow Roxl	C	+	+	+	+	Mn	Z	v.	
i m	<i>Cedrus deodara</i> (Roxh ex Lamb) G.Don		• +	+	. +	• +	Mn	Z	2 02	
. 4	Picea smithiana (Wall). Boiss	D	+	+	+	+	Mp	Z	ŝ	
5.	Pinu roxburghii Roxb.	D	+	+	+	+	Mp	Z	s	
9	Pinus gerardiana Wall. ex Lamb	D	+	+	+	+	Mp	Z	S	
7.	Pinus wallichiana A. B Jackson	D	+	+	+	+	Mp	N	S	
	3. Cupressaceae									
%	Cupressus funibris Endl	D	+	+	+	+	Np	Г	s	
6.	Cupressus sempervirons L.	D	+	+	+	+	Mp	Γ	S	
10.	Juniperus excelsa H,B	D	+	+	+	+	Np	Г	s	
	B. Monocotyledons									
:	4. Aunaceae	C		-	_		c	N	ŭ	
15	Allium cepa L. Allium entivum I			+ +	+ +		50	2 2	00	
14.		)		-	-	•	2		c	•
13.	Asparagus adscendens Roxb.	D		,	+	+	G	L	s	,
	6. Asphodelaceae									
14.	Asphodelus tenuifolius Cav.	W&D		+		'	IJ	L	s	
	7. Cyperaceae									
15.	Cyperus longus L.	M	,	+	+	,	5	Z	s	
16.	Cyperus rotundus L.	Μ	+	+		+	5	Z	s	
17	5. Iridaceae Monada aiminahina (1.) Var Comi		4	4	4	4	Ċ	I	0	
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18	Inneus articulatus I.	M			+	+	Ċ	1	<b>v</b>	
19.	Juncus bufonius L.	M			+	+	00	L	s	
20.	Juncus inflexus L.	M			+	+	Ð	Г	S	
;	10. Liliaceae	ı					ę		,	
21.	Hemerocallis fulva (L.) L.	a ı			+		5	ц;	s o	
77	Notholition thomsonianum (D. Don) Stapt	בר	+		• -1	÷	50	ZZ	00	
.07	1 uupu cusuunu DC 11 Orchidaceae	A			÷		5		a	
24.	Zeuxine strataumatica (L.) Schlechter	W&D	+	+	+	+	Н	Г	s	
	12. Poaceae									
25.	Apluda mutica L.	D	,	,	+	+	H	Z	S	,
26.	Aristida adscensionis L.	D	+				Н	Mic	s	
27.	Aristida cyanantha Nees ex Steud	0	+ -		+ -	+	ΞĘ	Z	S C	
87	Aristida mutabilis Trin. & Kupr.	26	+ -	+	+		u I	ZŻ	N C	
5.5	Ansuaa irincolaes Henr.	U 	+		,		ΞĘ	22	<u> </u>	
	Avena sauva L. Conchrus ciliaris I.	U X X		+ +		• +	11		00	
3.5	Cimbonogon ingranaries (Iones) Schult		• +	- +	• +	- +	ΞI	Mic	2 0	
33.	Cynodon dactylon (L.) Pers.	D	+	+	+	+	н	T	ŝ	
34.	Dichanthium annulatum (Forssk.) Stapf.	D		+		,	Η	Z	S	
35.	Lolium temulentum L.	D	,		+	,	Th	Z	s	
36.	Oryza sativa L.	C				+	Th	Mic	s	
37.	Paspalidium flavidum(Retz) A.camus	D	+			,	Ð	Z	s	
38.	Phalaris aquatica L.	M				+	IJ	Z	S	
39.	Poa annua L.	M		+	+		Th	L	s	
40.	Saccharum spontaneum L.	D	+	+			Ch	L	S	

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$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	45.	Typha latifolia L.	M	+	+	+	+	IJ	Mes	s	,
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	46.	<i>Tvnha minima</i> Funck ex Honne	M	+			+	G	Mes	s	•
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		1. Amaranthaceae									
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$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	48.	Amaranthus hybridus L.	D			+	,	Πh	Z	s	Sp
	49.	Amaranthus viridis L.	D	+	,	,	,	ď	N	s	1
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	50.	Celosia argentea L.	D	,	,	+	,	Th	Z	s	,
		2. Acanthaceae									
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A. Approximated     A. Approximated     b     +     +     +     b     b     b     +     +     b	52.	Pistacia chinensis ssp. integerrima (J. L. Stewart) Rech. F	D	+	+	+	+	dN	Mic	s	
		4. Apocyanaceae									
Substant after been:Starter been:	53.	Nerium indicum Mill.	D	+	+	+	+	d	Mic	s	•
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	55.	Periploca aphylla Decne.	Q	+	+	+	+	dz;	Ap	Abs	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	56.	Periploca calophylla (Wight) Falc.	D	+	+	+	+	dN	Ap	Abs	
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$\begin{array}{rcrcrc} Leontopodium (DC.) Hand. \\ Myriactis valitchii Less \\ Saussurea herromalia (D. Don) Hand \\ Saussurea herromalia (D. Hand Herromalia (D$	ć,	Lectuca saligna L.	5	+ ·	+		+	4	Mes	N C	•
Myracits walterin Less     Myracits walterin Less       Phagnalon niveum Edgew.     D     +     +     -     -     In     L       Saussurea heteromalla (D. Don) Hand     D     +     +     +     +     +     T     N       Senecio chrysenthemoides DC     D     -     -     +     +     +     T     N       Senecio chrysenthemoides DC     D     -     -     +     +     +     T     N       Senetic chrysenthemoides DC     D     +     +     +     +     +     +     L       Sonchus arvensis L.     D     +     +     +     +     +     T     Mic       Sonchus arvensis L.     D     -     -     -     +     +     +     H       Sonchus arvensis L.     D     -     -     +     +     +     H       Sonchus arvensis L.     D     -     -     +     +     +     H       Tagazes partul     D     -     -     +     +     +     +       Sonchus arvensis L.     D     -     -     +     +     +     +       Tagazes partul     D     -     -     +     +     +     +	<u>.</u>	Leontopodium leontopodinum (DC.) Hand.	<u> </u>	+ ·				41	ц,	N C	•
Fragration inverse     Fragration inverse     Hope     Mic       Saussurea heteromalia (D. Don) Hand     D     -     +     +     +     H       Senecio chrysenthemoides DC     D     -     -     +     +     +     H       Senecio chrysenthemoides DC     D     -     -     +     +     +     H       Senecio chrysenthemoides DC     D     +     +     +     +     H     N       Sonchus arvensis L.     D     +     +     +     +     H     Mic       Sonchus asper (L.) Hill     D     -     -     +     +     +     H       Tragates partel     D     -     -     +     +     -     H		Myriactis wallichti Less	חנ	+ ·		1.		u ;	, L	N O	
Saussurea neteromatia (D. Don) Hand       D       -       +       +       +       +       +       N         Senecio chrysenthemoides DC       D       -       -       +       +       +       +       N       N         Senecio chrysenthemoides DC       D       -       -       +       +       +       T       N         Senetio chrysenthemoides DC       D       +       +       +       +       +       T       N         Sonchus arvensis L.       D       -       -       +       +       +       T       Mic         Tagates partel       L.) Hill       D       -       +       +       -       T       Mic         Tagates partel       L.       D       -       +       +       -       T       Mic         Tagates partel       L.       D       -       +       +       -       T       Mic	x x	Phagnalon niveum Edgew.	<u>а</u> (	+	+	+ ·	+ •	đ	MIC	N O	
Serie convertine notaes DC + + + + In - L Scriphidium kurramense (Qazilb.) Y. R. Sling D + + + + + + Ch L Sonchus arvensis L. Sonchus asper (L.) Hill Mic Tagates parta L + Th Mic Tragates parta L + Th Mic	. 60	Saussurea heteromatia (D. Don) Hand	ם נ	'		+ -	+ -	5 ¢	Ζ.	2	
Serphuaium kuramense (Qazilo.) Y.K. Sling D + + + + + Ch L Sonchus arvensis L. D - + + Th Mic Sonchus asper (L.) Hill D - + Th Mic Tagates pathal L. D - + Th Mic	. o 0	Senecto curysentnemotaes DC	-			+ -	+ -	5 5	ц.	Con Con	
Sonchus arventis L In Mic Sonchus asper (L.) Hill D + Th Mic Tagates patual L. D + Th Mic	δ1.	Seripniaium kurramense (Vazilo.) Y. K. Sling	ם ב	ł	ł	ł	+ -	5 ¢	ц Ц	n 2	
Sometries asper $(L_{c})$ Hill $D$ - + In Mic Tagates parted L. $D$ - + In Mic Transaction and $L$ $L$ $T$ $T$ $D$ + - $T$ $D$ $L$ $D$	.70	Sonchus arvensis L.	יר				÷	= e	MIC	SIC C	
	83. 04	Soncrus asper (L.) HIII	ם ב		+			u f	MIC	UIS	
	04. 05	Tagates partia L. Tagates partia L.	ם ב		•	÷		II E	L S	com 2	

