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FLORISTIC DIVERSITY AND CHOROTYPE ANALYSIS OF TERICH VALLEY CHITRAL: A CONTRIBUTION TO THE FLORA OF HINDUKUSH RANGE, NORTHERN PAKISTAN

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ABSTRACT

Terich valley in district Chitral, Hindukush Range, being a remote area remained unexplored regarding plant resources. The present study was conducted during 2017-2019 in different seasons for the documentation of species diversity, phyto-climatic spectrum and Chorotype. Floristic inventory of the study area showed that there were 445 species belonging to 272 genera and 71 families. The ecological adaptation of plant species was determined using Raunkiaer's method and chorotype by indispensible references. The dominant families were Asteraceae (88 Species, 19.73%), Poaceae (49 Species, 10.73%), Papilionaceae (34 Species, 7.6%) and Brassicaceae (30 Species, 6.62%). Among the exsiting genera there were 29 monotypic genera, 11 genera with two species, 10 genera with three species and the other with low diversity. Out of 273 genera, *Taraxacum* (12 Species), *Astraglus* and *Cousinia* (9 Species each), *Artemisia* and *Silene* (8 Species each) and (*Bromus* 7 Species) were the richest genera. The most extended Chorotype (233 Species, 53%) was related to Irano-Turanian elements (52 Species, 12%) and endemic taxa. The current work showed that the flora of the valley is diverse due to climatic conditions, altidutinal variation, slope and tophography. This study is the first inventory of the valley which provides baseline information for the future prediction regarding plant resources.

Keywords: Flora, Biological spectrum, Chorotype, Terich Valley
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INTRODUCTION

This study was conducted in Terich Valley, Chitral of Hindukush region throughout the growing seasons from 2017 to 2019. This valley is located between 72° 07/ to 73° 97/ E longitude and 35° 20/ to 36° 55/ N latitude, the altitude ranges from 2850 m at Rayeen to 7685 m at Terich Mir (Fig. 1). The area of Terich Valley is 1275km^2 with a total population of 32537 individuals. Rugged and uneven terrain characterizes the Valley. Temperature ranges from -12 ^{0}C in winter to 30 ^{0}C in summer. Phytogeographically, Terich Valley lies in Irano-Turanian floristic region. Floristically, Irano-Turanian region is luxuriant occupied by 45.6 % of the flora of Pakistan (Ali and Qaiser, 1986). Floristic diversity depends upon the altitudinal gradient, climatic and habitat conditions (Raunkiaer, 1934). Floristic study is a basic prerequisite for much of the essential exploration of tropical community ecology, such as showing dynamics of species diversity and understanding the pattern of species distribution (Perveen *et al*., 2008). In 1934, Raunkaier coined the term 'biological spectra' referring to their annual buds and environmental conditions. Leaf size also helps to provide information on the relationship between plants and the physiological cycle of individual plant species (Odland, 2009). Alsherif, (2013) for floristic composition of the Khulais Region, Western Saudi Arabia, Perveen *et al*., (2008) Dureji Khirthar Range, Durrani *et al*., (2010) Aghberg Rangelands, Balochistan, Amjad *et al*., (2012) Sakardu Gilget District, has conducted different studies on our research. There are three major phytochorias, including Irano-Turanian, Saharo-Sindian and Sino-Japanese, dominated by the introgression of Euro-Siberian (boreal), Mediterranean species (Vetaas and Grytnes, 2002). There is, however, no reference to the Terich Valley floristic research, so the present study aims to explore the species diversity, biological spectrum and chorotype of the valley.

MATERIALS AND METHODS

A detailed inventory of the flora of Terich valley, Chitral was prepared through collection of plant specimens in different seasons. The Plant specimens were collected from five selected ecological zones Shagrom, Warimon, Zondrangam, Rosh Gol and Ghari, then hard-pressed and identified according to the Flora of Pakistan (Nasir and Ali, 1970-1989, Ali and Nasir, 1989-1991, Ali and Qaiser, 1993-2018) in Herbarium Department of Botany, University of Peshawar. In this study, the Chorotype of plants was determined by using Flora of Pakistan. Also, the endemic species of the Terich valley have been specified by different references (IUCN, 2010).

The life form and leaf size spectrum were determined through Raunkier's classification

$$\text{Raunkiaerian Life form spectrum} = \frac{\text{No. of species in a particular life form}}{\text{Total no. of species}} \times 100$$

$$\text{Raunkaierian Leaf Size Spectrum} = \frac{\text{No. of species in a particular leaf size}}{\text{Total no. of species}} \times 100$$

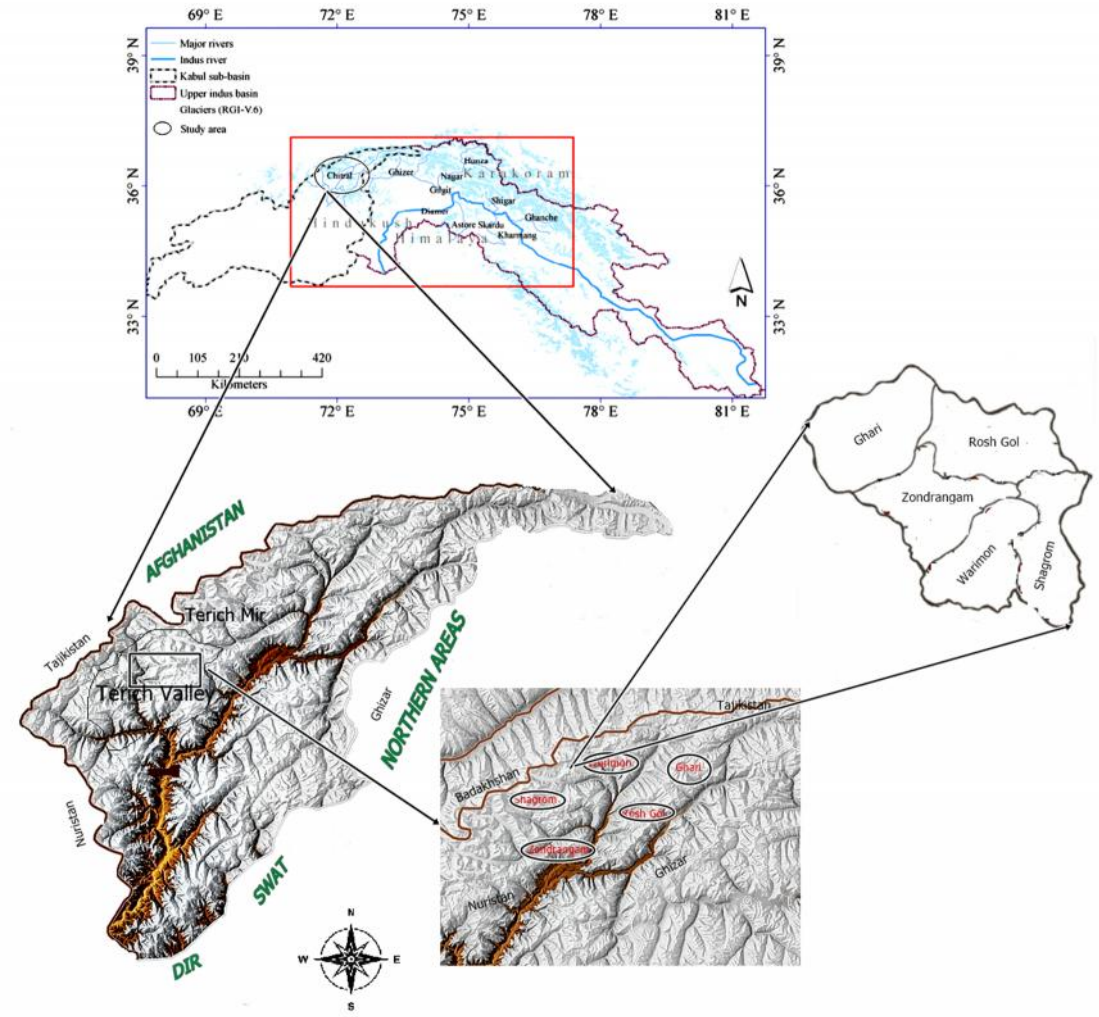

Fig 1. Geo-reference Map of Terich valley, Chitral.

