# PHYTOSOCIOLOGY AND SOME ECOLOGICAL ATTRIBUTES OF WEED FLORA OF WHEAT IN TEHSIL CHARSADDA KHYBER PAKHTUNKHWA PAKISTAN

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## ABSTRACT

*Weed infestation of wheat crop is a serious problem throughout the country as well as worldwide, as weeds cause huge yield and quality losses. To investigate the phytosociology of weeds of wheat in Tehsil Charsadda, Khyber Pakhtunkhwa province, Pakistan, a field field survey through Quadrat method was conducted during March and April, 2013. A total of 32 weed species belonging to 18 families were recorded from the research area. The predominant families were Brassicaeae (5 spp.), Poacea and Fabaceae (4 spp. ea.) followed by Polygonaceae, Asteraceae, Caryophlliceae and Plantaginaceae (2 spp. ea.), while the remaining families were represented by only one species each. Five weed communities were established on the basis of importance value constancy index in the investigated area. Coronopus-Poa-Anagallis appears as the predominant community in Tarnab area while at Azeem Khan Pul, Veronica-Coronopus-Melilotus emerged as a dominant weed community. Anagallis-Euphorbia-Veronica, Melilotus-Coronopus-Poa and Polygonum-Ranunculus-Veronica were established as dominant weed communities at Sardheri, Kaptan Kali and Sardaryab area, respectively. Based on the importance value constancy index, Anagallis arvensis (55), Melilotus indicus (54), Euphorbia helioscopia (44), Coronpus didymus (43.5) and Poa annua (37.1) were the dominant weed species in the study area. The Life Form spectra comprised of 84.38% therophytes (18 spp.), 12.5% hemicryptophytes (4 spp.) and 3.13% Chamaephytes (1 sp.). Whereas, the Leaf size spectra showed the predominance of microphylls (53.13%), comprising 17 species, followed by nanophylls (25%) consting 8 species and leptophylls and mesophylls were represented by 18.75% and 3.13%,, consisting 6 and 1 species, respectively. Regarding the Habit of infesting species, it was observed that the annual herbs (75%) comprising 24 species overwhelmed the perennials. Creeping perennial herbs (21.88%) consisted of 7 species, while one species reprepresented creeping perennial shrubs (3.13%). The dominance of annuals could be attributed to the fact that under annual tillage regime the perennials are not successful to establish as their perennating parts are disturbed by tillage, while the short lived annuals germinate, establish, set seed and vanish.*

**Keywords:** Biological spectra, ecological attributes.weed diversity, weed communities.

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## INTRODUCTION

During 2015-16 wheat was cultivated on an area of 9.224 million ha with a production of 25.633 million tons in Pakistan (Anonymous, 2016). Whereas, in Charsadda district, the area under wheat crop during 2014 -15 was 27,488 ha with a production of 70,567 tons. (Crop Reporting Service). The total area of District Charsadda is about 996 square kilometers or 99,600 ha (Fig. 1). The climate of Charsadda is extremely harsh in summer and very cold in winter season. The highest temperatures prevail during the months of June and July rising upto as high as 49$^{o}$C while in the month of October temperature rapidly falls down to 15$^{o}$C. The coldest months are December and January. The climate of Charsadda is well suited for growing many crop plants like sugarcane, rice, wheat and maize. In addition a diversity of fruits and vegetables is grown in the District Charsadda.