		T	Table 1. (Cont'd.)							
S. No.	Division / Family / Species	Habitat	V	Seasonality W S	nality	Sm	L. form	L. size	Lamina	Spinescence
86.	Xanthium strumarium L.	D			+		Th	N	s	Sp
	8. Balsamacea	:					;	;	t	
87.	Impatiens lemannii subsp. kurramensis Grey-Wilson 0 Botuloooo	M	+	+	+	+	Np	Z	s	
88.	Petula utis D. Don	D	+	+	+	+	Mp	z	s	
	10. Berberidaceae	ſ					, ;	,	c	
.68 .06	<i>Berberis calitobotrys</i> Aitch. cx Kochne <i>Berberis lucium</i> Rovle	ממ	+ +	+ +	+ +	+ +	dN	ЛГ	n n	
	11. Boraginaceae	2					4.	ł	2	
91.	Heliotropium crispum Dest.	Q	+	+	+ -	+ -	щ	Z	S C	
77	Heliotropium elipticum Leaco.	בר			+ +	÷	IL AL	Mis	<u>v</u> 0	
. 76	neuoropium europaeum L. Heliotronium ovalifolium Forssk				+ +	• +	∃₽	Mic	2 00	
95.	Nonnea edgewerthii DC	D		,		+	Th	N	ŝ	
ò	12. Brassicaceae	ſ					ł	,	i	
96	Brassica deflexa Boiss	au	+	+ +	• +		E F	Mic	Dis 2.C	
	Capsella bursa-pastoris (L.) Medik	þ		- 1	- 1	• +	Th	гı	Com	
66	Cardamine impatiens L.	D	,	,	,	+	Th	L	s	
100.	Cardaria chalepense (L.) Hand.	D	,		+	+	Th	Z	S	
101.	Conringia orientalis (L.) Andrz	מ			+	+ -	f f	ц.	S C	
102.	Coronopus ataymus (L.) Smith Descrurativia conhia ([_) Wehh & Berth					+ +	∃₽		<u>n v</u>	
104.	Eruca sativa Mill.	20			+	- +	14	Z	2 00	
105.	Isatis brevipes (Bunge) Jafri	D		,	+	+	Ę	: -1	ŝ	
106.	Lepidium pinnatifidum Ledeb	D			+	+	μŢ	Z	s	
107.	Malcolmia africana (L.) R. Br.	D	,		+	,	Th	Z	s	
108.	Nasturtium officinale R.Br.	D			+	+	וט	Z	Com	
109.	Notoceras bicorne (Aiton) Amo					+ -	ĘĘ	ЧZ	s 2	
111	Sisymbrium lacelii L. Sisymbrium laeselii L				+ +	+ +	∃₽	Mic	si v	
	13. Buddleiaceae	1					1		2	
112.	Buddleja crispa Benth	D	+	+	+	+	Np	Z	s	
	14. Buxaceae	ſ					;	;	c	
113.	Buxus papillosa C.K.Schneid	п	+	+	+	÷	dN	Z	'n	
114.	15. Cannabarcac Cannabis sativus L.	D	,		+	,	Th	Z	Com	
	16. Caprifoliaceae									
115.	Lonicera hispida Pall. ex Willd.	םנ	+ -	+	+ -	+ -	dN	Mic	s s	
110.	17 Carronbullacese	п	ł		ł	ł	dN	MIIC	n	
117.	Cerastium glomeratum Thuill	D			+		Th	L	s	
118.	Dianthus crinitus Sm.	D	+	+	+	+	ch	Г	s	
119.	Silene conoidea L.	D	,	,	+	,	Th	Z	s	
120.	Spergula arvensis L.	D			+		Th	Z	s	
121.	Stellaria media (L.) Vill.	D	,		+	,	Th	Г	s	
122.	Vaccaria hispanica (Miller) Rauschert	D			+		đ	L	s	
	18. Caesalpiniaceae	ſ					ē	,	C	
123.	Cassia senna L.	a i				+ -	5;	ч,	Com	
124.	Gleatista triacanthos L.	0			+	÷	Mp	Г	Com	
125	Fuonumus involution Thumb.	C	+	+	+	+	Nn	Mes	v.	
	20. Chenopodiaceae	2					4.1		2	
126.	Chenopodium album L.	D	-	+	+		Th	N	s	-