RESULTS AND DISCUSSION

In the present analysis, 445 species were reported belongings to 272 genera and 71 families were identified (Table 1). The dominant families with a significant number of species in the area studied were Asteraceae (88 species, 19.73 %), Poaceae (49 species, 10.73 %), Papilionaceae (34 species, 7.6 %) and Brassicaceae (29 species, 6.62 %). Of the 272 genera, *Taraxacum* (12 species), *Astraglus* and *Cousinia* (9 species each), *Artemisia* and *Silene* (8 species each and (*Bromus* 7 species) were the richest genera. Different aspects about flora were studied by other reserchers Shah *et al*. (2006) reported 63 plant families with 218 species from the summer vegetation of Mastuj, Chitral, Hussain *et al*. (2015) described 571 plant species with 104 families from the Mastuj Valley, Chitral and Asteraceae, Papilionaceae, Poaceae, Lamiaceae and Rosaceae as dominant families in the locality. Our findings are similar with results of Ali *et al*. (2016), who collected 463 species of plants from Chail Valley, Swat, in which Asteraceae, Lamiaceae, Rosaceae, Papilionaceae and Apiaceae were also prominent families. Variation in species diversity of the Terich Valley is due to transition altitude, tophography, slope, habitat and climatic conditions. Life form is the main character of a plant that

suggests a morphophysiological adaptation to certain environmental conditions (Odland, 2009). Life form or growth form shows the prevailing micro and macroclimatic conditions of the region (Raunkiaer, 1934), whereas the phytoclimatic range is useful for the evaluation of geographically diverse plant communities and is used as an indicator for the persistence of the ecological conditions of the area (Sharma *et al*., 2014) which may be modified due to overgrazing, browsing and anthrophogenicity. In this analysis, Therophytes (174 species, 39.46 %), Hemicryptophyte (139 species, 31.23 %), Chamaephytes (58 species, 13 %), Nanophanerophytes (29 species, 6.50 %), Geophytes (23 species, 5.15 %), Megaphanerophytes (9 species, 2.01 %), Mesophanerophytes (10 species, 2.24 %) and Microphanerophytes (4 species, 0.89 %). In the present study, Therophytes (174 Species, 39.46 %), Hemicryptophyte (139 Species, 31.23 %), Chamaephytes (58 Species, 13%), Nanophanerophytes (29 Species, 6.50 %), Geophytes (23 Species, 5.15 %), Megaphanerophytes (9 Species, 2.01 %), Mesophanerophytes (10 Species, 2.24%) and Microphanerophytes (4 Species, 0.89 %) (Fig. 2).

Our findings are in line with that of Al-Yemeni and Sher, (2010); Ali *et al*., (2016); Samreen *et al*., (2016). Therophytes adapted to the dryness of the valley because these plants, in the form of seeds, spend vegetative time and increase the density of short-lived species (Asri, 2003). Our findings are also confirmed by Alsherif *et al*., (2013); Ilyas *et al*., (2012) that biotic pressure on flora has a major effect on their survival in wild habitats.

The information of leaf size spectrum is useful for understanding the morpho-physiological processes of plant species and their communities (Oosting, 1956). In the current analysis, the leaf size spectra reveals that the prominent leaf size class was nanophylls (136 Species, 30.49 %) followed by leptophylls (107 Species, 23.99 %), microphylls (97 Species, 21.74 %) mesophylls (86 Species, 19.28 %), macrophylls (8 Species, 1.79 %), megaphylls (5 Species, 1.12 %) while aphyllous plants were described (7 Species, 1.56 %) (Fig. 3). Seasonal variations occur in the leaf spectrum due to annual herbaceous flora in the region, as reported by various researchers from other regions Ali *et al*., (2016); Al-Yemeni and Sher, (2010). Our findings are also consistent with the work of (Qadir and Tareen, 1987) who identified the same leaf size of dry-temperate plants of Quetta.

Chorotype is the distribution of plant species that represents prevailing climatic conditions (Azizi and Keshavarzi, 2014). Considering the mountainous tophography of the Terich valley (226 species, 52.92 %) of the plants are Irano-Turanian elements, we can infer that this area belongs to the phytogeographical region of Irano-Turanian (Table 1, Fig. 4). Due to the proximity of the Mediterranean and Euro-Siberian areas, there are distributional elements restricted to this region. The presence of endangered species (60 species, 14.05 %) in the valley is due to the climax and dry-temperate climate (Fig. 5). Our findings support the statement that the proportion of endemic plants increases with increasing altitude (Pauli *et al*., 2007; Vediya and Kharadi, 2011). Approximately 47% of the species described have two or multi-regional phytochoria. The presence of multi-regional elements is the explanation for the overlapping of many geographical areas in this valley. The taxonomic similarities of most endemic species suggest that the origin of the alpine flora of the Terich Valley is of the Iranian-Turanian type (Table 2).

Table 1. Floristic list, Biological spectrum and Chorotype of flora of Terich Valley, Chitral.

Division/ Family	Botanical Name		Life from	Leaf size	Chorotype
A. Pteridophytes					
1. Aspleniaceae	1.	*Asplenium septentrionale* (L.) Hoffm.	G	L	IT, SJ
	2.	*Asplenium viride* Huds.	G	L	IT
2. Dryopteridaceae	3.	*Cystopteris fragilis* (L.) Bernh.	G	Mic	IT, SJ
3. Adiantaceae	4.	*Adiantum venustum* D. Don	G	L	IT, SJ
4. Equisetaceae	5.	*Equisetum ramossimum* Desf.	G	Aph	IT, SJ
B. Gymnosperms					
5. Cupressaceae	6.	*Juniperus communis* L.	Np	L	IT, SJ
	7.	*Juniperus excelsa* M. Bieb	Megp	L	IT, SS
6. Ephedraceae	8.	*Ephedra gerardiana* Wall.ex Stapf	Ch	Aph	IT
	9.	*Ephedra intermedia* Schrenk & Meyer	Ch	Aph	IT
C. Angiosperms					
(I)					
onocots					
7. Alliaceae	10.	*Allium chitralicum* Wang & Tang	G	Mes	END
	11.	*Allium barszczewskii* Lipsky	G	Mes	IT

