FLORISTIC DIVERSITY AND WEED COMMUNITIES OF MAIZE, POTATO AND MUNGBEAN CROPS OF KALASH VALLEY CHITRAL HINDUKUSH RANGE KHYBER PAKHTUNKHWA, PAKISTAN

Zahid Fazal[1], Jaweria Gul[2], Muhammad Subhan, Khan Sher and Qasir Ali

https://doi.org/10.28941/25-2(2019)-1

ABSTRACT

The present study was conducted during 2016-2017 to record the weed flora of economically important crops, viz. maize, potato and mungbean in Kalash Valley, Chitral, Pakistan. All the three localities of Kalash Valley (Bumburet, Birir and Rumbor) were surveyed. For each crop three locations from each valley were selected and five 1x1 m^2 quadrants were used at each location. For the first time phytosociological data regarding absolute density, relative density, frequency, relative frequency, importance value %, average importance value, Constancy classes and Importance value constancy index of various weeds of the area were recorded. The mean data across surveyed localities revealed that the flora is dominated by Digitaria sanguinalis with the highest relative density of 63.78% in maize, 58.78% in potato and 33.11% in mungbean, among all *species.* In all three crops studied, 23 weed species were competitive with the crops. Based on the Importance Value Constancy value index the most competitive weeds in all crops studied were *Digitaria sanguinalis* (L.) Scop. (123.3), *Amaranthus viridis* Linn. (107.9), *Rumex dentatus* L. (89.3), *Solanum nigrum* (79.7), *Chenopodium album* L. (75.8) and *Setaria viridis* (64.6). *Digitaria sanguinalis* (98.6), *Solanum nigrum* (70.7), *Trifolium repens* (56.4) and *Amarathus viridis* (49.2). On the basis of IVCI the communities established in Kalash Valley in the studied crops are *Digitaria-Amaranthus-Rumex in maize, Digitaria-Solanum-Rumex* in potato and *Digitaria-Solanum-Setaria* in mungbean. Regarding life form classification, 18 species (78.3%) were therophytes, four (17.4%) were geophytes and one species (4.3%) belonged to nanophanerophytes. Leaf size spectra evidenced the highest and equal number of species (seven ea.) in nanophylls and microphylls, either class comprised 30.7% of the species. Mesophylls four spp. (17.3%) followed by three spp. in macrophylls (13%). Aphyllous and leptophyllous groups were merely represented by one species ea. either sharing 4.3%. In order to harvest the optimum yields of these crops appropriate management of the highlighted weeds is recommended.

Keywords: Importance value Constancy Index, weed infestation, weed diversity, weed distribution.

Citation: Fazal, Z., J. Gul, M. Subhan, K. Sher and Q. Ali. 2019. Floristic diversity and weed communities of maize, potato and mungbean crops of Kalash Valley Chitral Hindukush Range Khyber Pakhtunkhwa, Pakistan. Pak. J. Weed Sci. Res., 25 (2):79-90.

[1]Department of Botany, Shaheed Benazir Bhutto University, Sheringal, Dir Upper, Khyber Pakhtunkhwa, Pakistan.
[2]Department of Biotechnology, Shaheed Benazir Bhutto University, Sheringal, Dir Upper, Khyber Pakhtunkhwa, Pakistan.

INTRODUCTION

Chitral district is situated at the extreme North-West of Pakistan ranging from 35°, 15´ 06″ to 36°, 55´32″ North latitude and 71°, 11´ 32″ to 73°, 51´ 34″ East longitude (Anonymous, 1998). Due to its geographical location, the ditrict gives support to a large number of plants which provide food, medicine and ornamental importance. Chitral is also rich in other plant products like morels, vegetables, chalghoza, fruits and honey. Kalash Valley, one of the most beautiful picnic spots of international fame, consists of three sub-valleys viz., Bumburet, Rumbor and Birir. Among them, Bumburet is the most beautiful. Chitral is the land of great diversity having over a dozen of different cultures and languages spoken by the inhabitants from the at least 4,000 years. The Kalash people have an indigenous and unique culture and are considered to be the descendants of Alexander the Great's army (Hadi and Ibrar, 2015).