SolutionControlControlLotren		-	Ľ	Table 1. (Cont'd.)			-				
$ \begin{array}{c} \mbox{Constraints} (1) & Constra$	S. No.		Habitat	V	Seaso	nality S	Sm	L. form	L. size	Lamina	Spinescence
$ \begin{array}{llllllllllllllllllllllllllllllllllll$	127.	Chenopodium ambrosioides L.	D			+		Th	Г	s	.
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	128.	Chenopodium murale L.	D	+	,		'	Th	Г	s	
$\label{eq:constraints} \begin{tabular}{l lllllllllllllllllllllllllllllllllll$	129.	Salsola tragus L.	D	,	,	+	+	Th	L	s	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	130.	Salsola griffithii (Bunge) Freitag & Khan	D	+	+	+	+	Ch	Г	s	
Constraints alteration of the constraints alteration of the constraints and the constrai		21. Convolvulaceae						İ		;	
$ \begin{array}{llllllllllllllllllllllllllllllllllll$	131.	Convolvulus arvesis L.	חמ		+			ff (	Z	s	
$\label{eq:production} \mbox{field} (eq.) 11. Ohen the eq. (for (for (for (for (for (for (for (for$	152.	Ipomoea purpura (L.) Koth.	n				+	ЧI	Z	n	
$ \begin{array}{llllllllllllllllllllllllllllllllllll$	133	22. Utassutateat Hidatalanhiini muanii (I adah ) H Ohha				+	+	2	L	U	
1. Construction1. Construction0 $+$	134	Rosularia adenotricha (Wall. ex Edoew.) Iansson & Rech f				- +	- +	<u>ی</u> د	Z	2 00	
		23. Cuscutaceae	3					)		2	
A Dynamication $1$	135.	Cuscuta reflexa Roxh.	C	+	+	+	+	Р	An	Abs	
		24. Dipsacaceae	1					•	÷.		
	136.	Dipsacus inermis Wall.	D				+	Th	Mic	s	
	137.	Scabiosa candollei DC.	D	,	,		+	Н	L	s	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		25. Ebenaceae									
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	138.	Diospyros kaki L.	C	+	+	+	+	Np	Mes	s	
<b>A. Relationce</b> Telesconce Telesconce Elegence Telesconce Elegence Elegence 	139.	Diospyros lotus L.	D	+	+	+	+	Np	Mic	s	
The grant of grant of grant of the first		26. Elacagnaceae									
T. Fuptoritiered hybridized (Wile expected Music prioritie configer Biss.Description the function of the function the function of the functionDescription to the function the functionDescription the function the functionDescription the function the functionDescription the function the functionDescription the function the functionDescription the functionDescription the function the functionDescription the function the functionDescription the functionDescription the functionDescription the function the function the functionDescription the function the function the function the function the functionDescription the function the function the function the functionDescription the function the function the functionDescription the function the functionDescription the function the function the functionDescripti	140.	Elaeagnus angustifolia L	D	+	+	+	+	Np	Z	s	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		27. Euphorbiaceae									
	141.	Andrachne cordifolia (Wall. ex Decne.) Muell	Q	+	+	+	+	d	Z	s	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	142.	Euphorbia cornigera Boiss.	D I	+ -	'	'		ų;	ц,	s	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	143.	Euphorbia granulata Forssk.	Ωı	+			·	ΞĘ	ц;	S C	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	144.	Euphorbia helioscopia L.	חנ			+ -		u e	Z,	× c	
3. Representation.2. A constraint of the second form2. Frank the	145.	Eupnorvia prostrata Alt.	ם ב	+	•	+ -		5 £	L L	00	
$ \begin{array}{cccccc} \mbox{Decreas balacity} Decreas bal$	140.	Activity Community L.	п			F	F	CII	IMICS	a	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	147	Currents halfoot Cait?		+	+	+	4	N	Ν	J	c,n
<b>29.</b> Function structure transition <b>10.10.10.10.10.10.29.</b> Function formaria indice (flassicn) Pugsley <b>6.</b> Grantmatexed formation <b>10.11.</b> <t< td=""><td>148</td><td>Quercus semicarnifolia Smith</td><td></td><td>- +</td><td>- +</td><td>- +</td><td>- +</td><td>d y</td><td>Mic</td><td>2 04</td><td>dс -</td></t<>	148	Quercus semicarnifolia Smith		- +	- +	- +	- +	d y	Mic	2 04	dс -
Function indicationD-+ThNSoftiant actionD++-+ThNSoftiant actionD++ThNSoftiant actionD++ThNSoftiant actionD+++ThNSoftiant actionD++++HNSoftiant actionD+++++LHypericatesD++++++NMesHypericatesD+++++NMesSoftwart actionD+++++NMesJuglandsconD+++++NMesJuglandsconD+++++NMesJuglands vegatiD+++++NMesJuglands vegatiD++++++NNJuglands vegatiD++++++HNJuglands vegatiD+++HNJuglands vegatiD+++HN<		Zuer cas semicar pijona sumu 20. Fumariaceae	د			-		drut	ATTA	2	
<b>30. Gentiamecae30. Gentiamecae30. Gentiamecae30. Gentiamecae</b> $Brodium alcicatorium (L) L. Herit ex AtionD++ThN31. Hypericateae(L) L. Herit ex AtionD++ThN31. Hypericateae(L) L. Herit ex AtionD+++ThN31. Hypericateae(L) L. Herit ex AtionD++++N31. Hypericateae(Nallex Camb) Hookf.D++++++N33. Juglandaceae(Nallex Camb) Hookf.D+++++NMes33. Juglandaceae(Nallex Camb) Hookf.D+++++NMes33. Juglandaceae(Nallex Camb) CoddD+++++NMes33. Juglandaceae(L) DruceD+++++NN34. Judarsegat(L) DruceD++++++N34. Judarsegat(L) DruceD++++++N34. Judarsegat(L) DruceD+++++HN34. Judarsegat(L) DruceD+++HNAlgean regotD++++H$	149.	Fumaria indica (Hausskn.) Pueslev	D	,	+		,	μL	Z	Dis	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		30. Gentianaceae	1							2	
Erodium nalacoides (T.) L. Herie ex AitonD+ThN $37.$ Hipportation performHyperican performD++ThN $37.$ Hipportation performHyperican performD+++NMes $37.$ Hipportation performD+++++NMes $37.$ Hipportation performD+++++NMes $37.$ Hipportation performD+++++NMes $37.$ Hipportation endowD+++++NMes $37.$ HipportationD+++++NMes $37.$ HipportationD+++++NMes $37.$ HipportationD+++++NN $37.$ HipportationD+++++NN $37.$ HipportationD++++NNN $37.$ LamiaceaD++++++NNLamiun vulgare L.Marnhium vulgare L.D+++HNMarnhium vulgare L.NMarnhium vulgare L.D++++HLNeption postiantor.L.D+++	150.	Erodium cicutarium (L.) L. Herit, ex Aiton	D	,			+	Th	L	S	,
31. Hypericaceae31. Hypericaceae $Hypericaceae$ $Hypericaceae$ $Hypericaceae$ $Hypericaceae$ $Hypericaceae$ $Hypericaceae$ $2. HippocasinamecaeP_1 + + + + + N_P3. JugiandaceaeP_1 + + + + + N_PAesculus indica (Wall.ex Camb.) Hook.f.D + + + + + + N_P3. JugiandaceaeI_{aedian} + + + + + + N_PAesculus indica (Wall.ex Camb.) Hook.f.D + + + + + + + N_P3. JugiandaceaeI_{aedian} + + + + + + + N_PJugian vulgaris (L.) DruceD + + + + + + + + + + N_PIaminin vulgare L.D + + + + + + + + N_PMentha splician L.D + + + + + + + + N_PNerata postorichs Benth.D + + + + + + + + N_PNerata postorichs Benth.D + + + + + + + N_PNerata postorichs Benth.D - + - + + + + + + + N_PNerata postorichs Benth.D - + - + + + + + + + N_PNerata postorichs Benth.D - + - + + + + + + + N_PNerata postorichs Benth.D - + - + + + + + + N_PNerata postorichs Benth.D - + + + + + + + + N_PNerata postorichs Benth.D - + - + + + + + + + N_PNerate postorichs Benth.D - + + + + + + + + + N_PNerate postorichs Benth.D - + + + + + + + + + N_PNerate postorichs Benth.D - + + + + + + + + + N_PNerate postorichs Benth.D - + + + + + + + + + N_PNerate postorichs Nerate.D - + + + + + + + + + + N_PNerate postorich Nerate.D - + + + + + + + + + + + + N_PNerate po$	151.	Erodium malacoides (L.) L. Herit ex Aiton	D		,		+	μŢ	Z	S	
$\begin{array}{llllllllllllllllllllllllllllllllllll$		31. Hypericaceae									
3.1. Implementation $A_{extention}$ $A_{exten$	152.	Hypericum perforatum L.	D			+	+	Ch	L	s	
3.3. Statutus function for the formation of t	153	32. HIPPOCAStanaceae According indian (Well av Comb.) Hook f		4	+	+	-1	Nin	Mac		
$ \begin{array}{llllllllllllllllllllllllllllllllllll$		acount mutu (mail.va Callor) moorie 33 Jugiandaceae	à		-	-	-	der	COTAT		
<b>3.4. Tamistere</b> <i>answerti</i> <b>3.4. Tamistere</b> <i>tranistere</i> <b>3.4. Tamistere</b> 	154	Inolane reoria I.		+	+	+	+	Mn	Mes	<b>X</b>	
Calaminita vulgaris (L.) DruceD++++NpIsodon rugosus (Wall. ex Benth.) CoddD+-+++ThIsodon rugosus (Wall. ex Benth.) CoddD+++ThMartubium wulgare L.D++++ThManha longifolia (L.) L.D+++HMentha longifolia (L.) L.D+++HNepeta podostachys Benth.D+++HOrignum basilicum L.D+++++HOrignum valgare L.D+++++HPhlomis stevertii Hook. f.D++++++		34. Lamiaceae	•					Aver		2	
$ \begin{array}{llllllllllllllllllllllllllllllllllll$	155	Calamintha vulgaris (L.) Druce	C	+	+	+	+	Nn	Mic	S.	
Lamium amplexicaule L.D-++++Marubium vulgare L.D+++HMentha longifolia (L.) L.D-++++HMentha spicata L.D-++++HNepeta podostachys Benth.D-+++HOcimum basilicum L.D++++HOriganum vulgare L.D++++HPhlomis stewertii Hook. f.D++++Np	156.	Isodon rugosus (Wall. ex Benth.) Codd		+		+	+	10	Z	2 00	
Marubium vulgare L.D-++++Mentha longifolia (L.) L.D-++++HMentha spicata L.D-++++HNepeta podostachys Benth.D+++HOcimum basilicum L.D++++HOriganum vulgare L.D++++HPhlomis stewertii Hook. f.D++++Np	157.	Lamium amplexicaule L.	D			+	+	μŢ	Γ	s	
Mentha longifila (L.) L.D-+++-GMentha spicata L.D-+++++HNepeta podostachys Benth.D+++HOcimum basilicum L.D++++HOriganum vulgare L.D+++HPhlomis stewertii Hook. f.D++++	158.	Marrubium vulgare L.	D			+	+	Н	Z	s	
Mentha spicata L.D-+++-GNepeta podostachys Benth.D+++HOcimum basilicum L.D++++HOriganum vulgare L.D++++HPhlomis bracteosa Royle cx Benth.D++++NpPhlomis stewertii Hook. f.D++++Np	159.	Mentha longifolia (L.) L.	D		+	+		Ċ	Z	S	
Nepeta polostachys Benth.D+++HOcimum basilicum L.D+++++ChOriganum vulgare L.D++++HPhlomis bracetesa Royle cx Benth.D++++NpPhlomis stewertii Hook. f.D++++Np	160.	Mentha spicata I.		,	+	+	,	5	Z	8	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	161	Neneta nodostachus Renth				+	+	Ξ			
Origanum vulgare L. Philomis stewertii Hook. f. Philomis stewertii Hook. f. D + + + + + Np	162	Ocimium hasilicium I		+	+	+	+ +	ť	2	2 04	
Philomis stewertii Hook. f. D + + + + Np	163	Origanism vasiticam L. Origanism vulgares I		- +		- 1	-	ц П	- 1	2 0	
Philomis stewertii Hook. f. D + + + + Np	164	Urgunum vurgure L. Dhlowie hundaona Porda av Banth		- +	14	• +	• +	r N	Mis	20	
	165	I nomes of acteors royte ex period. Phlomis stowertii Hook f		- +	- +	- +	- +	d d	N	2 02	
			4					e e		2	