	12. *Allium caroliniannum* DC.	G	Mes	IT
8. Asphodelaceae	13. *Eremurus stenophyllus* subsp. *stenophyllus* S. I. Ali	H	Mac	IT
9. Convallariaceae	14. *Polygonatum geminiflorum* Decne	G	N	IT, SJ
10. Cyperaceae	15. *Carex chitralensis* Nelmes.	G	L	END
	16. *Carex vulpinaris* Nees.	Ch	L	END
	17. *Carex stenocarpa* Turcz.ex V. Krecz	G	L	IT
	18. *Carex stenophylla* Wahlenb. subsp. *stenophylloides* (V. Kreez.) Egor.	Ch	L	IT
	19. *Cyperus nutans* subsp. *eleusinoids* (Kunth) T.	Th	L	IT
	20. *Fimbristylis bisumbellata* (Forssk.) Bubani.	H	N	IT, SJ
	21. *Kobresia laxa* Nees, Contr.	H	L	IT
	22. *Kobresia pygmaea* (C. B. Clarke) C. B. Clarke	H	N	IT
	23. *Schoenoplectus lacustris* (L.) Palla subsp. *tabernaemontani* (C. C. Gmel) A. & D. LÖve.	H	L	IT
11. Iridaceae	24. *Iris hookeriana* Foster.	G	Mes	IT, SJ
12. Juncaceae	25. *Luzula spicata* (L.) DC.	H	N	IT
13. Liliaceae	26. *Fritillaria imperialis* var. *chitralensis* Hort.	G	Mic	END
	27. *Gagea gageoides* (Zucc.) Vved.	G	L	IT
	28. *Gagea alexia* Ali.	G	L	IT
	29. *Gagea chitralensis* Dasgupta & Deb.	G	L	END
14. Orchidaceae	30. *Dactylorhiza hatagirea* (D.Don) Soo	G	N	IT, SJ
	31. *Dactylorhiza kaftriana* Renz Marshe	H	N	IT
	32. *Dactylorhiza umbrosa* (Kar. & Kir.) Nevski	H	N	IT, SJ
	33. *Epipactis gigantea* Douglas ex Hook.	Ch	Mic	IT
15. Poaceae	34. *Agrostis nervosa* Nees ex Trin.	H	N	COS
	35. *Agrostis viridis* Gouan, Hort.	H	N	COS
	36. *Arthraxon prionodes* (Steud.) Dandy	H	L	IT
	37. *Avena sativa* Retz.	Th	N	COS
	38. *Brachypodium distachyon* (L.) P. Beauv.	Th	N	IT
	39. *Brachypodium sylvaticum* (Huds.) P. Beauv	H	L	IT
	40. *Bromus danthoniae* Trin.	Th	L	IT
	41. *Bromus japonicus* Thunb. ex Murr	Th	L	COS
	42. *Bromus oxyodon* Schrenk.	Ch	N	IT
	43. *Bromus pectinatus* Thunb.	Th	L	IT
	44. *Bromus persicus* Boiss.	Th	N	IT
	45. *Bromus ramosus* Huds.	Th	L	IT
	46. *Bromus tectorum* L.	Th	L	IT, Med
	47. *Calamagrostis decora* Hook.f. Fl. Brit.	Ch	Mes	END
	48. *Calamagrostis pseudophragmites* subsp. *speudophragmites* (Hall.f.) Koel.	Ch	Mic	IT, ES
	49. *Calamagrostis pseudophragmites* (Hook. f.) R. R. Stewart	Ch	Mes	IT, ES
	50. *Cymbopogon commutatus* (Steud.) Stapf	H	L	IT, ES
	51. *Cynodon dactylon* (L.)Pers.	H	Mic	COS
	52. *Dactylis glomerata* L.	H	N	COS

	53.	*Dicanthium annulatum* Forssk. Stapf.	H	L	IT, SJ
	54.	*Elymus repens* (L.) Gould.	H	L	COS
	55.	*Elymus dahuricus* Turcz.ex. Grieseb.	Ch	L	IT
	56.	*Eragrostis cilianensis* (All.) Lut.ex F.T. Hubbard	Th	N	IT, SS
	57.	*Festuca olgae* (Regel) Krivot.	H	N	IT, Med
	58.	*Helictotrichon pratense* (L.) Pilger	Ch	N	IT, SJ
	59.	*Koeleria macrantha* (Ledeb.) Schult.	Ch	N	IT, SS
	60.	*Lolium temulentum* L.	H	N	IT, SS
	61.	*Melica persica* Kunth, Rev. Gram.	Ch	L	IT
	62.	*Pennisetum flaccidum* Griseb	Ch	L	IT, SS
	63.	*Piptatherum gracile* Mez.	H	L	IT, SJ
	64.	*Piptatherum laterale* (Munro ex Regel) Rozhev	H	N	IT
	65.	*Piptatherum hilariae* Pazij	H	L	IT, SS, SJ
	66.	*Poa alpina* L.	Ch	N	IT
	67.	*Poa versicolor* subsp. *araratica* (Trautv.) Tzvelev	H	N	IT, SJ
	68.	*Poa bulbosa* L.	G	N	IT, Med
	69.	*Poa pratensis* subsp. *pratensis*	Th	N	COS
	70.	*Polypogon monspeliensis* (L.) Desf	H	L	IT, SS, SJ
	71.	*Puccinellia minuta* Bor.	H	N	IT
	72.	*Setaria gluea* (Retz.) Trin ex Steud.	H	N	IT, SJ
	73.	*Setaria intermedia* Roem & Schult.	H	L	IT
	74.	*Schizachyrium impressum* (Hack.) A.Camus	H	N	END
	75.	*Stipa chitralensis* Bor.	H	L	END
	76.	*Stipa capillata* L.	H	N	IT
	77.	*Tetrapogon villosus* Desf.	H	N	IT, SS, SJ
	78.	*Trisetaria loeflingiana* (L.) Paunero	Th	L	IT, SJ
	79.	*Trisetum clarkei* (Hook.f.) R. R.	H	L	IT
	80.	*Trisetum spicatum* (L.) Richt.	H	N	COS
	81.	*Triticum aestivum* L.	Th	Mic	COS
	82.	*Zea mays* L.	Th	Mes	COS
(II) Dicots					
16. Amaranthaceae	83.	*Amaranthus viridis* L.	Th	Mic	IT, SJ
17. Anacardiaceae	84.	*Pistacia atlantica* subsp. *cabulica*	Mesp	Mic	IT
18. Apiaceae	85.	*Ammi visnega* (L.) Lam.	Ch	L	IT, SJ
	86.	*Anethum gravelons* L.	Th	L	IT, SJ
	87.	*Bunium persicum* (Boiss.) Fedtsch. Rastit	Th	N	IT
	88.	*Bupleurum gilesii* Wolf.	H	Mic	IT
	89.	*Bupleurum kohistanicum* E. Nasir	H	Mic	IT, Med
	90.	*Coriandrum stivum* L.	Th	L	COS
	91.	*Dacus carota* L.	G	Mes	COS
	92.	*Ferula hindukushensis* Kitamura.	H	Meg	IT
	93.	*Ferula jaeschkeana*Vatke.	G	Meg	IT, SJ
	94.	*Ferula narthex* Boiss.	H	Meg	IT
	95.	*Fonniculum vulgare* Miller.	Th	N	IT, SS, SJ
	96.	*Heracleum polyadenum* Rech.f. & Riedl.	H	Mic	IT
	97.	*Pleurospermum stylosum* C.B. Clarke	Th	N	IT
	98.	*Pimpinella stewartii* Dunn. Nasir	Th	Mic	IT, SJ
	99.	*Prangos pabularia* Lindl.	H	N	IT
	100.	*Scaligera chitralica* Hiroe	Th	L	END