The present study was carried out to examine different species of weeds growing in major crops of Kalash Valley such as maize, potato and mung bean. These all are major crops grown in the foothills and the people of Kalash Valley mostly depend on these for food and survival. The present survey is the first ever attempt to document various weed species infesting economically important crops of Kalash Valley. Many workers have already similar contributions in Chitral and other parts of Pakistan. For example, Hadi and Ibrar (2015) studied the ecology of weeds in wheat crop of Kalash Valley District Chitral Hindukush Range, Pakistan. Hussain *et al*. (2004) recognized three weeds communities in wheat of Mastuj Tehsil, Chitral, viz., *Mentha-Steria-Convulvulous* at Chapari and Kargin, *Mentha-Hordeum-Silene* in Khuz and *Convolvulus-Trifolium-Hordeum* in Brep. Hadi and Ibrar (2015) conducted a survey during the year 2014 to record the weed flora of wheat crop in three localities (Bumburet, Rumbor and Birir) of historical Kalash Valley, district Chitral. Zeb *et al.* (2016) conducted a research to investigate the floristic composition and phytosociology of the Hazar Nao hills, District Malakand, Khyber Pakhtunkhwa. Ghafoor *et al*. (1987) documented ten highly competitive weeds in Pakistan. Hassan *et al.* (2003) recognized 15 plant species as the highly harmful weeds in field of wheat in KPK. If the unwanted plants are left untouched the competition with crops increases and growth and yield decreases up to 35-70% (Khan *et al*., 2012). Jan *et al*. (2010) presented their findings on ethno-botanical survey of weeds of Dir, Kohistan valley, Khyber Pakhtunkhwa, Pakistan. Farooq *et al.* (2010) investigated phytosociology of Push Ziarat area (Shawal) in South Waziristan, Pakistan. Khan *et al*. (2013) conducted a field experiment during Rabi season to highlight the most important and problematic weeds of chickpea crop at Karak district, Khyber Pakhtunkhawa, Pakistan. Hassan *et al.* (2010) reported the phytosociology of chickpea in Lakki-Marwat, NWFP. Ullah *et al.* (2014) explored thirty one taxa of weeds in 30 genera and 18 families for their therapeutically active ingredients. Muhammad *et al*. (2009) concluded the presence of weeds in maize, wheat and potato fields of Gojra, district Toba-Tek-Singh, Punjab. Keeping in view the importance of weeds, studies were undertaken in Tehsil Charsadda to highlight the phystosociology and ecological attributes of the flora infesting wheat, for the guidance of weed managers to effectively take care of weeds and minimize yield losses in wheat crop.

MATERIALS AND METHODS

A field survey of different sub-valleys of the Kalash Valley, viz. Rumbor, Bumburet and Birir was carried out during September and October, 2016. The research work was carried out to investigate the distribution of different weed species in maize (*Zea mays* L.), potato *(Solanum tuberosum* L.) and mungbean *(Vigna radiata* (L.) Wilczek. crops. The sampling technique was comprised of the quadrant method having plots of standard size as it can be used for various communities of plants (Cox, 1990). As plants mostly occur in

groups and long and narrow plots often contain more species than square and round plots of equal area, particularly if the long axis is established parallel to the environmental gradients (Cox, 1990; Greg-Smith, 1983; Barbour *et al.,* 1987).

Three locations were randomly sampled from each of the sub-valleys in each crop. Five quadrants (1 x 1 m^2) were used randomly along an inverted horizontal pattern in each study site following the methodology of McCully *et al.* (1991) with some modifications. The distance between each quadrant depended upon the size and shape of the field and obstructions that were present in the field. The larger the field, the greater the distance among quadrants will be. Data were recorded in terms of density (m^{-2}) and frequency (%) of various weed species. From these basic data, Relative Density (%) and Relative Frequency (%) were computed. From these parameters the ultimate data on Importance Value (%), Constancy classes and Importance Value Constancy Index of different weed species were recorded (Hussain *et al,* 2004; Hassan *et al.*, 2010; Hussain *et al.*, 2015).

During the research work, different weed species were collected and identified at the Department of Botany, Shaheed Benazir Bhutto University Sheringal, Dir Upper, Khyber Pakhtunkhwa, Pakistan and the specimens were turned in to the Herbarium of the aforesaid Department.