	Ta	Table 1. (Cont'd.)							
. Division / Family / Species	Habitat	V	Seasonality W S	ality S	Sm	L. form	L. size	Lamina	Spinescence
Prunella vuloaris L.				1+	+	5	z	s	.
Salvia nloheia B Rr					+	Ē	Mic	2	
						30	Mac	2 0	
	יר				+ •	= :	INICS	20	
Scuteuaria unearis Bentu.	יב				+ -		ц,	20	
Stachys parvijiora Benth.	n n			+	+	Ξŧ	ц,	× v	•
Teucrium stocksianum Boiss.	a i	+	+	+	+	5	ц,	N (	
Thymus linearis Benth	D		,	+	+	H	Γ	S	
Ziziphora clinodioides Lam.	D	,		+	+	Ð	Г	s	
35. Loranthaceae	¢	-	-	-	-	F	L	G	
Viscum atoum L.	בר	+ -	+ -	+ -	+ -	- e		00	•
Viscum cruciatum Sieber ex Spreng	п	+	+	+	÷	ч	Ч	n	
Juithum actac				+	+	п	F	U	
Lymrum sancaria L. 37 Melverese	A	•		F	÷	ч	F	a	•
J. Maharatata Maha mederta Walir		,	+	+	+	μ	Mic	2	
Mahu negecta mun.			. 1	- +	- +	H H	Mic	200	
Malvastrum coromandelianum (L.) Garcke	D	,	,	+		н	N	s so	,
38. Meliaceae									
Melia azedarach L.	D	+	+	+	+	Mp	Z	Com	
<i>Cedrella toona</i> Roxb.	D	+ +	+	+	+	Mp	Z	Com	
39. Mimosaceae	ſ					;	,	t	
Prosopis glandulosa Torr	a i	+ ·	+ ·	+ ·	+ ·	d	ц,	Com	Sp.
Prosopis julifiora (Swartz) DC	n	+	+	+	+	ЧŅ	Г	Com	Sp
4u. Muraceae	2	+	-	+	+	N	Maa	U	
ricus carica L. Momis alba I	בר	+ +	+ +	+ +	+ +	dvi	Mee	00	
Morus utou L. Morus niora I.		• +	+ +	- +	• +	dw	Mes	2 00	
41. Morinaceae	1					deur		2	
Morina persica L.	D			+	+	Th	Mic	s	Sp
42. Myrtaceae	1						;	ł	
Eucalyptus globulus Labill.	ŋ	+	+	+	+	Mp	Z	N	
43. Oleaceae Fratinus vanthovuloidas (G. Don) DC		+	+	+	+	μN	Z	Com	
1 annus sammayromes (O. Don) DC Olas ferriainea Rovle		- +	- +	- +	- +	d n	zz	III S	
Syringa emodi Wall. ex Royle	D	+	+	+	• +	d	zz	s so	
44. Onagraceae									
Epilobium hirsutum L.	D			+	+	Н	Z	s	·
Profis nes-cannae	C	,	,	+	+	ĥ	Z	Com	
46. Papavaraceae	1						Ĩ		
Papaver somniferum L.	D			+	+	Th	Г	Dis	
47. Papilionaceae	¢				-	:		c	5
Aracins hypogaea L.	בר				ł	¤ €		<u>,</u>	ę.,
Astragatus psuocentros vat. puosus ratket. Astraoalus trihuloides Delile		• +		+ 1		55	<u>ن</u> ب		d 2
Caragana aerardiana Rovle ex Renth		- +	+	+		55	<u>ب</u> ډ	Com	5 S
Ebenus stellata Boiss	D	+	+	+	+	55	Ч	s	<u>,</u>
Indigofera heterantha var. heterantha Wall.	D	,	,	+	+	ch	L	Com	
Indigofera linifolia (L. f) Retz	Q			+	+	۴L	L	Com	
Lathyrus aphaca L.	D i	+			1	fl I	z;	Com	
Lathyrus sativus L.	<u>ם</u> נ			+ -	+	41	z	Com	
Medicago laciniata (L.) Mull.	а ı		+	+ ·		er e	Z	Com	•
Medicago lupulina L.	ביב			+ +	'	e e	22	com Com	
Methous matca (L.) All.	П	•	F	F		11	N	0	

S. No.

166. 167. 168. 170. 171. 173. 176. 177. 178. 179.

174. 175. 180. 181. 182. 183. 184. 185. 186. 187. 188. 189. 190.

192. 193. 194.