	101. *Scandix pecten-veneris* L.	Th	Mic	IT, SJ
	102. *Torilis arvensis* (Huds.) Link.	Th	Mes	IT, SJ
	103. *Trachydium depressum* ssp. *chitralicum*	H	Mic	END
	104. *Trachyspermum ammi* (L.) Spargue.	Th	L	IT, SS
19. Asclepiadaceae	105. *Cynanchum acutum* L.	H	Mes	IT, Med
20. Asteraceae	106. *Achillea millefolium* subsp. *chitralensis*	H	L	END
	107. *Ajania fruticulosa* (Ledeb.) Poljakov	Np	Mic	IT
	108. *Allardia glabra* Decne., Voy.	H	L	IT
	109. *Allardia stoliczkae* C.B. Clarke	H	N	IT
	110. *Allardia tridactylites* (Kar. & Kir.) Schultz	H	L	IT, SJ
	111. *Anaphalis chitralensis* Qaiser & Rubina	Ch	Mes	END
	112. *Anaphalis stantonii* Y. Nasir	H	L	END
	113. *Anaphalis triplinervis* (Sims) C.B Clarke	Ch	Mic	IT
	114. *Anthemis cotula* L.	H	N	IT, SJ
	115. *Artemisia biennis* Willd.	Ch	Mic	IT, ES
	116. *Artemisia brevifolia* Wall ex DC.	H	N	IT
	117. *Artemisia rutifolia* Spreng., Syst.	Ch	L	IT, ES
	118. *Artemisia elegantissim* Pamp., Nuovo Giorn.	H	L	IT, ES
	119. *Artemisia parviflora* Roxb ex. D. Don	Th	Mes	IT, ES
	120. *Artemisia persica* Boiss, Diagn.	H	L	IT, ES
	121. *Artemisia scoparia* Waldst.& Kit.	Th	N	IT, ES
	122. *Artemisia sieversiana* Ehrh.	Th	N	IT
	123. *Askellia flexuosa* (Ledb.) W.A. Weber	H	N	IT, SJ
	124. *Aster flaccidus* Bunge.	H	Mes	IT, SJ
	125. *Bellis perennis* L.	Th	Mes	IT, Med
	126. *Brachyactis roylei* (Candolle) Wendelbo.	H	Mic	IT, SJ
	127. *Carthamus tinctorus* L.	H	Mes	IT
	128. *Calendula officinalis* L.	Th	Mic	COS
	129. *Centaurea iberica* Trev.ex. Sprengel.	Th	N	COS
	130. *Cichoriun intybus* L.	H	Mes	IT
	131. *Cirsium arvense* (L.) Scop.	Th	Mic	IT
	132. *Cirsium wallichii* var. *glabratum* (Hook. f.) Wendelbo	Th	Mic	IT
	133. *Cirsium rhizocephalum* C. A. Mey	H	Mic	IT
	134. *Cirsium griffithii* Boiss.	Th	Mes	IT
	135. *Cnicus benedictus* L.	Th	Mes	IT, SJ
	136. *Conyza aegyptiaca* (L.) Dryand. ex Aiton	Th	N	COS
	137. *Conyza canadensis* (L.) Cronquist.	Th	N	COS
	138. *Cousinia buphthalmoides* Regel	H	Mes	IT
	139. *Cousinia chitralensis* Rech.	Th	Mic	END
	140. *Cousinia khashensis* Rech.f.	Ch	Mic	IT
	141. *Cousinia chionophila* Rech.f.	Ch	Mic	IT
	142. *Cousinia haeckeliae* Bornm.	H	Mes	IT
	143. *Cousinia oxytoma* Rech.f.	Th	Mes	IT
	144. *Cousinia multiloba* DC.	Np	Mic	IT
	145. *Cousinia pycnoloba* Boiss.	Np	Mic	IT
	146. *Cousinia eriobasis* Bunge.	H	Mic	IT

147.	*Crepis sancta* (L.) Babc. ssp. *sancta*	Th	N	IT
148.	*Crepis aitchisonii* Boiss.	H	N	IT
149.	*Crepis multicaulis* Ledeb. var. *congsta*	Th	N	IT
150.	*Crepis pulchra* L.	Th	N	IT
151.	*Echinops echinatus* Roxb.	Th	Mic	IT
152.	*Echinops chloroleucus* Rech.f.	H	Mes	IT
153.	*Filago germanica* (L.) Huds	Th	N	IT
154.	*Frolovia gilesii* (Hemsl.) B.A. Scherip	Ch	Mic	IT
155.	*Heteracia szovitsii* Fisch. & C.A. Mey.	Th	Mic	IT
156.	*Heteropappus altaicus* (Willd.) Novopokr.	Th	L	IT
157.	*Inula obtusifolia* Kerner.	Ch	Mes	IT, SJ
158.	*Koelpinia linearis* Pall. Var. *linearis*	Th	N	IT, SJ
159.	*Lactuca serriola* L.	Th	Mes	IT, ES
160.	*Lactuca tatarica* (L.) C.A. Mey.	Th	Mac	IT
161.	*Launaea acanthodes* (Boiss.) Kuntze.	Th	N	IT, SS
162.	*Matricaria chamomilla* L.	Th	N	IT, SJ
163.	*Myricatis wallichii* Less.	Th	Mic	IT
164.	*Pseudognaphalium luteo-album* (L.), O. M. Hilliard & B. L Burtt	Th	Mic	IT, SJ
165.	*Psychrogeton chitralicus* Grierson.	H	Mes	END
166.	*Saussurea leptophylla* Hemsl.	Ch	Mac	IT
167.	*Saussurea jacea* (Klotzsch) C.B.Clarke.	Th	Mac	IT
168.	*Saussurea elliptica* C. B. Clarke	H	Mes	IT
169.	*Scorzonera virgata* DC.	Th	N	IT
170.	*Senecio analogus* DC.	H	N	IT
171.	*Senecio chrysanthemoides* DC.	Ch	L	IT
172.	*Seriphidium brevifolium* (Wall. ex DC.) Ling & Y. R. Ling	Ch	Mic	IT
173.	*Seriphidium chitralense* (Podlech)Y. R. Ling	H	Mic	END
174.	*Sonchus asper* (L.) Hill.	Th	N	IT
175.	*Tanacetum griffithii* (C. B. Clarke) Muradyan.	Th	N	IT, Med
176.	*Tanacetum chitralense* (Podlech) K.	H	L	END
177.	*Taraxacum brachyglosoides* Soset.	Th	Mes	IT
178.	*Taraxacum brevirostre* Hand.-Mazz.var. *lanatum*	Th	Mes	IT
179.	*Taraxacum elegantiforme* Soest.	Th	Mes	IT
180.	*Taraxacum chitralense* Soest	Th	Mes	END
181.	*Taraxacum longirostre* Schischk var. *tirichinse* (Soest) S.Abedin	H	Mic	IT
182.	*Taraxacum polyodon* Dahlst.	H	Mes	IT
183.	*Taraxacum pseudotenebristylum* Soest	Th	Mic	IT
184.	*Taraxacums quarrosiceps* Soest	Th	Mes	IT
185.	*Taraxacum tricolor* V. S	Th	Mic	IT
186.	*Taraxacum wendelboanum* Soest	Th	Mes	END
187.	*Taraxacum officinale* Weber.	Ch	Mes	IT
188.	*Taraxacum obtusum* (Soest) R. Doll	Th	Mes	END
189.	*Tragopogon gracilis* D.Don.	H	L	IT
190.	*Tricholepis toppinii* Dunn.	Ch	Mac	END

