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Bioscience Research

Print ISSN: 1811-9506 Online ISSN: 2218-3973

Journal by Innovative Scientific Information & Services Network

RESEARCH ARTICLE BIOSCIENCE RESEARCH, 2020 17(4): 2541-2550. **OPEN ACCESS**

Floristics Pattern And Biological Characteristics of Plants of Toormang Valley, Dir Lower, Hindukush Range, Pakistan

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This study was proposed to document and assess the floristic composition and biological characteristics of plants of Toormang Valley, Dir Lower during 2018-2019. A record of plant species were organized based on field trips conducted in four seasons of the year. The flora of the Valley comprised of 238 species, 164 genera from 60 families. Asteraceae was leading family with 42 species (17.64%) followed by Rosaceae 16 species (6.72%), Brassicaceae 13 species (5.46%), Solanaceae 11 species (4.62%), Papilonaceae 10 species (4.20%), Apiaceae and Poaceae each with 9 species (3.78%), Lamiaceae contributed by 8 species (3.36%), Borganiaceae, Euphorbiaceae, and Moraceae each contributed by 7 species (2.94%), Amaranthaceae and Cucurbitaceae each consisted of 6 species (2.52%), Caryophyllaceae and Chenopodiaceae each with 5 species (2.10%) while, rest of 23 families contributed by 1 species each (0.42%).The largest genera was *Euphorbia* (6 species) followed by *Sonchus* and *Medicago* (4 species) each. Based on Raunkiaer classification therophytes were dominated with 102 species (42.85%), followed by nanophanerophytes with 27 species (11.34%), hemicryptophytes with 25 species (10.50%), chameophytes with 20 species (8.40%), microphanerophytes with 18 species (7.56%), megaphanerophytes with 16 species (6.72%), geophytes with 15 species (6.30%), mesophanerophytes with 14 species (5.88%), and parasite with 1 species (0.42%). Leaf size spectrum of the flora presented that microphyll was dominant leaf size class with 73 species (30.67%) followed by mesophyll 69 species (28.99%), nanophyll 60 species (25.21%), leptophyll 23 species (9.66%), macrophyll 8 species (3.36%), megaphylly 4 species (1.1.68%) and aphyllous contributed by 1 species (0.42%). Majority of the species 154 (64.70%) had simple lamina while, 5 species have spiny lamina shape. This study provides baseline information on the flora of the area and further study is recommended for the exploration of quantitative information of vegetation.

Keywords: Floristic pattern, Ecological features, Life form, Leaf size spectrum, Toormang Valley, Dir Lower, Pakistan

INTRODUCTION

The Valley is located in District Lower Dir, Khyber Pakhtunkhwa, Pakistan. The Valley is located in the north- west of Khyber Pakhtunkhwa and bounded by huge chain of Koh-e-Hindukush Range. It is situated between 34-37 to 35-7 North latitude and 71-31 to 72-14 East longitudes. The Valley is bounded by Wari in North, Khall and Rabat in the West, Laram hills in the South and District Swat in East. The climate of the Valley is influence by different ecological and topographic features. The high peaks of the mountains receive snowfall during the month of December, January, and February. The summer is pleasant and short while, winter is harsh season of the year. The important source of production and economy are

forest and agriculture.

Flora refers to all the plant species found in a particular locality. It differs from vegetation, which refers to population, distribution, size and relative importance of plants species (Ali, 2008). Changing environmental situations such as acid rain, soil erosion are alarming threats to flora (Hussain, 2003) while, on the other hand floristic configuration is a consideration of phytodiversity, environmental and biotic effects. So, studies on the local flora constantly provide accurate information. Leaf size and life form spectrum are key physiognomic characteristics commonly used in vegetation studies. The life form spectra are considered to be indicators of macro and microclimate (Shimwell, 1971). Many studies have been described therophytes as indicator species of particular desert type climate (Samreen et al. 2016). Shah et al. (2013) reported the floristic characteristics of each species from humid forest situated in inaccessible area of Pakistan. Hussain et al. (2015) conducted research on phytodiversity and ecological attributes of flora of Mastuj Valley, District Chitral, Pakistan and reported the highest percentage of therophytes followed by hemicryptophytes and geophytes. Seraj et al. (2014) determined the Raunkiaerian life form at Asir Mountain of South-Western Saudi Arabia and described that therophytes was dominant class followed by chaemophytes. Alsherif et al. (2013) prepared Raunkierian life form of Khuliais area, Saudi Arabia and found that therophytes was dominant class with highest percentage of species followed by chaemophytes and hemicryptophytes.