195. 196. 197. 201. 202. 203. 203. 205.

|        | -  | T        | Table 1. (Cont'd.) |               |            |      |                |            |            |             |
|--------|--|----------|--------------------|---------------|------------|------|----------------|------------|------------|-------------|
| S. No. | Division / Family / Species  | Habitat  | V                  | W Seasonality | ality<br>S | Sm   | L. form        | L. size    | Lamina     | Spinescence |
| 207.   | Pisum sativum L.   | D        |                    |               | +          | +    | dT.            | z          | Com        | .           |
| 208    | Rohinia neeudo-acacia L  | C        | +                  | +             | +          | +    | 'nZ            | Z          | Com        |             |
| .007   | Contour mollin Com   |          |                    |               | • -        | • -1 | 4 N            |            | uno j      |             |
| 202.   |  | <b>ب</b> | •                  |               | + -        | ŀ    | हे।            | ; <i>د</i> | Coll       | •           |
| 210.   | Irijouum pratense L.   | ، ر      |                    | +             | +          |      | = 1            | Z          | Com        |             |
| 211.   | Trifolium repens L.  | с<br>С   |                    | +             | +          |      | Πh             | Z          | Com        |             |
| 212.   | Trigonella monantha ssp. incisa (Benth.) Ali comb. & stat                          | C        |                    |               | +          | +    | ЧĽ             | Γ          | Comp       |             |
| 213.   | Vicia sativa L.  | D        | ,                  | ,             | +          | ,    | Th             | L          | Com        |             |
|        | 48. Platanaceae  |          |                    |               |            |      |                |            |            |             |
| 214.   | Platanus orientalis L.   | D        | ,                  | ,             | +          | +    | Mp             | Mes        | s          |             |
|        | 49. Plantaginaceae   |          |                    |               |            |      |                |            |            |             |
| 215.   | Plantago ciliata subsp. lanata (Boiss.) Rech.                                      | D        | +                  | ,             | ,          | +    | Th             | z          | s          |             |
| 216.   | Plantago lanceolata L.   | D        |                    |               | +          | +    | μ              | N          | S          |             |
| 217    | Plantaso maior 1.  |          | ,                  | ,             | +          | +    | Ē              | Mic        | 2          |             |
| 218.   | Plantago ovata Forssk  | D        |                    |               | +          | +    | f.             | Z          | ŝ          |             |
|        | 50. Podonhvllaceae   | I        |                    |               |            |      |                |            | I          |             |
| 210    | Podonhvillum emodi Wall ex Rovle   |          |                    |               | +          | +    | Ċ              | N          | Com        |             |
|        | 51. Polyaslareae   | 3        |                    |               |            |      | ,              |            |            |             |
| 000    | Dohnala abuscinica R Rr  |          | ,                  |               | 1          | +    | Ę              | 1          | 2          |             |
|        | r urgana uryaanneu 18. m.<br>23 Dahvaanaaaaa                                       | 2        | ı                  | ı             | ı          | -    |                | 1          | מ          |             |
| 100    | Distorts annulation (D. Dan) Green   |          |                    |               | +          | +    | Ċ              | Ν          | 0          |             |
| 177    | Distorta amplexicaturs (D. Don) Orcen  | בר       | • -                |               | + +        | + +  | פכ             | 2 -        | 00         |             |
| .777   | Oxyrua aigyna (L.) rill  | י ב      | F                  | F             | + -        | F    | <b>4</b> E     | ц,         | 20         |             |
| .577   | Polygonum aviculare L.   | n n      |                    |               | + ·        |      | = 1            | с Г.       | <b>^</b> 0 |             |
| . 774. | Polygonum glabrum WILIG  | ı د      | •                  |               | + -        |      | u :            | z          | 2          |             |
| 225.   | Polygonum plebejum R. Br.  | D        | •                  | +             | +          |      | Н              | Z          | s          | •           |
| 226.   | Rumex nepalensis L.  | D        |                    |               | +          |      | 5              | Mes        | s          |             |
| 227.   | Rumex dentatus L.  | D        |                    |               | +          | +    | Th             | Mic        | s          |             |
|        | 53. Primulaceae  |          |                    |               |            |      |                |            |            |             |
| 228.   | Anagallis arvensis L.  | D        |                    | ,             | ,          | +    | Th             | Z          | s          |             |
| 229.   | Androsace rotundifolia Hardwicke   | D        |                    |               | +          | +    | Ċ              | Z          | s          |             |
|        | 54. Punicaceae   |          |                    |               |            |      |                |            |            |             |
| 230.   | Punica granatum L.   | D        | +                  |               | +          | +    | Np             | Z          | s          |             |
|        | 55. Ranunculaceae  |          |                    |               |            |      |                |            |            |             |
| 231.   | Adonis aestivalis L.   | D        | ,                  | ,             | +          | ,    | ЧТ             | Г          | s          |             |
| 232.   | Aquilegia pubiflora var. pubiflora L.  | D        |                    |               | +          | +    | IJ             | Mic        | s          |             |
| 233.   | Clematis orientalis L.   | D        | +                  | +             | +          | +    | с <sup>р</sup> | z          | Com        |             |
| 234.   | Ranunculus laetus Wall. ex Hook.f. & Thoms   | D        | +                  | +             | +          | +    | Ū              | Mic        | s          |             |
|        | 56. Khamnaceae   | ,        |                    |               |            |      | ;              | :          | ,          | ,           |
| 235.   | Berchemia edgeworthii Lawson   | D i      | + -                | + -           | + -        | + ·  | H;             | z          | N C        | ę,          |
| 230.   | Sagerena thea var. branarethiana (Aitch.) Qaiser & Nazim                           | n        | +                  | +             | ÷          | +    | dN             | Z          | <b>^</b>   | de          |
| 100    |  | ¢        | -                  | -             | -          | -    | -M             | Mar.       | G          |             |
| 121.   | Urataegus songarica N. Noci  | בר       | ł                  | ł             | + +        | + +  | dy             | Mes        | 2          |             |
| 730    | Lucnesneu nuuca (ruutews) rocke<br>Fragaria nubicola (Hook f ) I indl. ev I acaita |          |                    |               | - +        | - +  | 20             | ZZ         | Com        |             |
| 240.   | r ragara nanerota (1100k.1.) Dinut. VA bavana<br>Mahis namila Mill                 |          |                    |               | - +        | - +  | , r            | Mic        | S          |             |
| 241.   | Potentilla gerardiana Lindl. ex Lehm   |          |                    |               | - +        | - +  | μ              | N          | 200        |             |
| 242    | Potentilla sumina L.   |          | ,                  | ,             | +          | +    | Ξ              | Z          | Com        |             |
| 243    | Rosa hrunonii Lindl  |          |                    |               | +          | • +  | 10             | z          | Com        |             |
| 244.   | Rosa webbiana Wall. ex Rovle   | D        | +                  | +             | +          | +    | 5              | z          | Com        |             |
| 245.   | Rubus anatolicus (Focke) Hausskn   | D        |                    |               | +          | +    | Н              | Z          | Com        |             |
|        | 58. Rubiaceae  |          |                    |               |            |      |                |            |            |             |
| 246.   | Galium tricornutum Dandy   | D        |                    |               | +          | +    | Th             | Z          | s          |             |
| 247.   | Rubia cordifolia L.  | D        |                    |               | +          | +    | Н              | Z          | s          |             |
|        | 59. Rutaceae   |          |                    |               |            |      |                |            |            |             |
| 248.   | Skimia laureola (DC) Scib & Zucc.  | D        | +                  | +             | +          | +    | Ch             | Mic        | s          |             |
|        |  |          |                    |               |            |      |                |            |            |             |