	191. *Tussilago farfara* L.	Ch	Mic	IT, SJ, Med
	192. *Xanthium strumarium* L.	Th	Mac	COS
	193. *Youngia japonica* (L.) DC.	Th	L	IT, SJ
21. Berberidaceae	194. *Berberis calliobotrys* Aitch.ex Koehne.	Np	N	IT
	195. *Berberis lyceum* Royle.	Np	Mic	IT, SJ
	196. *Berberis parkeriana* Schneid	Np	N	IT
22. Betulaceae	197. *Betula chitralica* Browicz	Mesp	Mes	END
	198. *Betula utilis* D.Don	Mesp	Mes	IT
23. Boraginaceae	199. *Arnebia euchroma* (Royle ex Benth.) I .M. Johnston	Ch	N	IT
	200. *Arnebia griffithii* Boiss.	Th	N	IT
	201. *Arnebia hispidisma* (Lehm.) A. DC	Th	Mes	IT
	202. *Asperugo procumbens* L.	H	L	IT, ES
	203. *Cynoglossum lanceolatum* Wall.ex. Benth.	Ch	Mes	IT
	204. *Cynoglossum glochidiatum* Wall.ex Benth.	H	N	IT
	205. *Lappula barbata* (M. Bieb) Gurke.	H	L	IT
	206. *Lindelofia stylosa* (Kar. & Kir.) Brand, Pflanzenr.	Ch	L	IT
	207. *Lindelofia anchusoides* (Lindl.) Lehm.	Ch	L	IT
	208. *Myosotis avensis* (L.) Hill.	H	Mic	IT
	209. *Onosma chitralicum* I. M. Johiston	H	N	END
	210. *Pseudomertensia chitralensis* (Riedl) Riedl	Ch	Mes	END
	211. *Rochelia chitralensis* Y. Nasir	Th	L	END
	212. *Solenanthus circinnatus* Ledeb	H	N	IT, Med
24. Brassicaceae	213. *Alliaria petiolata* (M. Bieb.) Cavara & Grande	H	Mes	IT, ES, Med
	214. *Arabidopsis wallichii* (Hook. f. & Thoms.) N. Busch	H	Mes	IT
	215. *Brassica campestris* L.	Th	Mic	IT, SS, SJ
	216. *Capsella bursa-pestoris* L.	Th	Mic	COS
	217. *Conringia orientalis* (L.) Andrz.	H	Mes	IT
	218. *Coronopus didymus* (L.) Sm.	Th	L	IT, SS, Med
	219. *Descurainia sophia* (L.) Webb & Berth.	H	N	IT, ES, Med
	220. *Draba olgae* subsp. *chitralensis* (O. E. Schultz) Jafri	Ch	N	END
	221. *Draba korshinskyi* (O. Fedtschenko) Pohle.	Ch	L	IT, ES
	222. *Draba stenocarpa* Hook.	Th	N	IT, ES
	223. *Draba tibetica* var. *chitralensis* (O. E. Nasir) Jafri.	Ch	L	END
	224. *Draba pakistanica* Jafri.	Th	N	END
	225. *Erysimum erosum* O.E Schultz	H	Mic	END
	226. *Goldbachia laevigata* (M. Bieb.) DC.	H	Mes	IT, SS
	227. *Graellsia chitralensis* O.E. Schulz	H	Mes	END
	228. *Isatis tinctoria* L. subsp. *tinctoria*	Th	Mic	IT, ES, Med
	229. *Cardaria draba* (L.) Desv	Th	N	IT, SJ
	230. *Lepidium apetalum* H. & T.	Th	N	IT, SJ, Med
	231. *Malcolmia cabulica* var. *topppinii* (O.E. Schulz) Nasir	Th	N	IT, SJ
	232. *Malcolmia intermedia* C.A. Mey.	Th	L	IT, SJ

	233. *Matthiola flavida* Boiss.	Th	Mes	IT
	234. *Nasturtium officinale* R. Br.	Th	N	IT, SS, Med
	235. *Neslia apiculata* Fisch., C.A. Mey. & Ave	Th	L	IT, SS
	236. *Parrya chitralensis* Jafri.	Th	Mes	END
	237. *Raphanus raphanistrum* L.	Th	N	IT, SS
	238. *Raphanus sativus* L.	Th	Mac	IT, SS
	239. *Rorippa islandica* (Oeder) Borbas	Th	N	IT
	240. *Sisymbrium brassiciforme* C. A. Mey.	Th	L	IT
	241. *Thlaspi perfoliatum* L	Th	Mes	IT
25. Buxaceae	242. *Buxus wallichiana* Baill, Monogr. Bux.et Styloc.	Np	Mic	IT
26. Campanulaceae	243. *Campanula staintonii* Rech.f. & Schimann-Czeike	Th	Mes	END
	244. *Asyneuma strictum* Wendelbo.	Th	Mes	IT
	245. *Codonopsis clematidea* (Schrenk) C.B. Clarke	Th	N	IT
27. Capparaceae	246. *Capparis spinosa* L.	H	Mic	IT, SS, Med
28. Caprifoliaceae	247. *Lonicera asperifolia* (Decne.) Hk. f.	Np	Mic	IT
	248. *Lonicera griffithii* Hook.f. & Thoms.	Np	Mic	IT
	249. *Lonicera myrtillus* Hook. f. & Thoms.	Np	Mic	IT, SJ
29.Caryophyllaceae	250. *Arenaria orbiculata* Royle ex Edgew.	Th	N	IT
	251. *Acanthophylum laxiflorum* Boiss.	H	N	IT
	252. *Cerastium cerastioides* (L.) Britton.	Th	N	IT
	253. *Dianthus angulatus* Royle ex Benth.	H	N	IT
	254. *Dianthus orientalis* Adams.	Ch	L	IT
	255. *Lepyrodicalis holosteoides* (C.A.M.) Fenzl	Th	N	IT
	256. *Minuartia hybrida* (Vill.) Schischkin. subsp. *hybrida*	Th	N	IT
	257. *Silene affghanica* Rohrb.	H	N	IT
	258. *Silene conoidea* L.	Th	N	IT
	259. *Silene gonosperma* (Rupr.) Bocquet	Th	N	IT
	260. *Silene stantonii* S. A. Ghazanfar	H	L	END
	261. *Silene joerstadii* Wendelbo	H	L	END
	262. *Silene viscosa* (L.) Pers.	Th	N	IT
	263. *Silene vulgaris* (Moench) Garcke.	Th	L	IT
	264. *Silene longisepala* E.Nasir	Th	N	END
	265. *Stellaria decumbens* Edgew	Th	L	IT
	266. *Stellaria media* (L.)Vill.	Th	N	IT
30. Chenopodiaceae	267. *Atriplex schugnanica* Iljin.	H	N	IT, SS
	268. *Chenopodium botrys* L.	Th	L	IT, SS, SJ
	269. *Chenopodium foliosum* (Merrich.) Aschers	Th	N	IT, SS, SJ
	270. *Chenopodium murale* L.	Th	N	IT, ES
	271. *Kochia indica* Wight, Icon.	Th	L	IT, SS
	272. *Haloxlon griffithii* subsp.*grifthii* Moq.	Ch	Mic	IT, SS
31. Convolvulaceae	273. *Convulvulus arvensis* L.	Th	Mes	COS
32. Cuscutaceae	274. *Cuscuta lupuliformis* Krocker	Th	Aph	IT
	275. *Cuscuta capitata* Roxb.	Th	Aph	IT
	276. *Cuscuta villosa* L.	Th	Aph	END
33. Cucurbitaceae	277. *Citrulus vulgaris* L.	Th	Mes	IT
	278. *Cucurbita maxima* Duch ex Lam.	Th	Meg	IT
34. Crassulaceae	279. *Orostachys thyrsiflora* (DC.) Fischer	Th	Mes	IT