RESULTS AND DISCUSSION

Floristic variability in maize crop

According to mean data from all localities, *Digitaria sanguinalis* weed showed dominance with the highest relative density of 63.78% in maize, 58.78% in potato and 33.11% in mungbean (data not shown). The data in Table-1 show that maize crop in Kalash Valley was infested with 19 species of weeds belonging to ten families. The number of species infesting each location (Rumbor, Bumburet and Birir) was almost the same. Poaceae has been the most dominant family comprising four representative species. Fabaceae and Solanaceae having three species each were the next dominant families in the array. However, Amaranthaceae was represented by two species, while, Ploygonaceae, Cannabacae, Convolvulaceae, Plantaginaceae, Cyperaceae and Lamiaceae families were represented by only one species each (Table-1). The numerical superiority of Poaceae and Fabaceae and Solanaceae is perhaps due to their competitive ability with maize crop under ambient edaphic and ecological conditions of Kalash Valley. *Lycopersicon esculentum* L. (tomato) and *Trifolium repens* L. (white clover) are cultivated crops, but the latter is not a cultivated crop of Pakistan, hence these are considered volunteer weeds of maize as per 'weed definition' (Rao, 2000).

In maize crop, varying weed communities were established at each locality of the study area on the basis of importance value (Table-1). *Amaranthus-Rumex-Digitaria* community has been predominant at Rumbor, while at Bumburet *Digitaria-Trifolium-Amaranthus* prevailed. At Birir, *Chenopodium-Digitaria-Amaranthus* has been the representative community (Table-1). *Digitaria* was involved in the predominant communities of all three locations. For the overall Kalash Valley, the predominant weed community based on AIV and IVCI is the *Digitaria-Amaranthus-Rumex* (Table-1). Out of the ten families, enumerated at Rumbor, two families, viz. Poaceae and Cyperaceae are the monocots (sedges and grasses), while rest are dicots or broadleafs. Based on the Importance Value Constancy value index the most competitive weeds in the maize crop of Kalash Valley were *Digitaria sanguinalis* (L.) Scop., *Amaranthus viridis* Linn., *Rumex dentatus* L. and *Chenopodium album* L. with an IVCI value of 113.4, 107.9, 89.3 and 75.8, respectively (Table-1).

Dominance of *Digitaria sanguinalis* might be due to its invasiveness, allelopathic nature, higher growth rate, higher fecundity, rapid

flowering and earlier space capture. Another phytosociological study of weed plants in Chitral valley was presented by Hussain *et al*. (2004) who recognized 3 weed communities in wheat fields of Mastuj valley, District Chitral, viz. *Mentha-Steria-Convulvulous* in Kargin and Chapari, *Mentha-Silene-Hordeum* at Khuz and *Convulvulus-Trifolium-Hordeum* at Brep. Hadi and Ibrar (2015) conducted a survey during the year 2014 to record weed flora of wheat crop in three localities (Bumburet, Rumbor and Birir) of historical Kalash Valley, district Chitral. In their findings they elucidated Asteraceae was represented by the highest (ten) number of species competing with wheat crop.

Floristic variability in potato crop

Potato crop in Kalash Valley was infested by 16 species of weeds belonging to 11 families. The number of species infesting each location (Rumbor, Bumburet and Birir) was variable (Table-2). The highest number of species (12) was recorded in Bumburet, followed by ten in Birir and the least (nine) species were recorded in Rumbor. Poaceae has been the highest represented family comprising four representative species. Fabaceae, Amaranthaceae and Solanaceae having two species each were the next dominant families in potato. However, Ploygonaceae, Asteraceae, Convolvulaceae and Lamiaceae families were represented by only a single species each (Table-2). The numerical superiority of Poaceae is perhaps due to its competitive superiority in potato crop, over the other families.

Weed communities

Digitaria-Solanum-Rumex community was established at Rumbor. While, at Bamburet, *Setaria-Digitaria-Solanum* community prevailed. At Birir, *Setaria-Rumex-Solanum* emerged as the dominant community (Table-2). Based on the Importance Value Constancy value index the community prevailing in potato crop was *Digitaria-Solaum-Rumex* and the most competitive weeds of Kalash Valley are *Digitaria sanguinalis* (123.3), *Solanum nigrum* (79.7), and *Rumex dentatus* (74.8), *Setaria viridis* (64.6) and *Amarathus viridis* (52.6) [Table-2].