Khan et al*.* (2012) reported that leaf spectra of plants study show the dominance of microphyll followed by nanophyll and leptophyll from Tehsil Takht-e-Nasrati, Karak, Pakistan. Highest percentage of microphyll followed by leptophyll, nanophyll & megaphyll shows that the studied area is under severe biotic stress due to overgrazing & deforestation Sher & Khan, (2007). All the above literature reveals that there is no record available on floristic configuration & ecological attributes of Toormang Valley, District Dir Lower. Therefore, the current attempt was made to investigate the floral diversity with its ecological attributes of the Valley.

MATERIALS AND METHODS

Floristic study was established all over the Valley during the year 2018 to 2019 from time to time. For this purpose, the whole study area was thoroughly covering each season by walking method (Nazar et al. 2008). Plant specimens were collected, pressed, dried and mounted on normal herbarium sheets. Plants were identified with the help of Flora of Pakistan (Nasir & Ali, 1970-1989; Ali & Nasir, 1989-1992; Ali & Qaiser, 1995-2015). The identification of plant specimens were further confirmed at Herbarium, Department of Botany, Islamia College Peshawar. A list of plants was prepared by assembling plants names family-wise alphabetically. The implements used during research work were mobile, knife, polythene bags, old newspaper, plant presser, map of the area, note book, and pencil.

RESULTS AND DISCUSSION

Floristic and ecological attributes

Study of floristic composition of vegetation is crucial for conservation management by providing habitats for wildlife and contributing to the ecologically sustainable management of natural resources (Ahmad & Ehsan, 2012). The flora of the Valley consisted of 238 species, 164 genera from 60 families. It included 53 families of dicots, 4 monocot families, 1 family of Gymnosperms and 2 Pteridophyte families. Pteridophyte had 3 genera (1.82 %) while, Gymnosperms has 1 genus (0.60 %). There were 11 genera of monocots (6.70 %) and 149 genera of dicots (90.85 %). Leading families were Asteraceae 42 species (17.64%) followed by Rosaceae 16 species (6.72%), Brassicaceae 13 species (5.46%), Solanaceae 11 species (4.62%), Papilionaceae 10 species (4.20%), Apiaceae and Poaceae each with 9 species (3.78%), followed by Lamiaceae contributed by 8 species (3.36%). Borganiaceae, Euphorbiaceae, and Moraceae each contributed by 7 species (2.94%) while, Amaranthaceae and Cucurbitaceae each consisted of 6 species (2.52%). Caryophyllaceae and Chenopodiaceae had 5 species(2.10%) each, Aspleniaceae and Salicaceae each consists of 4 species (1.68%). While, Fagaceae, Oleaceae, Rananculaceae, Rutaceae and Urticaceae each contributed by 3 species (1.26%), which is followed by Alliaceae, Asclepiadaceae, Cannabaceae, Ebenaceae, Fumariaceae, Malvaceae, Mimosaceae, Pinaceae, Polygonaceae and Zygophyllaceae contributed 2 species each (0.84%). Rest of 23 families contributed by 1 species each (0.42%).(Table 3, Fig. 2) The present results are in line with Haq et al., (2010) and Ravanbakhsh et al., (2014) who reported Asteraceae and Rosaceae as dominant families in their research areas. Similarly, Ullah and Ullah, (2016), Inayat et al., (2014), Khan et al*.,* (2013), Badshah et al*.,* (2016), Khan et al*.,*