	ex Sweets			
	280. *Rhodiola heterodonta* (Hook.f. & Thomson) Boriss.	H	Mes	IT
	281. *Rhodiola wallichiana* (Hook.) S.H.	H	Mic	IT
	282. *Rosularia adenotricha* subsp. *adenotricha*	H	Mes	IT
	283. *Rosularia adenotricha* subsp. *chitralica*	H	Mes	END
	284. *Rosularia alpestris* (Kar & Kir) Boriss.	H	Mic	IT
	285. *Hylotelephium ewersii* (Ledeb.) H. Ohba	G	N	IT
35. Dipsacaceae	286. *Scabiosa olivieri* var. *olivieri*	Th	N	IT, ES, Med
36. Elaeagnaceae	287. *Elaeagnus angustifolia* var. *angustifolia*	Micp	Mic	IT, ES
	288. *Hippophae rhamnoides* Rousi.	Np	N	IT
37. Euphorbiaceae	289. *Euphorbia wallichii* Hk.	Th	N	IT
	290. *Euphorbia thomsoniana* Boiss.	Th	N	IT
	291. *Euphorbia osyridea* Boiss.	Ch	N	IT
38. Fumariaceae	292. *Fumaria indica* (Hausskn.) Pugsley.	Th	L	COS
39. Gentianaceae	293. *Aloitis smithii* Omer	Th	L	END
	294. *Gentianodes argentea* (Royle ex D.Don) Omer	Th	Mes	IT
	295. *Lomatogonium spathulatum* (Kern.) Fernald.	Th	L	IT
40. Geraniaceae	296. *Geranium wallichianum* D.	Th	Mes	IT, ES
41. Grossulariaceae	297. *Ribes orientale* Desf.	Ch	Mes	IT
42. Hypericaceae	298. *Hypericum scabrum* L.	H	L	IT
	299. *Hypericum perforatum* L.	H	Mic	IT
43. Juglandaceae	300. *Juglans regia* L.	Mesp	Mic	IT, ES
44. Lamiaceae	301. *Alajja rhomboidea* (Benth.) Ikonn.	G	N	IT
	302. *Dracocephalum nutans* L.	Ch	N	IT
	303. *Dracocephalum stamineum* Kar. & Kir.	Ch	L	IT
	304. *Eremostachys edelbergii* Rech.f.	H	Mes	IT
	305. *Eremostachys speciosa* Rupr.	H	Mes	END
	306. *Lagochilus cabulicus* Bth.	H	L	IT
	307. *Mentha longifolia* (L.) Huds.	H	N	IT, SS, SJ
	308. *Mrrubium vulgare* L.	Ch	Mes	IT
	309. *Nepeta cataria* L.	Ch	Mes	IT
	310. *Nepeta clarkei* Hook.f.	Th	N	IT
	311. *Nepeta floccosa* Benth.	Th	Mic	IT
	312. *Nepeta podostachys* Benth.	Th	N	IT
	313. *Peroviskia atriplicifolia* Benth.	Ch	Mic	IT
	314. *Scutellaria heydei* Hook.	H	N	IT
	315. *Scutellaria multicaulis* Boiss.	H	L	IT
	316. *Thymus linearis* Benth. subsp. *linearis* Jalas.	H	L	IT
	317. *Ziziphora clinopodioides* Lam.	Th	L	IT
45. Malvaceae	318. *Alcea nudiflora* (Lindl.) Boiss	Th	Mac	IT
46. Meliaceae	319. *Melia azedarach* L.	Megp	Mic	IT, SS, SJ
47. Moraceae	320. *Morus nigra* L.	Megp	Mes	IT, SS, SJ
	321. *Morus alba* L.	Megp	Mes	IT, SS, SJ
48. Oleaceae	322. *Fraxinus hookerrii* Wenzig	Megp	Mic	IT
	323. *Fraxinus xanthoxyloides* (G. Don) DC.	Megp	Mic	IT
49. Onagraceae	324. *Epilobium angustifolium* L.	Th	Mes	IT

	325. *Epilobium chitralensis* Raven.	Th	N	END
	326. *Epilobium hirsutum* L.	Th	N	IT,SJ,Med
	327. *Epilobium royleanum* Hausskn, Oesterr.	Th	N	IT
50. Orbancaceae	328. *Orobanche cernua* Leofl.	H	Aph	IT
51. Papaveraceae	329. *Corydalis urosepala* Fedde.	Th	Mes	END
	330. *Papaver nudicaule* L.	Th	Mes	IT
52. Papilionaceae	331. *Astragalus affghanus* Boiss.	Th	N	END
	332. *Astragalus amberstianus* Bth.ex. Royle.	H	L	IT
	333. *Astragalus coluteocarpus* Boiss.ssp. *chitralensis* Wenninger, Mitt.	Ch	L	END
	334. *Astragalus imitensis* Ali	H	N	END
	335. *Astragalus chitralensis* Ali	H	N	END
	336. *Astragalus laspurensis* Ali	H	L	END
	337. *Astragalus minuto-foliolatus* Wendelbo.	H	L	END
	338. *Astragalus toppinianus* Ali	H	L	END
	339. *Astragalus edelbergianus* Sirj & Rech.f.	H	N	END
	340. *Chesneya cuneata* (Benth.) Ali.	H	L	IT
	341. *Chesneya depressa* (Oliv.) Pop.	H	L	IT
	342. *Cicer macranthum* M. Popov	H	L	IT
	343. *Cicer nuristanicum* Kitamura.	Th	N	IT
	344. *Colutea paulsenii* Freyn.ssp. *mesantha*, (Shap. ex Ali) Ali.	Np	N	IT
	345. *Glycyrrhiza glabra* var. *glandulifera* (Waldst. & Kit.) Boiss.	G	Mes	IT
	346. *Galegia officinales* L.	H	Mic	IT
	347. *Hedysarum folconeri* Baker.	Ch	Mic	IT
	348. *Hedysarum minjanense* Rech.f.	H	Mic	IT
	349. *Hedysarum cachemirianum* Benth. ex Baker	Ch	Mic	IT
	350. *Hedysarum alpinum* L.	H	Mic	IT
	351. *Lotus corniculatus* var. *tenuifolius* L.	Th	L	IT, SJ
	352. *Medicago lupulina* L.	Th	N	IT, ES, Med
	353. *Medicago sativa* L.	Th	N	IT, ES, Med
	354. *Melilotus officinalis* (L.) Pall., Reise.	Th	N	IT, ES, Med
	355. *Melilotus indica* (L.) All.	Th	L	IT
	356. *Oxytropis crassiuscula* A. Boriss	H	L	IT
	357. *Oxytropis chitralensis* Ali.	H	L	END
	358. *Psoralea drupaceae* Bunge.	Th	Mic	IT
	359. *Sophora mollis* subsp. *duthiei* (Prain) Ali Comb.nov	Np	N	END
	360. *Trifolium resupinatum* L.	Th	Mic	IT, ES
	361. *Trifolium repens* L.	H	Mic	IT, ES
	362. *Trigonella incisa* Benth.	Th	N	IT, SJ
	363. *Vicia bakeri* Ali.	Th	L	IT
	364. *Vicia sativa* L.	Th	N	COS
53. Plantaginaceae	365. *Plantago major* L.	Th	Mes	IT, Med
54. Platanaceae	366. *Platanus orientalis* L.	Megp	Mes	IT, SJ
55. Plumbaginaceae	367. *Acantholimon leptostahyum* Aitch.	Ch	L	IT
	368. *Acantholimon longiflorum* Boiss.	H	L	IT
	369. *Acantholimon lycopodioides* (Girard.) Boiss.	Np	N	IT