|  |           |   |         |   | 5           |       |     |         |            |          |             |
|--|-----------|---|---------|---|-------------|-------|-----|---------|------------|----------|-------------|
| Off with the state of the state o                               | . No.     |   | Habitat | V | Season<br>W | slity | Sm  | L. form | L. size    | Lamina   | Spinescence |
| $\label{eq:matrix} \mbox{form} form$             |           | 60 Salicaceae                             |         | • | :           | 2     |     |         |            |          |             |
|  | 010       |   | 2       |   |             | -     | -   | M.      | ME         | 5        |             |
|  | 249.      |   | ם נ     |   |             | + -   | + - | dw      | MIC        | 00       |             |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$  | .007      | Popius nigra L.                           | ם ב     |   | 1.          | + ·   | + · | dz;     | MIC        | <u>^</u> |             |
| $ \begin{array}{llllllllllllllllllllllllllllllllllll$  | .107      | Salix alba L.                             | n       | + | +           | +     | +   | dM      | Z          | n        |             |
| Safe and finition of definitionMiceNMiceNSafe and set of (static filt)Safe and set of (static filt) $(s, shift)$ $(s, shift$  | 252.      | Salix denticulata Andersson               | D       | • |             | +     | +   | ЧN      | Mic        | s        |             |
| C. StathardC $+$ <td>253.</td> <td>Salix wallichiana Anderssson</td> <td>D</td> <td></td> <td></td> <td>+</td> <td>+</td> <td>Np</td> <td>Mic</td> <td>s</td> <td></td>  | 253.      | Salix wallichiana Anderssson              | D       |   |             | +     | +   | Np      | Mic        | s        |             |
|  |           | 61. Sambucaceae                           |         |   |             |       |     | I       |            |          |             |
| <b>C. Set Money StateC. Set Mana StateC. Set Mana StateDeter Mana StateDeter Mana StateDeter Mana StateDeter Mana StateC. Set Mana StateC. Set Mana StateDeter Mana StateC. Set Mana StateDeter Mana State</b>   | 254.      | Sambucus nigra L.                         | C       | + | +           | +     | +   | ND      | Z          | Com      |             |
|  |           | 62. Savifragreae                          | •       |   |             |       |     | 1.      |            |          |             |
| $ \begin{array}{llllllllllllllllllllllllllllllllllll$  | 255       | Revenia strashari (Hock f. & Thoms ) Find |         | ı |             | +     | +   | Ċ       | Mic        | 2        |             |
| $ \begin{array}{llllllllllllllllllllllllllllllllllll$  |           |   | ۲       | ı | ı           | -     | -   | 2       | ALLA       | ב        | •           |
| $\label{eq:constraint} Performation Regards L, Constraint Regards L, Constraint Regards Regar$       |           | 03. Scropnulariaceae                      |         |   |             |       |     |         |            |          |             |
| $\label{eq:constraints} Periodic and metal Beth, here a constraints and the form of an offer the constraint and the form of an offer the constraint and the form of the form $       | 256.      | Verbascum thapsus L.                      | D       | + | +           | +     |     | ЧĽ      | Mes        | s        | •           |
| Promise agained Bern, Formise agained Bern, Formise agained Bern, Formise agained Bern, Formise agained Bern, Enternet and Ness. Parameter and N         | 257.      | Verbascum erianthum Benth.                | D       | + | +           | +     |     | ЧТ      | Mic        | s        |             |
| $\label{eq:constraints} \begin{tabular}{lllllllllllllllllllllllllllllllllll$   | 258       | Veronica aautica Bern.                    |         |   |             | +     |     | Ľ       | z          | Dis      |             |
| 6. Solution $6.$   | 250       | Veronica didima Tenore                    |         |   |             | +     | +   | 5       | Z          | v        |             |
| $ \begin{array}{llllllllllllllllllllllllllllllllllll$  |           | ka Colomozozo                             | 2       |   |             |       |     | ,       | -          | 2        |             |
| Pantar and Noss. $Pantar and Noss.$ $Solaman nigram. L. Solaman nigram. Solada. Note C. Solaman nigram. Solada. Note L. Solaman nigram. L. Solaman nigram. Solada. Note L. Solada. Note L. Solada. Note L.  Solada. Not$   | 0.00      |   | ſ       |   |             |       |     | Ē       |            | đ        | c           |
| Printi alla liss         Print alla list         Print alla list         Print list  | 260.      | Datura alba Nees.                         | D       |   |             | +     | ,   | ЧТ      | Mic        | s        | Sp          |
| $ \begin{array}{llllllllllllllllllllllllllllllllllll$  | 261.      | Petunia alba Juss                         | D       |   |             | ,     | +   | ЧĽ      | Г          | s        |             |
| $ \begin{array}{llllllllllllllllllllllllllllllllllll$  | 262.      | Solanum dulcamara L.                      | D       | + | +           | +     | +   | Np      | z          | s        |             |
| $ \begin{array}{llllllllllllllllllllllllllllllllllll$  | 263       | Solanum melanoina I.                      | C       |   | ,           | +     | +   | Ē       | Mic        | 2        |             |
| $ \begin{array}{ccccc} \mbox{communication} \mbox{inform} infor$ |           | Colonium nicemian                         |         |   |             | • +   | • + | Ē       | Mic        |          |             |
| $\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$   | 5         | Journam nugram L.                         | יר      | • |             | + -   | + - | =       | INTIC      | 0 0      | •           |
| Solarm strattered Bun, I:<br>Michanis consultant strattered Bun, I:Solarm strattered Bun, I:<br>michanis consultant strattered Bun, I:Michan is<br>michanis consultant strattered Bun, I:Michan is<br>   | 702.      | Solanum nigrum var. villosum L.           | ה       |   |             | +     | +   | U P     | Z          | 2        | • ,         |
| Withanis corgulars (Stocks) Dunal<br>Grithanis corgulars (Stocks) DunalD $+$ <td>266.</td> <td>Solanum surattense Burm. f.</td> <td>D</td> <td>+</td> <td></td> <td>,</td> <td></td> <td>Н</td> <td>Mic</td> <td>s</td> <td>Sp</td>  | 266.      | Solanum surattense Burm. f.               | D       | + |             | ,     |     | Н       | Mic        | s        | Sp          |
| Withanis someface (L) DunalD········S $G_s$ . Trynsoamerface (L) Dunal $G_s$ . Trynsoamerface (L) Dunal $D$ ·····S $Dayline merconata RyleD·······SSDayline merconata RyleD·······SSDayline merconata RyleD·······SSG_s. UnbellifereaD········SSBaplearum candoler Wall ex DCD·······SSBaplearum candoler Wall ex DCD·······SSBaplearum candoler Wall ex DCD········SBaplearum candoler Wall ex DCD········SG_s. UnmercenD·········SSG_s. UnmercenD·········SSG_s. UnmercenD·········SSG_s. UnmercenD·····$  | 267.      | Withania coagulans (Stocks ) Dunal        | D       | + | +           | +     | +   | ch      | Mic        | s        | •           |
| 6. Trynelestere6. Trynelestere6. Trynelestere6. Trynelestere6. Trynelestere $Pikromarca RoylePikromarca RoylePironerona ConscererD++Pironerona ConscererD +Pironerona ConscererD ++Pironerona ConscererD  +Pironerona ConscererD  ++Pironerona ConscererD  +++Pironerona ConscererD  ++++Pironerona ConscererD   -$  | 268.      | Withania somnifera (L.) Dunal             | D       |   |             | +     | +   | Ch      | Mic        | s        |             |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$   |           | 65. Thymelaeaceae                         |         |   |             |       |     |         |            |          |             |