(2011), Sher et al., (2014), Ali et al., (2016), Hussain et al*.,* (2015), Khan et al., (2014), Shah et al., (2013) and Ganji, (2016) also recorded Asteraceae as leading family in their research areas. Flora of the area under study included wild species 196 (82.35%) and cultivated species 42 (17.64%). The largest genera was *Euphorbia* (6 species) followed by *Sonchus*, *Chenopodium* and *Pyrus* (4 species each). There were 5 thorny species (2.10%) and 233 (97.89%) non-thorny species. Based on habitat115 species (48.31%) were found in dry conditions, 35 species (17.64%) in wet, 42 species (17.64%) in cultivated and 46 species (19.32%) in both dry & wet conditions. Leaf size spectra of the flora showed that the most dominant leaf size class was microphyll 73 species (30.67%) followed by mesophyll 69 species (28.99%), nanophyll 60 species (25.21%), leptophyll 23 species (9.66%), macrophyll 8 species (3.36%), megaphylly 4 species (1.1.68%) and aphyllous contributed by 1 species (0.42%). Majority of the species 154 (64.70%) had simple lamina while, 5 species has spiny lamina shape. The study area has four distinct seasons with mild summer and harsh winter. Seasonal distinction in flora was verified, with highest species richness in summer and spring season. Summer flora had 135 species (30.57 %), spring with 182 species (30.08 %) and autumn had 130 species (21.48%). Lowest species richness 108 (17.35%) were recorded in winter. Our results are strongly correlates with the findings of other researchers such as; Ullah & Badshah, (2017) reported highest number of species in summer season from Jelar Valley, District Dir Upper. Similarly, Ali et al*.* (2016) and Samreen et al*.* (2016) also recorded highest percentage of species in summer and spring seasons from Chail Valley, District Swat and Darazinda F.R. D.I. Khan.

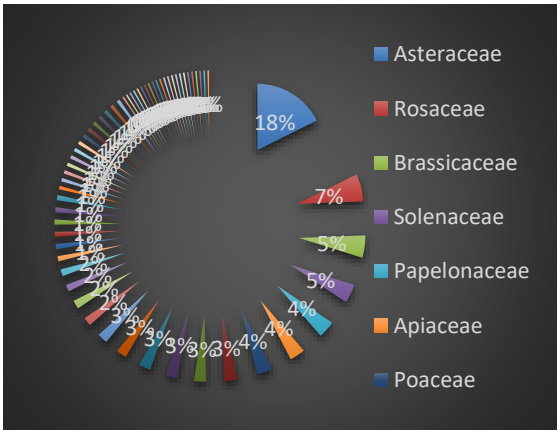

Figure 1: Percentage of species based on their families

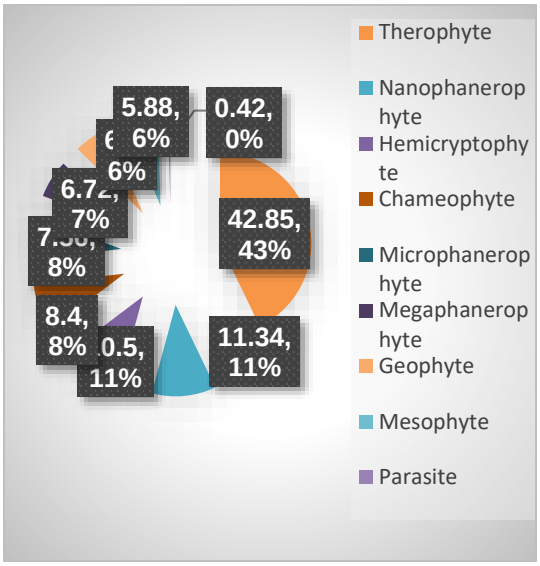

Figure 2: Life form classes

Biological spectrum

Biological spectrum of vegetation is the index of the phytoclimate, deduction of which is based on diverse life-forms composing the flora Khan et al. (2013). The life form area is the result of their genetic makeup and tolerance towards the climatic changes Hussain et al. (2015). Physiognomy of flora and vegetation depends upon the life forms and environmental conditions. Raunkiaer, (1934) proposed life form classification which is based on position of perennating structures during unfavorable conditions. By using Raunkiaerean classification, it was found that most abundant life form was therophytes having 102 species (42.85%) followed by nanophanerophytes represented by 27 species (11.34%), hemicryptophyte with 25 species (10.50 %) and Chamaephytes having 20 species (8.40%). Microphanerophytes were represented by 18 species (7.56%), megaphanerophytes with 16 species (6.72 %), geophytes with 15 species (6.30), mesophanerophytes with 14 species (5.88%) and parasite 1 species (0.42) stayed the next prevailing life forms (Table 4, Fig. 3). Badshah et al*.* (2016) and Naveed et al*.* (2012) reported that therophytes and nanophanerophytes were the dominant life form classes in their study areas.