Floristic variability in mungbean crop

Fabaceae (three spp.) outnumbered all other Families among the phytosociology of mungbean fields in Kalash Valley, Chitral Pakistan. It was followed by Poaceae (two spp.) and Amarathaceae (two spp.). While, Solanaceae, Plantaginaceae, Asteraceae, Cannabaceae, Lamiaceae and Convolvulaceae were merely represented by one species each (Table-3).

Weed communities

Our data (Table-3) exhibit that *Digitaria-Solanum-Trifolium* community was established at Rumbor. Bamburet was overwhelmed by *Digitaria-Trifolium-Setaria* community. Whereas, Birir was almost similar to Bamburet having *Digitaria-Solanum-Setaria* community as the dominant combination (Table-3). The data in Table-3 further reveal that the appraisal through the Importance Value Constancy value index (IVCI) exhibits the most competitive weeds in the mungbean crop of Kalash Valley were *Digitaria sanguinalis* (98.6), *Solanum nigrum* (70.7), *Setaria viridis* (60.8), *Trifolium repens* (56.4) and *Amarathus viridis* (49.2) and the predominant weed community is *Digitaria-Solanum-Setaria*.

Several similar studies corroborate our findings including the phytosociological studies of plants in Pakistan such as in Pakistani Kashmir (Malik *et al*., 2002), Peshawar (Shah *et al*., 2006), District Karak (Ahmad *et al*., 2006), Frontier Region Bannu, Khyber Pakhtunkhawa, (Muhammad *et al*., 2011), Tehsil Gojra,District Toba-Tek Singh, Punjab (Muhammad *et al*., 2009), Push Ziarat (Shawal) area in South Waziristan (Farooq *et al.,* 2010), Dir, Kohistan valley, Khyber Pakhtoonkhwa, (Jan *et al*. 2010), Landikotal Khyber Agency (Ullah *et al.* 2014), Peshawar Valley (Khan *et al*. 2014), District Lakki Marwat (Hassan *et al.* 2010), Tehsil Manki Sharif, District

Nowshera (Ali *et al*. 2015), Hazar Nao Hills, District Malakand, Khyber Pakhtunkhwa (Zeb *et al.* 2016), Mastuj alley Chitral (Hussain *et al.*, 2015) and Tall Dardyal, (Khan *et al*. 2016).

Biological spectra of weeds infesting maize, potato and mungbean crops in Kalash Valley.

Among the 23 weed species of the study area, the life form classification revealed that 18 species (78.3%) were therophytes, four (17.4%), one species (4.3%) belonged to nanophanerophytes (Tables 4 & 5). Leaf size spectra evidenced the equal number of species (seven ea.) in nanophylls and microphylls, either class comprised 30.7% of the species (Tables 4 & 5). Mesophylls were comprised of four species (17.3%) followed by three species in macrophylls (13%). Aphyllous and leptophyllous groups were the least in representation in the target area, just having one species each, either sharing 4.3% (Tables 4 & 5). The life cycle of a weed determines success or failure in a given cropping situation. In annual crops, perennial species are seldom successful where proper tillage operations are practiced annually or seasonally in case of a crop rotation. However, in perennial crops like sugarcane and orchards etc., the perennial weeds like johnsongrass (*Sorghum halepense)*, bermudagrass *(Cynodon dactylon)* and nutgrass *(Cyperus rotundus)* establish and efficiently compete for resources, viz. nutrients, space, water, solar radiation and gases, spreading their propagules for further successful infestation. Annual herbs were represented in the highest number 14 out of 23 constituting 60.9%. Perennial herbs comprising nine species (39.1%) has been the next category (Tables 4 & 5). In order to harvest bumper crops, clean cultivation is recommended and as far as possible the growth of weeds may be discouraged through preventive and weed managerial means. Our findings agree with Sher *et al. (*2011), Hadi *et al.* (2015) and Samad *et al.* (2018) who concluded the dominance of therophytes in Lahor district Swabi Pakistan in wheat crop, Kalash Valley also in wheat crop and in Lala Kalay near Peshawar, respectively. Further studies of Khan *et al.* (2014), Hussain *et al*. (2015), Ali *et al.* (2017), Khan *et al.* (2017) and Begum and Ahmad (2018) illustrated a varying composition of biological spectra in their similar findings from different locations of Pakistan.