| Wistronuic cancerer MetanD++++NNS66. Unitaliferea66. UnitalifereaD+++NNS $70$ risis legrophylla (L.) Reich, FD+++NNS $70$ risis legrophylla (L.) Reich, FD+++NNS $70$ risis legrophylla (L.) SpragueD+++NNS $70$ risis legrophylla (L.) SpragueD++++NNS $70$ risis regroup monthD+++NNS $61$ unitationD++++NNS $Calits ericorary Decne.D++++NNS61 unitationD+++++NNCom61 unitationD++++++NNCom70 unitationDDNCom61 unitationDNNCom70 unitationD$   | 269.      | Daphne mucronata Royle                    | D       | + | +           | +     | +   | Np      | Г          | s        | '           |
| 6. Unbelificate $\delta_{u}$ Unbelificate $\delta_{u}$ Unbelificate $Buplearam condoleri Wall. ex DCD\cdots+++<$   | 270.      | Wikstroemia canescens Meisn               | D       | + | +           | +     | +   | Np      | Z          | s        |             |
| $ \begin{array}{llllllllllllllllllllllllllllllllllll$  |           | 66. Umbellifereae                         |         |   |             |       |     |         |            |          |             |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$  | 171       | Runleurum candolloi Wall ex DC            | C       | , |             | +     | +   | Nn      | Z          | v.       |             |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$   | 272       | Torilis lentonholla (1.) Reichh. F        |         | , | ,           | +     | +   | ŤΗ      | :          |          |             |
| 67. Unificate $0.7.$ $M_{\rm D}$ $N$ $S$ 67. Unification $0.7.$ $0.1$ $1.1.$ $M_{\rm D}$ $N$ $S$ 68. Uritication $0.1.$ $0.1.$ $1.1.$ $0.1.$ <t< td=""><td>273</td><td>Trachvenermum ammi (I.) Shraone</td><td></td><td>,</td><td>,</td><td>. ,</td><td>+</td><td>ΞĹ</td><td><u>ب</u> ہ</td><td></td><td></td></t<>  | 273       | Trachvenermum ammi (I.) Shraone           |         | , | ,           | . ,   | +   | ΞĹ      | <u>ب</u> ہ |          |             |
| Order is eric correctedD++++MpNS $Order is eric correctedD+++MpNSOrder is eric correctedD+++HLSOrder is eric correctedD+++HLSOrder is eric correctedD+++HLSOrder is eric correctedD+++HNCorrOrder is eric correctedD+++NNCorrOrder is eric correctedD+++NNCorrOrder is eric correctedD+++NNCorrOrder is eric correctedDSNOrder is eric correctedDNNCorrOrder is eric correctedDNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN<$   |           | 67 Illmaceaa                              | 1       |   |             |       |     |         | 1          | 2        |             |
| 6. Unicar pluiper a L $M_{P}$ <th< td=""><td>P14</td><td>Coltis enjocarna Decne</td><td></td><td>+</td><td>+</td><td>+</td><td>+</td><td>Мп</td><td>Z</td><td>2</td><td></td></th<>  | P14       | Coltis enjocarna Decne                    |         | + | +           | +     | +   | Мп      | Z          | 2        |             |
| Order of initial for a function of the initial form of the initial fo                        | ÷.        | ceus eriorarpa poeno.<br>Kg Tirtheacaaa   | 2       |   |             | -     | -   | diat    | 5          | ב        | I           |
| Ortica punityera L.6) Verbinaceae6) Verbinaceae6) Verbinaceae6) Verbinaceae6) Verbinaceae6) Value6) Value7) Value <td>375</td> <td>United with figure I</td> <td></td> <td></td> <td></td> <td>+</td> <td></td> <td>Ċ</td> <td>Min</td> <td>ŭ</td> <td></td>   | 375       | United with figure I                      |         |   |             | +     |     | Ċ       | Min        | ŭ        |             |
| Prise enclosedD-++++++-SPrise enclosedD+++++NComPrise negrado L.D++++++NComThere are officialis L.D+++NComTo violaceaeDGMicSTo violaceaeD+GMicSTo violaceaeD+STo violaceaeD+STo violaceaeD++SSTo arcsci Boiss.D+SSTo violarceaeD+ <td>· · · · ·</td> <td>Orneu puunyeru L.<br/>60 Varhinaaaaa</td> <td>۲</td> <td>·</td> <td>ı</td> <td>F</td> <td>•</td> <td>2</td> <td>TITA</td> <td>a</td> <td>•</td>   | · · · · · | Orneu puunyeru L.<br>60 Varhinaaaaa       | ۲       | · | ı           | F     | •   | 2       | TITA       | a        | •           |
| Topical matrix in the interval of the interv                         | 276       | Dhula nodifiora (T.) Green                |         |   | 1           | +     | +   | п       | 1          | 2        | I           |
| veroena ojjicinairs L.D-++++NNSVitex negundo L.D+++++++NCom70. Violaceae70. ViolaceaeViola consersens Wall. ex Roxb.D+++NS70. Violaceae71. Vitaceae71. Vitaceae72. ZygophylaceaePitis vinife73. Tribulus terrestris L.74. Tribulus terrestris L.   |           |   | ב       |   |             |       |     |         | 2          | 20       |             |
| Vitex neginal L.D++++++Com70. Violaceae70. Violaceae70. Violaceae71. Viola stocksi Bois.71. Vitaceae71. Vitaceae72. Vigophylaceae73. Vibitulus tervestris L.74. Tribulus tervestris L.75. State tervestris L.75. Vibitulus tervestris L.76. State tervestris L.77. State tervestris L. <td>.117</td> <td>Verbena ojjicinaiis L.</td> <td>ם ב</td> <td></td> <td>1 •</td> <td>+ ·</td> <td>+ -</td> <td>- ;</td> <td>2 2</td> <td>° .</td> <td></td>   | .117      | Verbena ojjicinaiis L.                    | ם ב     |   | 1 •         | + ·   | + - | - ;     | 2 2        | ° .      |             |
| 70. Violaceae70. Violaceae $Viola conscents Wall. ex Roxb.DViola conservents Wall. ex Roxb.DViola stocksii Boiss.Viola stocksii Boiss.Viola stocksii Boiss.T1. VitaceaeT1. VitaceaeT. VitaceaeT1. VitaceaeT. Vitaceae<$   | 278.      | Vitex negundo L.                          | D       | + | +           | +     | +   | dN      | z          | Com      |             |
| Viola carescens Wall. ex Roxb.D++++GMicS $Viola stocksi Bois.D+GMicST1. VitaceaeVitis vinifera LPisi per la stocksi Bois.D+-+++++T2. VigophyllaceaeT2. VigophyllaceaeD++++TDisTribulas tarbertis L.D+HLCom$  |           | 70. Violaceae                             | I       |   |             |       |     |         |            |          |             |
| Viola stocksii Boiss.         D         +         -         -         -         G         Mic         S           71. Vitaceae         71. Vitaceae         D         +         -         +         +         +         S           71. Vitaceae         D         +         -         +         +         +         Nic         Mic         S           71. Vitaceae         D         +         -         +         +         +         +         S           72. Xgophyllaceae         D         -         -         +         +         Dis           Pesaruta transfal.         D         +         -         -         H         L         Dis           Tribulus transfal.         D         +         -         -         H         L         Com  | 279.      | Viola canescens Wall. ex Roxb.            | D       |   |             | +     | +   | G       | Mic        | s        | •           |
| 71. Vitaceae       71. Vitaceae         Yitis vinifera L       D       +       +       +       +       +       S         72. Zygophyllaceae       D       -       -       +       -       H       L       Dis         Peganum harmala L.       D       +       -       -       H       L       Com   | 280.      | Viola stocksii Boiss.                     | D       | + |             |       |     | U       | Mic        | s        | •           |
| Vitis vinjera LD+-++Np<MesS72. ZygophyllaceaeD++LDisPeganum karmala L.D+HLDisTribulus terrestris L.D+HLCom   |           | 71. Vitaceae                              |         |   |             |       |     |         |            |          |             |
| 72. Zygophyllaceae<br>Peganum harmala L.<br>Tribulus terrestris L.<br>D + H L Dis  | 281.      | Vitis vinifera L                          | D       | + |             | +     | +   | Np      | Mes        | s        |             |
| Peganum harmala L. Dis H L Dis<br>Tribulus terrestris L. D + H L Com   |           | 72. Zygophyllaceae                        |         |   |             |       |     |         |            |          |             |
| Tribulus terrestris L. D + H L Com   | 282.      | Peganum harmala L.                        | D       |   |             | +     |     | Н       | Г          | Dis      | •           |
|  | 283.      | Tribulus terrestris L.                    | D       | + |             | ,     |     | Н       | Г          | Com      | Sp          |