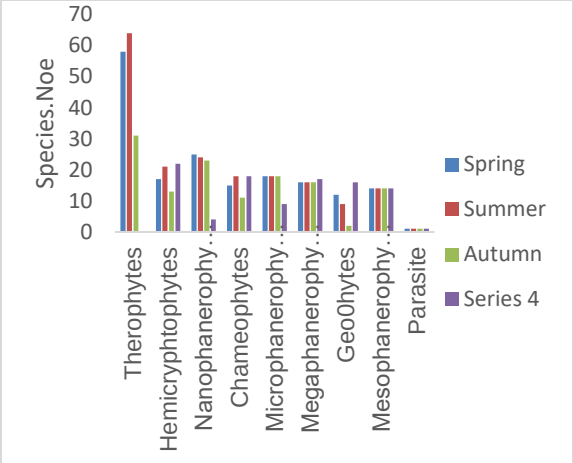

Figure 3: Seasonal variation in life form

Leaf size spectrum

The dominance of therophyte over other life forms in this area is mainly because of several reasons as extreme climatic conditions, overgrazing and human influences Rafay et al. (2013).

Seasonal variations

Seasonal variation of life form revealed that highest number species (185) were found in summer. The most abundant were therophytes with 64 species (34.59%), followed by nanophanerophytes with 24 species (12.97%), hemicryptophytes with 21 species (11.35%), Chameophytes and microphanerophytes each with 18 species (9.72%), megaphanerophytes with 16 species each 8.64%), mesophanerophytes with 14 species (7.56%), geophytes with 14 species (7,56%), and parasite were represented by 1 species (0.54%). Therophytes were also dominant in spring season represented by 58 species (32.95%), followed by nanophanerophytes 25 species (14.20%), microphanerophytes 18 species (10.22%), hemicrophanerophytes 17 species (9.65%), megaphanerophytes 16 species (9.90%), chameophytes 15 species (8.52%), mesophanerophytes 14 species (7.95%), geophytes 12 species (6.81%), and parasite represented by 1 species (0.56%). During Autumn therophytes consists of 31 species (24.03%), nanophanerophytes 23 species (17.82%), microphanerophytes 18 species (13.95%), megaphanerophytes 16 species (12.40%), mesophanerophytes 14 species (11.11%), hemicryptophytes 13 species (10.07%), chameophytes 11 species (8.52%), geophytes 2 species (1.55%), and parasite include 1 species (0.77%), while,the lowest numbers of species were noted in winter. (Table1, Fig.4). Our findings are supported by Badshah et al. (2016) who reported highest number of therophytes in spring and summer seasons from Parachinar, Kurram Agency, Pakistan.

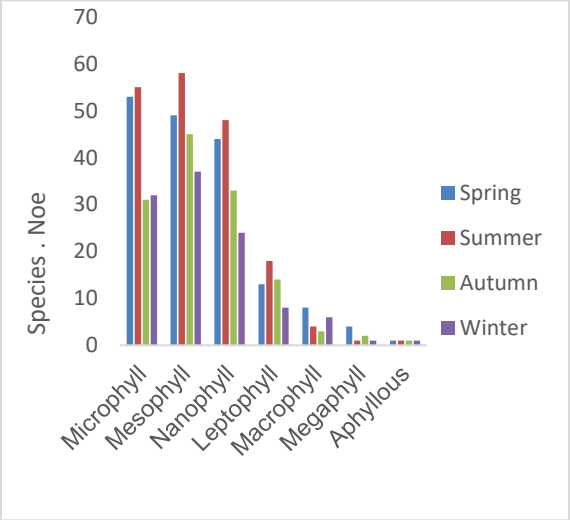

Figure 4: Seasonal variation in leaf size spectrum.