Table-1. Importance value, average importance value (AIV), constancy index and importance value constancy index (IVCI) of weeds infesting maize crop at different locations of Kalash Valley, Chitral, Pakistan.

S. No.	Plant Species	Family	Rumbor	Bumburet	Birir	AIV	Constancy Class	IVCI
1	*Digitaria sanguinalis* (L.) Scop.	Poaceae	23.24**c**	24.25**a**	20.55**c**	22.68**a**	**5**	113.4**a**
2	*Amaranthus viridis* Linn.	Amarathaceae	27.34**a**	16.17**c**	21.23**b**	21.58**b**	**5**	107.9**b**
3	*Rumex dentatus* L.	Polygonaceae	23.45**b**	13.38	16.77	17.87**c**	**5**	89.3
4	*Chenopodium album* L.	Amaranthacea	3.04	10.39	32.04**a**	15.16	**5**	75.8
5	*Trifolium repens* L.	Fabaceae	3.47	16.67**b**	3.43	7.86	**5**	39.3
6	*Setaria viridis* L.	Poaceae	4.80	1.09	8.77	4.89	**5**	24.5
7	*Cannabis sativa* L.	Cannabaceae	4.19	3.96	3.60	3.92	**5**	19.6
8	*Convolvulus arvensis* L.	Convolvulaceae	4.74	3.56	2.05	3.45	**5**	17.3
9	*Solanum nigrum* L.	Solanaceae	1.42	1.47	0.8	1.23	**5**	6.2
10	*Pisum sativum* L.	Fabaceae	_	_	7.29	2.43	**2**	4.9
11	*Plantago lanceolata* L.	Plantaginaceae	_	_	6.02	2.01	**2**	12.0
12	*Cyperus rotundus* L.	Cyperaceae	_	2.41	_	0.80	**2**	1.6
13	*Cynodon dactylon* (L.) Pers.	Poaceae	_	_	1.72	0.57	**2**	1.1
14	*Mentha longifolia* L.	Lamiaceae	_	1.47	_	0.49	**2**	1.0
15	*Medicago denticulata* Willd.	Fabaceae	0.95	_	_	0.32	**2**	0.6
16	*Vicia sativa* L.	Fabaceae	0.95	_	_	0.32	**2**	0.6
17	*Lycopersicon esculentum* L.	Solanaceae	0.88	_	_	0.29	**2**	0.6
18	*Datura stramonium* L.	Solanaceae	0.81	_	_	0.27	**2**	0.5
19	*Saccharum spontaneum* Linn.	Poaceae	_	0.70	_	0.23	**2**	0.5
No. of Representing Species			13	12	12			

Table-2. Importance value, average importance value, constancy index and importance value constancy index of weeds in potato crop of Rumbor, Bumburet and Birir Valleys.