	370. *Acantholimon polystachyum* Boiss.	Ch	L	IT
	371. *Acantholimon stocksii* Boiss.	Ch	N	IT
	372. *Acantholimon longiscapum* Bokhari.	H	L	IT
56. Polygalaceae	373. *Polygala* sp.	Th	L	IT
57. Polygonaceae	374. *Oxyria digyna* (L.) Hill, Hort.	Th	N	IT, ES
	375. *Polygonum cognatum* subsp. *chitralicum* (Rech. f. Schiman-Czeika) Qaiser	Th	L	END
	376. *Polygonum paronychioides* C.A. Mey.f	Th	N	IT
	377. *Rheum webbianum* Royle.	G	Meg	IT
	378. *Rumex hastatus* D. Don	Ch	Mes	IT, SS
58. Primulaceae	379. *Androsace harrissii* Duthie subsp. *harrissii*	Np	Mic	END
	380. *Androsace mucronifolia* Watt.	H	Mic	IT
	381. *Androsace stantonii* Y. Nasir.	Th	Mic	END
	382. *Primula macrophylla* var. *macrophylla* D. Don	H	Mes	IT
59. Ranunculaceae	383. *Adonis aestivalis* L.	H	Mic	IT, SJ
	384. *Anemone rupicola* var. *sericea* Hook.f.& Thomson	H	Mic	IT
	385. *Aquilegia pubiflora* Wall. Ex Royle	H	Mic	IT
	386. *Clematis alpina* var. *sibirica* (L.) O. Kuntze, Verh.	Ch	N	IT, SJ
	387. *Clematis aspleniifola* Schrenk	Ch	N	IT
	388. *Clematis graveolens* Lindl.	Ch	Mic	IT
	389. *Clematis orientalis* L.	Np	N	IT, Med
	390. *Delphinium chitralense* H. Riedl	H	Mes	END
	391. *Delphinium nordhagenii* Wendelbo.	Ch	Mic	END
	392. *Ranunculus laetus* Wall.ex Hook.f. & Thoms.	H	N	IT, ES
	393. *Thalictrum foetideum* L.	H	N	IT
	394. *Thalictrum alpinum* L.	H	N	IT, SJ
	395. *Trollius acaulis* Lindl.	Th	L	IT
60. Rhamnaceae	396. *Rhamnus prostrata* Jacq.ex Parker	Np	Mic	IT, ES, Med
61. Rosaceae	397. *Cotoneaster affinis* var. *bacillaris* (Lindl.) Schneider.	Mesp	Mes	IT, SJ
	398. *Cotoneaster nummularia* Fisch. & Mey.	Np	N	IT
	399. *Cotoneaster racemiflorus* (Desf.) Booth ex Bosse	Np	L	IT
	400. *Crataegus songarica* C. Koch.	Micp	Mic	IT
	401. *Crataegus wattiana* Hemsl.	Mesp	Mic	IT
	402. *Duchesnea indica* (Andrews) Focke	H	Mic	IT, SJ
	403. *Fragaria nubicola* (Hook.f.) Lindl.ex Lacaita	Th	Mic	IT, SJ
	404. *Potentilla desertorum* Bunge.	H	N	IT
	405. *Potentilla grisea* Juz.var. *grisea*	H	L	IT
	406. *Prunus prostrata* Labill.	Mesp	Mic	IT, ES
	407. *Prunus jacquemontii* Hook.f.	Mesp	Mes	IT
	408. *Prunus griffithii* (Boiss.) C.K. Schneid	Micp	Mic	IT
	409. *Prunus kuramica* (Korsh.) Kitamura.	Mesp	Mic	IT, SJ
	410. *Pyrus pashia* Buch.-Ham. ex D.Don	Micp	Mes	IT, SJ
	411. *Rosa ecae* Aitch.	Np	N	IT

	412. *Rosa beggeriana* Schrenk.	Np	Mic	IT
	413. *Rosa webbiana* Wall.ex. Royle.	Np	Mic	IT, SJ
	414. *Rubus sanctus* Schreb., Icon. Descr	Np	Mes	IT, SJ
	415. *Spiraea pilosa* Franch	Np	Mic	IT
	416. *Sorbaria tomentosa* (Lindl.) Rehder var. *tomentosa*	Np	Mic	IT, SJ
62. Rubiaceae	417. *Asperula oppositifolia* Reg. & Schmalh.	Np	N	IT
	418. *Rubia chitralensis* Ehrend.	Ch	Mic	END
	419. *Rubia tibetica* Hook.f.	H	L	IT, Med
	420. *Gaillonia chitralensis* Nazim.	Np	L	END
	421. *Galium chitralensis* Nazim.	Th	N	END
63. Rutaceae	422. *Haplophyllum dubium* Korov.	H	N	IT, SJ
64. Salicaceae	423. *Salix turanica* Nasarov.	Megp	Mic	IT
	424. *Salix pycnostachya* Andersson.	Micp	Mic	IT
	425. *Salix acmophylla* Boiss.	Megp	Mic	IT
65.	426. *Linaria odora* (M.B.) Fisch.	H	L	IT
Scrophulariaceae	427. *Linaria vulgaris* Miller, Gard.	Th	L	IT
	428. *Pedicularis bicornuta* Klotzsch.	Ch	N	IT
	429. *Pedicularis caruleolbescans* Wendelbo.	H	N	END
	430. *Pedicularis stantonii* Y. Nasir	Th	Mes	END
	431. *Scrophularia scabiosifolia* Benth.	Th	N	IT
	432. *Scrophularia striata* Boiss.	Th	N	IT
	433. *Verbascum thapsus* L.	Th	Mac	IT, SJ
	434. *Veronica anagalis-aquatica* L.	Th	Mic	IT, SJ
66. Solanaceae	435. *Lycopersicum esculentum* L.	Th	Mic	COS
	436. *Solanum nigrum* L.	Th	Mes	COS
	437. *Solanum tuberosum* L.	G	Mes	COS
67. Tamaricaceae	438. *Myricaria squamosa* Desv.	Mesp	Mic	IT
	439. *Tamaricaria elegans* (Royle) Qaiser & Ali	Np	L	IT, SJ
68. Verbenaceae	440. *Verbena officinalis* L.	H	Mes	IT
69. Valerianaceae	441. *Valeriana hardwickii* var. *hoffmeisteri* (Kl.) Clarke	H	Mes	IT
70. Vitaceae	442. *Vitis jacquemontii* Parker	Np	Mes	IT
71. Violaceae	443. *Viola rupestris* Schm.	Th	Mic	IT
	444. *Valerianella szovitsiana* Fisch. & C.A. Mey.	Th	Mic	IT, SJ
	445. *Valerianella dentata* (L.) Poll.	Th	Mic	IT, SJ