Leaf size spectrum

Knowledge of the leaf size clarifies the biological processes of plants and its communities. Leaf size spectrum and biological spectrum are used in the classification of communities and its association Ali et al. (2016). The knowledge of leaf size is helpful for the understanding of physiological processes of plants species and their communities (Oosting, 1956) as well as the leaf sized classes are useful for associations. Study of leaf size spectrum of the flora showed that the most dominant leaf size class was the microphyll contributed by 73 species (30.68%), followed by mesophyll 69 species (28.99%), nanophyll 60 species (25.22%), leptophyll 23 species (9.66%), macrophyll 8 species (1.26%), megaphyll 4 species (1.68%), and aphyllous comprised by 1 species of *Cuscuta reflexa* (0.42%). (Table 4, Fig.7). Our results are in line with the findings of Khan et al. (2013), Shah et al. (2013), Khan et al. (2011), Amjad, (2012) and Khan et al. (2014).

Table 1: Seasonal variations in life form

S.no	Life form	Spring	%age	Summer	%age	Autumn	%age	Winter	%age
1	Therophytes	58	32.95%	64	34.59%	31	24.03%	22	20.72%
2	Hemicryptophytes	17	9.65%	21	11.35%	13	10.07%	4	3.77%
3	Nanophanerophytes	25	14.20%	24	12.97%	23	17.82%	18	16.98%
4	Chameophytes	15	8.52%	18	9.72%	11	8.52%	9	8.49%
5	Microphanerophytes	18	10.22%	18	9.72%	18	13.95%	17	16.03%
6	Megaphanerophytes	16	9.09%	16	8.64%	16	12.40%	16	15.09%
7	Geophytes	12	6.81%	9	4.86%	2	1.55%	5	4.71%
8	Mesophanerophytes	14	7.95%	14	7.56%	14	11.11%	14	13.20%
9	Parasite	1	0.56%	1	0.54%	1	0.77%	1	0.94%
		176		185		129		106	99.93%

Table 2: Seasonal variation of Leaf size spectrum

S.no	Leaf size spectra	Spring	%age	Summer	%age	Autumn	%age	Winter	%age
	Microphyll	53	30.81%	55	29.72%	31	24.03%	32	29.35%
	Mesophyll	49	28.48%	58	31.35%	45	34.88%	37	33.94%
	Nanophyll	44	25.58%	48	25.94%	33	25.58%	24	22.01%
	Leptophyll	13	7.55%	18	9.72%	14	10.85%	8	7.33%
	Macrophyll	8	4.65%	4	2.16%	3	2.32%	6	5.50%
	Megaphyll	4	2.32%	1	0.54%	2	1.55%	1	0.91%
	Aphyllous	1	0.58%	1	0.54%	1	0.77%	1	0.91%
		172	99.97%	185		129	99.98%	109	99.95%