S.No.	PLANT SPECIES	Family	Rumbor	Bumburet	Birir	AVI	Constancy Class	IVCI
1	*Digitaria sanguinalis* (L.) Scop.	Poaceae	32.92**a**	19.33**b**	21.7**a**	24.65**a**	5	123.3a
2	*Amaranthus viridis* L.	Amaranthaceae	9.21	7.88	14.47	10.52	5	52.6
3	*Solanum nigrum* L,	Solanaceae	18.27**b**	15.80**c**	13.72**c**	15.93**b**	5	79.7b
4	*Rumex dentatus* L.	Polygonaceae	11.72**c**	13.90	19.24**b**	14.95**c**	5	74.8c
5	*Setaria viridis* L.	Poaceae	7.51	23.09**a**	8.14	12.91	5	64.6
6	*Chenopodium album* L.	Amaranthaceae	8.75	0.79	7.66	5.73	5	28.7
7	*Trifolium repns* L.	Fabaceae	6.57	0.96	3.40	3.64	5	18.2
8	*Cichorium intybus* L.	Asteraceae	_	1.66	3.94	1.87	4	7.5
9	*Echinochloa crus-galli* (L.) P. Beauv.	Poaceae	_	4.84	=	1.61	2	3.2
10	*Cynodon dactylon* (L.) Pers.	Poaceae	_	_	4.56	1.52	2	3.0
11	*Pisum sativum* l.	Fabaceae	_	4.14	-	1.38	2	2.7
12	*Convolvulus arvensis* L.	Convolvulaceae	2.11	_	-	0.70	2	1.4
13	*Conyza canadensis (*L.) Cronquist.	Asteraceae	_	1.76	-	0.59	2	1.2
14	*Mentha longifolia* L.	Lamiaceae	_	_	1.47	0.49	2	0.5
15	*Equisetum arvense* L.	Equisetaceae	1.18	_	-	0.39	2	0.8
16	*Lycopersicon esculentum* Mill.	Solanaceae	_	0.63	-	0.21	2	0.4
	Locationwise No. of species		9	12	10			

Table-3. Importance value, average importance value, constancy index and importance value constancy index of weeds in mungbean crop at Rumbor, Bumburet and Birir Valley.

S.No.	Plant Species	Family	Rumbor	Bumburet	Birir	AVI	Constancy Class	IVCI
1	*Digitaria sanguinalis* (L.) Scop.	Poaceae	23.17**a**	16.27**a**	19.71**a**	19.72**a**	**5**	98.6**a**
2	*Solanum nigrum* L.	Solanaceae	16.39**b**	7.9	18.12**b**	14.14**b**	5	70.7**b**
3	*Setaria viridis* L.	Poaceae	9.27	11.97**c**	15.20**c**	12.15**c**	5	60.8**c**
4	*Trifolium repens* L.	Fabaceae	13.99**c**	14.67**b**	5.15	11.27	5	56.4
5	*Amaranthus viridis* L.	Amaranthaceae	4.52	10.47	14.50	9.83	5	49.2
6	*Plantago lanceolata* L.	Plantaginaceae	3.09	9.11	9.42	7.21	5	36.1
7	*Conyza canadensis(*L.) Cronquist.	Asteraceae	2.93	3.44	7.12	4.50	5	22.5
8	*Medicago denticulata* Willd.	Fabaceae	2.93	5.09	1.65	3.22	5	16.1
9	*Chenopodium album*	Amaranthaceae	6.32	2.07	_	2.80	5	14.0
10	*Cannabis sativa* .L.	Cannabaceae	3.91	_	4.09	2.67	4	10.7
11	*Mentha longifolia* L.	Lamiaceae	2.93	4.97	_	2.63	4	10.5
12	*Convolvulus arvensis* L.	Convolvulaceae	2.49	2.42	_	1.64	4	6.6
13	*Pisum sativum* L.	Fabaceae	_	_	5.06	1.69	2	3.4
	Locationwise No. of species		12	12	10			

Table-4. Ecological attributes of floral diversity in maize, potato and mungbean crops of Rumbor, Bumburet and Birir Kalash Valley, Chitral Pakistan.