Table 2. Summary of characteristics of flora listed in table 1.

| Table  | 2. Summary of characteristics | of flora lis | sted in table 1. |
|--------|-------------------------------|--------------|------------------|
| S. No. | Ecological characteristics    | No.          | Percentage       |
|        | A. Flora                      |              |                  |
| 1.     | Total species                 | 283          | -                |
| 2.     | Family                        | 85           | -                |
| 3.     | Genera                        | 222          | -                |
|        | B. Seasonality/Aspect         |              |                  |
| 1.     | Autumn                        | 120          | 42.40            |
| 2.     | Winter                        | 114          | 40.28            |
| 3.     | Spring                        | 224          | 79.15            |
| 4.     | Summer                        | 198          | 69.96            |
|        | C. Habitat types              |              |                  |
| 1.     | Wet                           | 11           | 3.88             |
| 2.     | Dry                           | 252          | 89.04            |
| 3.     | Both                          | 3            | 1.06             |
| 4.     | Cultivated                    | 17           | 6.00             |
|        | D. Habit                      |              |                  |
| 1.     | Spiny                         | 18           | 6.36             |
| 2.     | Smooth                        | 265          | 93.63            |
|        | E. Leaf type                  |              |                  |
| 1.     | Simple                        | 230          | 81.27            |
| 2.     | Compound/ disected            | 50           | 17.66            |
| 3.     | Absent                        | 3            | 1.06             |
|        | F. Life form spectra          |              |                  |
| 1.     | Therophyte                    | 107          | 37.80            |
| 2.     | Hemicryptophyte               | 37           | 13.07            |
| 3.     | Chamaephyte                   | 30           | 10.60            |
| 4.     | Geophyte                      | 37           | 13.07            |
| 5.     | Nanophanerophyte              | 47           | 16.60            |
| 6.     | Microphanerophyte             | 22           | 7.77             |
| 7.     | Parasite                      | 3            | 1.06             |
|        | G. Leaf size spectra          |              |                  |
| 1.     | Leptophyll                    | 89           | 31.44            |
| 2.     | Nanophyll                     | 121          | 42.75            |
| 3.     | Microphyll                    | 51           | 18.02            |
| 4.     | Mesophyll                     | 19           | 6.71             |
| 5.     | Aphyllous                     | 03           | 1.06             |
|        |                               |              |                  |

It is pragmatic to classify the vegetation into strata. Microphanerophytes constituted the tree layer and nanophanerophytes that of shrub layer. Therophytes, hemicryptophytes and geophytes give rise to herbaceous layer. The stratification is however less obvious due to drought, deforestation and heavy grazing. Shimwell (1971) and Cain & Castro (1959) concluded therophytes as the characteristics of desert environment. The dominant biological spectrum in Brazil was phanerophytes and hemicryptophyte also in harmony with the current study (Batalha & Martins 2002). Hussain et al. (2009) determined parallel trend concerning the occurrence of hemicryptophytes and therophytes in ruined and dry habitats. Nanophanerophytes and therophytes were common across the year particularly in spring due to availability of water. Guo et al., 2009; Musila et al., 2003 and Manhas et al., 2010 suggested occurrence of therophytes due to hostile habitation which is in agreement to our findings. Similarly life form, from Kotli Hill, Sarsawa supported nanophanerophyte, hemicryptophytes and therophytes respectively as stated by Nazir & Malik (2006). The high proportion of therophytes is in accordance with our findings. Therophytes and chamaephytes were also measured as the main biological form in open plains and deserted condition by Batalha & Martins (2002, 2004) and Gutkowski *et al.*, (2002). Dry-cool climate and heavy grazing direct to ruthless circumstance in Kurram Agency. Conclusion from Odisha, India of (Kar *et al.*, 2010) regarding the prevalence of nanophanerophytes and therophytes are just similar to the present work.

Leaf spectrum: The overall leaf size spectra showed that the leaf spectrum consisted of 121 Sp. (42.75%) of class nanophylls and 89 Sp. (31.44%) of leptophylls. Mesophylls and microphylls respectively showed 19 Sp. (6.71%) and 51 Sp. (18.02%). Periplocacalopyhlla, Cuscutareflexa and Periplocaaphyllawas leafless plants in the area (Table 2). Temporal variation in the leaf size index dominated by nanophylls with 49 Sp. (40.83%) in autumn. Thirty one species (25.83%) as Leptophylls, 22 species (18.33%), as microphylls, 15 species (12.50%) as mesophylls and 3 species (2.50%) as aphyllous were subsequently existing. Winter being, dry possessed nanophylls as 51 sp. (44.37%) and leptophylls (25 Sp.). The other sizes were 22 (19.29%) as Microphyll and 13 (11.40%) (Table 3). Nanophylls with 104 species (46.42%), leptophylls with 61 species (27.23%), microphylls with 41 species (18.30%) and leafless 3 (1.33%) respectively were present in spring. However summer was dominated with 79 sp. (39.89%) by nanophylls and 60 sp. (30.30%) by leptophylls. Microphyll 41 (20.70%), and mesophyll 15 (7.57%) of least concern. Tareen & Qader, 1993; Cain & Castro 1959 and Husain et al., 2005 stated that nanophylls and leptophylls are the indicators of warm desert and brackish habitats and Microphylls that of steppes conditions.

Moist and Dry climate consisted high proportion of nanonphyllous. Nasir & Sultan (2002) observed that leptophylls are prevalent in dry and unfavorable situation. While moist environmental condition in Azad Kashmir supported microphyllous vegetation opposite to our results (Hussain & Chudhary, 2009). Meager nutrients make the soil deserted thereby making tolerance for roots to catch and transport mineral ultimately, supporting nanophyllous and leptophyllous shrubbery similar to the current study (Costa et al., 2007). In the present study it is crystal clear that leaf spectrum is constantly changing according to the season and weather due to ephemerals and bulbous geophytes, but the evergreen more or less maintained the same status throughout the year. Hussain et al. (2015) stated that regional climatic condition play key role in determination, the leaf spectrum dominancy. The nanophyllous and microphyllous in Waziristan and Kotli is right in favor of the present findings (Badshah et al., 2010a; Malik et al., 2007). The harmony is mostly due to the hilly and topographic similarity among the areas. The leaf spectrum and biological spectrum alone is not sufficient for the ecological study of a region but quantitative studies like vegetation structure and conservation is equally important.

|        |                   |     |       |     | Seas  | ons |       |     |       |
|--------|-------------------|-----|-------|-----|-------|-----|-------|-----|-------|
| S. No. | Parameters        | Au  | ıtumn | W   | ïnter | S   | pring | Su  | mmer  |
|        |                   | No  | % Age |
|        | Life form         |     |       |     |       |     |       |     |       |
| 1.     | Therophyte        | 21  | 17.50 | 23  | 20.17 | 70  | 31.25 | 55  | 27.77 |
| 2.     | Hemicryptophyte   | 14  | 11.66 | 10  | 8.77  | 26  | 11.60 | 28  | 14.14 |
| 3.     | Chamaephyte       | 16  | 13.33 | 13  | 11.40 | 30  | 13.39 | 22  | 11.11 |
| 4.     | Nanophanerophyte  | 40  | 33.33 | 40  | 35.08 | 47  | 20.98 | 45  | 22.72 |
| 5.     | Microphanerophyte | 18  | 15.00 | 15  | 13.15 | 21  | 9.35  | 21  | 10.60 |
| 6.     | Geophyte          | 08  | 6.66  | 10  | 8.77  | 27  | 12.05 | 24  | 12.12 |
| 7.     | Parasites         | 03  | 2.5   | 003 | 2.63  | 03  | 1.33  | 03  | 1.51  |
|        | Total             | 120 | 100   | 114 | 100   | 224 | 100   | 198 | 100   |
|        | Leaf size         |     |       |     |       |     |       |     |       |
| 1.     | Leptophyll        | 31  | 25.83 | 25  | 21.92 | 61  | 27.23 | 60  | 30.30 |
| 2.     | Nanophyll         | 49  | 40.83 | 51  | 44.37 | 104 | 46.42 | 79  | 39.89 |
| 3.     | Microphyll        | 22  | 18.33 | 22  | 19.29 | 41  | 18.30 | 41  | 20.70 |
| 4.     | Mesophyll         | 15  | 12.50 | 13  | 11.40 | 15  | 6.69  | 15  | 7.57  |
| 5.     | Aphyllous         | 03  | 2.50  | 03  | 2.63  | 03  | 1.33  | 03  | 1.51  |
|        | Total             | 120 | 100   | 114 | 100   | 224 | 100   | 198 | 100   |

Table 3. Seasonal diversity in life form and leaf sizes.

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