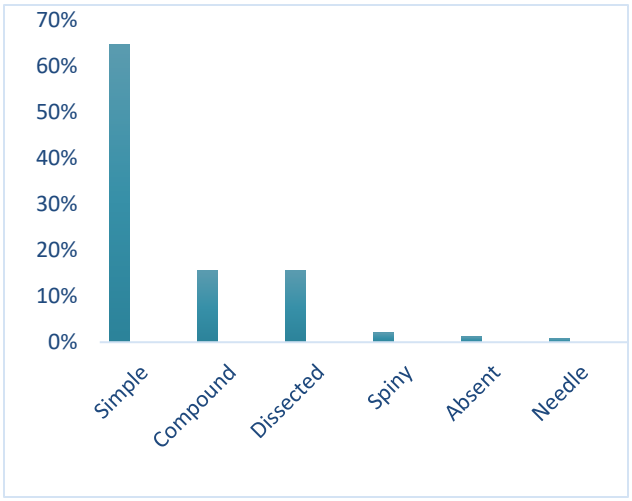

Figure 5: Percentage of species based on lamina shape

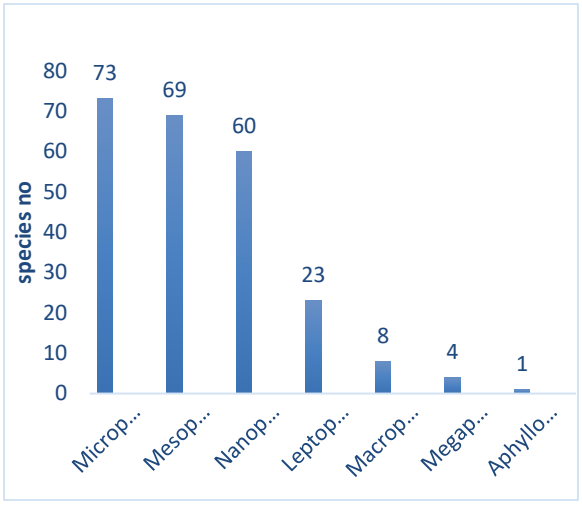

Figure 6: Leaf size spectrum of vegetation

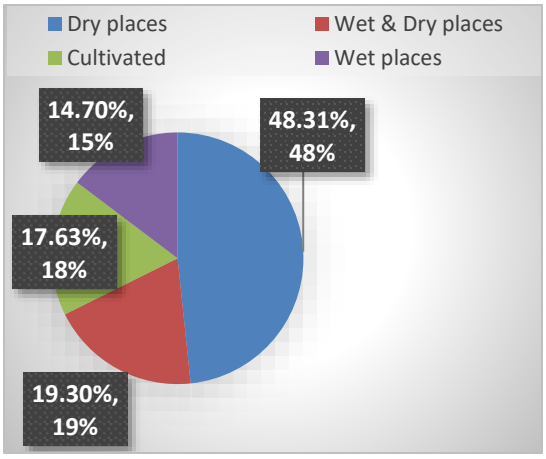

Figure 7: Percentage of species based on their habitat.

Table 4: Biological characteristics of the Valley

S.No.	Characteristics		
1	Vegetation	Number	%age
	Families	60	-
	Genera	164	-
	Species	238	-
2	Habitat type	No of Species	%age of species
	Dry places	115	48.31
	Cultivated	42	17.64
	Wet and dry places	46	19.32
	Wet places	35	14.70
3	Habit	No of species	%age of species
	Herbs	167	70.16
	Trees	43	18.06
	Shrubs	28	11.76
4	Seasonality	Species .no	%age
	Summer	185	30.57
	Spring	182	30.08
	Autumn	130	21.48
	Winter	108	17.85
5	Life form classes	Species .no	%age
	Therophytes	102	42.85
	Hemicryptophytes	25	10.50
	Nanophanerophytes	27	11.34
	Chameophytes	20	8.40
	Microphanerophytes	18	7.56
	Megaphanerophytes	16	6.72
	Geophytes	15	6.30
	Mesophanerophytes	14	5.88
	Parasite	1	0.42
6	Leaf size spectrum	Species. No	%age
	Microphyll	73	30.67
	Mesophyll	69	28.99
	Nanophyll	60	25.21
	Leptophyll	23	9.66
	Macrophyll	8	1.26
	Megaphyll	4	1.68
	Aphyllous	1	0.42
7	Lamina shape	Species.no	%age
	Simple	154	64.70
	Compound	37	15.54
	Dissected	37	15.54
	Spiny	5	2.10
	Absent	3	1.26
	Needles	2	0.84