S.No.	Weed species	Family	Biological spectra		
			Life Form	Leaf Size	Habit
1	*Digitaria sanguinalis* (L.) Scop.	Poaceae	Th	Na	A.H.
2	*Amaranthus viridis* Linn.	Amarathaceae	Th	Mes	A.H.
3	*Rumex dentatus* L.	Polygonaceae	Th	Mac	A. H
4	*Chenopodium album* L.	Amaranthacea	G	Na	A.H.
5	*Trifolium repens* L.	Fabaceae	G	Mic	P.H.
6	*Setaria viridis* L.	Poaceae	Th	Mes	A.H
7	*Cannabis sativa* L.	Cannabaceae	Th	Lep	A. H.
8	*Convolvulus arvensis* L.	Convolvulaceae	Th.	Na	P. H
9	*Solanum nigrum* L.	Solanaceae	Th	Mic	A.H.
10	*Pisum sativum* L.	Fabaceae	Th	Na	A.H.
11	*Plantago lanceolata* L.	Plantaginaceae	Th	Mac	P.H.
12	*Cyperus rotundus* L.	Cyperaceae	Th	Mic	P.H.
13	*Cynodon dactylon* (L.) Pers.	Poaceae	Th	Na	P.H
14	*Mentha longifolia* L.	Lamiaceae	Th	Mes	P.H.
15	*Medicago denticulata* Willd.	Fabaceae	Th	Mic	A. H.
16	*Vicia sativa* L.	Fabaceae	Th	Mic	A. H.
17	*Lycopersicon esculentum* L.	Solanaceae	Th	Mic	A.H.
18	*Datura stramonium* L.	Solanaceae	Np	Mes	A.H.
19	*Saccharum spontaneum* Linn.	Poaceae	G	Na	P. H
20	*Cichorium intybus* L.	Asteraceae	Th	Mac	P.H.
21	*Echinochloa crus-galli* (L.) P. Beauv.	Poaceae	Th	Na	A.H.
22	*Equisetum arvense* L.	Equisetaceae	G	Ap	P.H.
23	*Conyza canadensis(*L.) Cronquist.	Asteraceae	Th	Mic	A.H.

Habit: A. H. = Annual herb, P. H. = Perennial herb.
Life form:Th = Therophytes, G = Geophytes and Np. Nanophanerophytes
Leaf size: AP = Aphyllous, Lep = Leptophyll, Na = Nanophyll, Mic = Microphyll and Mes = Mesophyll.

Table-5. Percentage distribution of Life forms, Leaf Size and Habit spectra of weeds in maize, potato and mungbean crops of Kalash Valley, Chitral Pakistan.

S. No.	Classes	No. of species	% age
Life Form			
1.	Therophytes	18	78.3
2.	Geophytes	4	17.4
3.	Nanophanerophtes	1	4.3
Leaf Size			
1.	Nanophylls	7	30.4
2.	Microphylls	7	30.4
3.	Mesophylls	4	17.4
4	Macrophylls	3	13.0
5	Aphyllous	1	4.3
6.	Leptophylls	1	4.3
Habit			
1.	Annual Herbs	14	60.9
2.	Perennial Herbs	9	39.1

REFERENCES CITED

Ahmed, M., T. Hussain, A.H. Sheikh, S.S. Hussain and M.F. Siddiqui. 2006. Phytosociology and structure of Himalayan forests from different climatic zones of Pakistan. Pak. J. Bot., 8 (2): 361-383.

Ali, S., S.Z. Shah, K. Ali, M.S. Khan, S. Ullah, W.M. Khan and M.A. Sajad. 2015. Diversity of weeds and their ecological characteristics at Tehsil Manki Sharif, district Nowshera, Pakistan. Pak. J. Weed Sci. Res., 21(3): 417-423.

Barbour, M.G., J.H. Burk and W.D. Pitts. 1987. Terrestrial Plant Ecology. Chapter 9: Methods of Sampling the Plant community.

Cox, G. 1990. Laboratory manual of General Ecology 6th Ed. Dubuque, Iowa: USA

Farooq, S., A.Z. Khan, M. Yousaf and H. Fazal. 2010. Phytosociological study of Push Ziarat area Shawal in the South Waziristan, Pakistan. Pak. J. Weed Sci. Res., 16(1): 47-55.

Ghafoor, A., R.A. Shad and A. Sher. 1987. Ten most important weeds of Pakistan. Progr. Farm., 7(1): 17-20.

Greig-Smith, P. 1983. Quantitative Plant Ecology. Butterworths Publishers, London.

Hadi, F. and M. Ibrar. 2015. Ecology of weeds in wheat crops of Kalash valley, District Chitral, Hindukush Range, Pakistan. Pak. J. Weed Sci. Res., 21(3): 425-433.

Hassan, G., B. Faiz, K.B. Marwat and M. Khan. 2003. Effects of planting methods and tank mixed herbicides on controlling grassy and broad leaf weeds and their effects on wheat cv Fakhre-e-Sarhad. Pak. J. Weed Sci. Res., 9: 1-11.