Key to Abbreviations:
Life form H= Hemicryptophyte, **G**=geophyte, **Th**=Therophyte, **Ch**=Chamaephyte, **Np**=Nanophanerophyte, **Micp**=Microphanerophyte, **Mesp**= Mesophanerophyte,
Megp=Megaphanerophyte**, Leaf size Aph**=Aphyllous, **L**=Leptophyll, **N**=Nanophyll, **Mic**=Microphyll, **Mes**=Mesophyll, **Mac**=Macrophyll, **Meg**=Megaphyll**, Chorotype SS**: Saharo-Sindian, **SJ**: Sino-Japanese, **M**: Mediterranean, **IT**: Irano-Turanian, **ES**: Euro-Siberian, **COS**: Cosmopolitan, **End**: Endemic

Table 2. Phytogeographical distribution of taxa.

Distribution of taxa	No of taxa	% age
a. Uniregional elements		
Irano-Turanian Species	226	52.92
Endemic Species	61	13.70
b. Biregional elements		
Irano-Turanian, Sino-Japanese Species	59	13.81
Irano-Turanian, Saharo-Sindian Species	14	3.27

Irano-Turanian, Euro-Siberian Species	20	4.68
Irano-Turanian, Mediterranean Species	11	2.57
c. Plurriregional elements		
Irano-Turanian, Sino-Japanese, Mediterranean	2	0.46
Irano-Turanian, Saharo-Sindian, Mediterranean	3	0.70
Irano-Turanian, Euro-Siberian, Mediterranean	8	1.87
Irano-Turanian, Saharo-Sindian, Sino-Japanese	6	1.40
Cosmopolitan Species	18	4.21

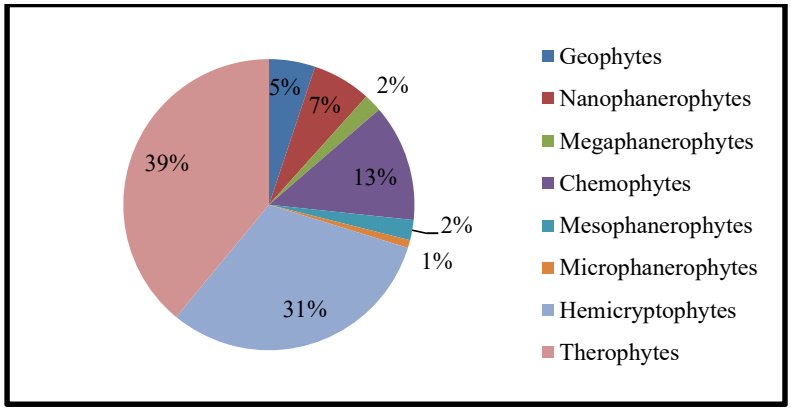

Fig 2. Life form of species in Terich valley

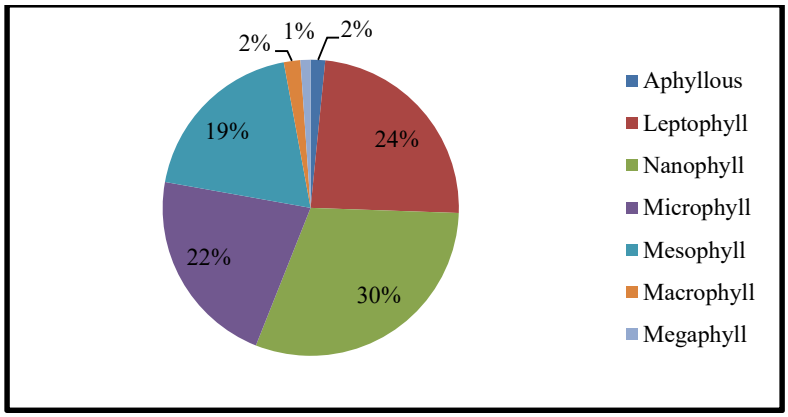

Fig 3. Leaf size of species in Terich valley

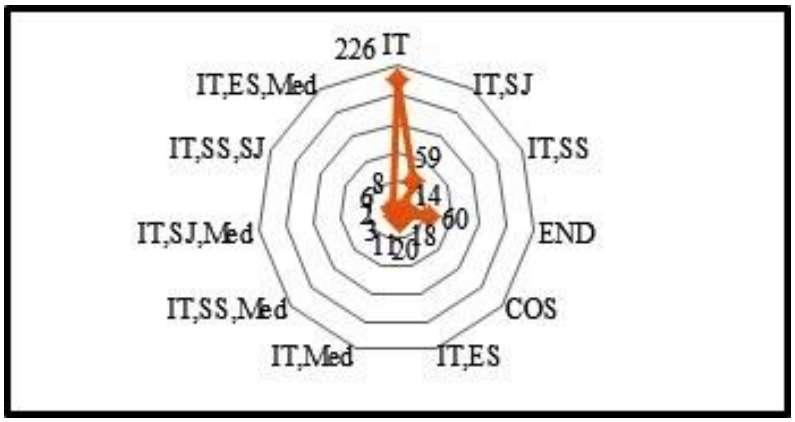

Fig 4. Phytochoria of Terich valley

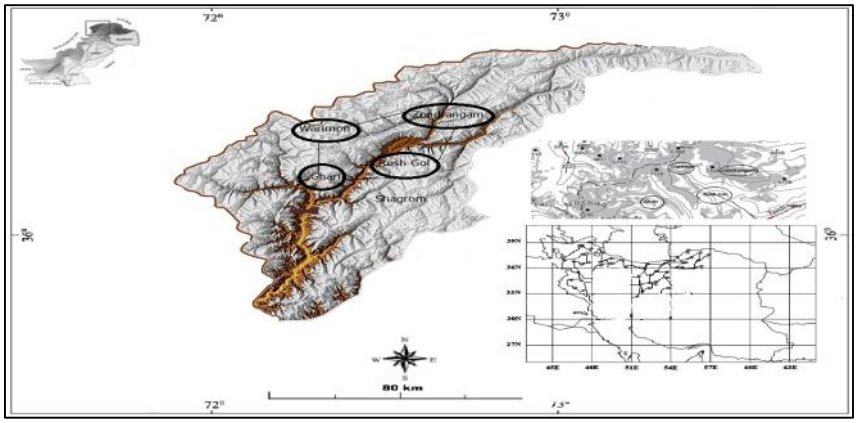

Fig 5. Distribution Map of SS: Saharo-Sindian, SJ: Sino-Japanese, Med: Mediterranean, IT: Irano-Turanian, ES: Euro-Siberian, COS: Cosmopolitan, End: Endemic elements in Terich Valley

Conclusions: The present exploration of Species diversity revealed that 445 species belong to 272 genera and 71 families are present in Terich Valley, Hindukush Range, Chitral. Phytoclimatic spectra of the area are Therophytic type and the climatic conditions of the valley are influenced by grazing and landsliding which supports short lived species. Chorotypically flora of Terich valley was diverse and having dominant Irano-turanian elements. This study offers baseline information on the flora, and further research is recommended for exploring quantitative vegetation attributes.

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