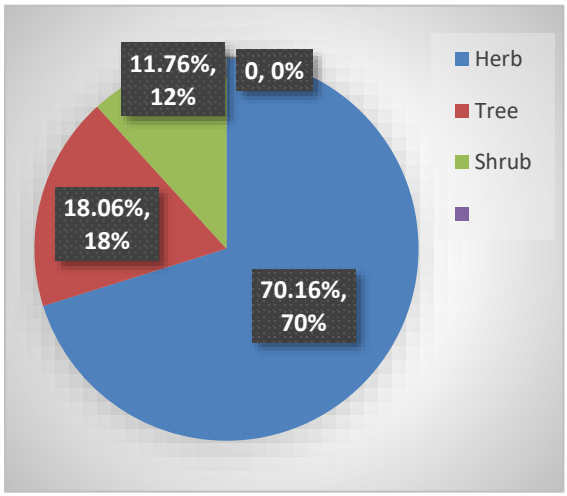

Figure 8: Percentage of species based on their habit

Seasonal variations

Seasonal variation of leaf size spectra showed that in summer mesophyll were the dominant leaf size class contributed by 58 species (31.35%), followed by microphyll 55 species (29.72%), nanophyll 48 species (25.94%), leptophyll 18 species (9.72%), macrophyll 4 species (2.16%), megaphyll and aphyllous by 1 species each (0.54%). In spring microphyll were dominant form consisted of 53 species (30.81%), followed by mesophyll 49 species (28.48%), nanophyll 44 species (25.58%), leptophyll 13 species (7.55%), macrophyll 8 species (4.65%), megaphyll 4 species (2.32%), and aphyllous contributed by 1 species (0.58%). In autumn mesophyll were the dominant form consisted by 45 species (34.88%), followed by nanophyll 33 species (25.58%), microphyll 31 species (24.03%), leptophyll 14 species (10.85%), macrophyll 3 species (2.32%), megaphyll 2 species (1.55%), and aphyllous contributed by 1 species (0.77%). While mesophyll was also dominant in winter contributed by 37 species (33.94%), followed by microphyll with 32 species (29.35%), nanophyll with 24 species (22.01%), leptophyll with 8 species (7.33%), macrophyll with 6 species (5.50%), megaphyll and aphyllous contributed by 1 species each (0.91%). (Table 2, Fig. 6)

Lamina shape

Lamina shape of different species shows that 154 species (64.70%) have simple lamina shape, followed by compound and dissected lamina each have 37 species (15.54%), spiny 5 species (2.10%), needles lamina shape consist 2 species (0.84%), while in 3species lamina shape is absent. (Table 4, Fig. 6) The lamina shapes of these species were also reported by Ullah & Badshah, (2017) from Jelar Valley, Dir Upper,Samreen et al. (2016) from Darazinda (D. I. Khan) and Ali et al. (2016) from Chail Valley, Swat.

Habit and Habitat

Among the flora, herbs were dominant comprises 167 species (70.16%), followed by shrub 48 species (18.06%) and trees were contributed by 28 species (11.76%). Highest numbers of 115 species (48.31%) were found growing in dry conditions, followed by 46 species (19.32%) growing on both dry and wet conditions, 42 species were found growing on agricultural land, while 35 species were found growing on wet land. (Table 4, Fig.7, 8) The area is under tremendous anthropogenic pressure as peoples of the locality obtain fuel wood and timber fromthe forest and rapid deforestation is resulting in habitat disturbance and destruction Ali et al. (2016).

CONCLUSION

The present results exposed that the flora of the Valley consisted of 238 species, 164 genera from 60 families. It included 53 dicots, 4 monocot families, 1 family of Gymnosperms and 2 Pteridophyte families. Pteridophyte had 3 genera (1.82 %) while; Gymnosperms had 1 genera (0.60 %). There were 11 genera of monocots (6.70 %) and 149 genera of dicots (90.85 %). Leading families was Asteraceae 42 species (17.64%), Rosaceae 16 species (6.72%), Brassicaceae 13 species (5.46%), Solanaceae 11 species (4.62%),

Papilonaceae 10 species (4.20%). The largest genera were *Euphorbia* (6 species), *Sonchus*, *Chenopodium*, *Medicago* and *Pyrus* (4 species each). The dominant life form was therophytes with 102 species (42.85%), followed by nanophanerophytes with 27 species (11.34%). Leaf size spectra of the flora presented that the most dominant leaf size class was microphyll 73 species (30.67%) followed by mesophyll 69 species (28.99%). This study provides baseline information on the flora of the area and further study is recommended for the exploration of quantitative information of vegetation.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

ACKNOWLEGEMENT

The present work is a part of Ph. D research project of the first author (Tahir Hameed). This research did not receive any specific grant from funding agencies in the public, commercial, or not for-profit sectors. The authors are thankful to the local inhabitants of Toormang Valley for their cooperation during data collection.

AUTHOR CONTRIBUTIONS

TH and IA designed the study and also wrote the manuscript. IA and SU help out in the interpretation of results and reviewed the manuscript. All authors read and approved the final version.

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