Hassan, G., I. Khan, M.Z. Khan, N.H. Shah, M. Khan and M. Liaqatullah. 2010. Weed flora of chickpea in district Lakki Marwat, NWFP. Pak. Sarhad J. Agric., 26(1): 79-86.

Hussain, F., A. Murad and M. J. Durrani. 2004. Weeds communities in the wheat fields of Mastuj, district Chitral, Pakistan. Pak. J. Weed Sci. Res., 10(3-4):101-108.

Hussain, F., S.M.Shah, L. Badshah and M. J. Durrani. 2015. Diversity and ecological characteristics of flora of Mastuj Valley, district Chitral, Hindukush Range, Pakistan. Pak. J. Bot., 47(2), 495-510.

Jan, G., M. A. Khan, F. Gul, M. Ahmad, M. Jan and M. Zafar. 2010. Ethnobotanical study of common weeds of Dir Kohistan valley, Khyber Pakhtoonkhwa, Pakistan. Pak. J. Weed Sci. Res. 16(1): 81-88.

Khan, A., N. Khan, K. Ali and Inyat-ur-Rahman. 2017. An Assessment of the Floristic Diversity, Life-Forms and Biological Spectrum of Vegetation in Swat Ranizai, District Malakand, Khyber Pakhtunkhwa, Pakistan. Sci. Technol. Dev., 36 (2): 61-78.

Khan, M.A., A.Ullah , A. Rashid, S. M. Shah and S. Fida . 2014. Floristic leaf-size and life form spectra of Asshab Baba Graveyard Chaghar Matti, district Peshawar, Khyber Pakhtoonkhwah , Pakistan. Int. J. Biol. Biotechnol., 11 (1): 167-171.

Khan, I.A., Zaheenullah and R. Khan. 2013. Weed Flora in Chickpea at District Karak, Khyber Pakhtunkhwa, Pakistan. Thai J.Agric. Sci., 46(2): 71-74.

Khan, W.M., S.Z. Shah and M.S. Khan. 2016. Ethnobotanical relevance of the weed flora of Tall Dardyal, Tehsil Kabal, district Swat, Pakistan. Pak. J. Weed Sci. Res. 22(1): 125-145.

Malik, Z.H., N.Z. Malik and R. Rafique. 2002. Weeds of maize fields around Kotli, Azad Jammu and Kashmir. Pak. J. Weed Sci. Res., 8(1-2): 77-79.

McCully, K.M., G. Simpson and A.K. Watson. 1991. Weed survey of Nova Scotia Lowbush (*Vaccinilum angustifolium*) fields. Weed Sci., 39(2): 180-185.

Muhammad, S., Z. Khan and T. A. Cheema. 2009. Distribution of weeds in wheat, maize and potato fields of Tehsil Gojra, district Toba Tek Singh, Pakistan. Pak. J. Weed Sci. Res., 15(1): 91-105.

Muhammad, Z., S.M. Wazir, A. Farooq, S. Ullah and Z. Hussain. 2011. Distribution and checklist of weeds in maize crop of Frontier region Bannu, Khyber Pakhtunkhawa, Pakistan. Pak. J. Weed Sci. Res., 17(4): 373-379.

Rao, V.S. 2000. Principles of Weed Science, Second ed. Science Publishers, Inc., New Hampshire, pp. 16-18.

Samad, M., L. Badshah and S. M. Khan. 2018. Biological spectra of Lala Kalay area district Peshawar, Khyber Pakhtunkhwa Province Pakistan. Pak. J. Weed Sci., Res. 24 (4): 353-262.

Shah, S.R.U., M.Qasim, I.A. Khan and S.A.U. Shah. 2006. Study of medicinal plants among weeds of wheat and maize in Peshawar region. Pak. J. Weed Sci. Res. 12(3): 191-197.

Ullah, S., A. Ullah and A. Rashid. 2014. Medicinal diversity of weeds in the historical valley of Landikotal, Khyber Agency, Pakistan. Pak. J. Weed Sci. Res., 20(4): 531-539.

Zeb, U., H. Khan, B. Gul and W.M. Khan. 2016. Floristic composition and phytosociological studies of Hazar Nao Hills district Malakand, Khyber Pakhtunkhwa, Pakistan. Pak. J. Weed Sci. Res., 22(2): 295-315.