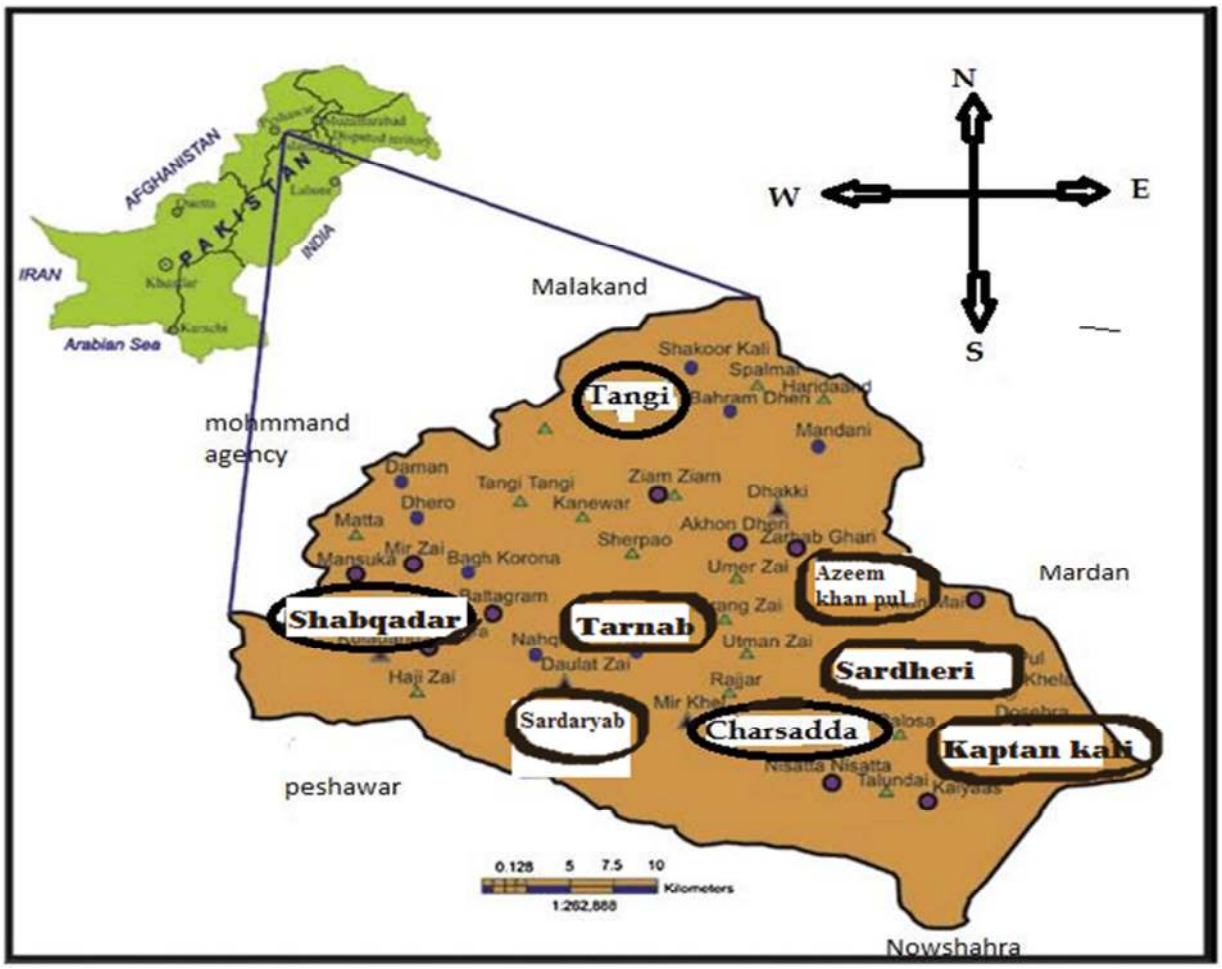
Wheat (*Triticum aestivum* L.) is the most important cereal crops and plays a significant role in the economy of Pakistan. Wheat provides 60% of average diet to man and also be the source for poultry and livestock in the country (Shehzad *et al*., 2012). One third of the world population depends on wheat crop for caloric and protein requirements (Montazeri *et al*., 2005). The agro-ecological conditions of Pakistan and the availability of one of the best canal network in the world, favours wheat production but its per unit area production is far less than the advanced wheat producing nations. Various factors affect wheat production per unit area viz. soil texture and structure, soil fertility, availability of moisture, environmental vagaries and biotic stresses, Among the biotic stresses, weed infestation is one of the main causes of low wheat yield in Pakistan (Shehzad *et al*., 2012). Crops are affected by weeds through many ways i.e. competition for nutrition, moisture, light, competition for gases, space and the chemical warfare i.e. allelopathy (Rao, 2000).

Weeds tend to persist despite man's efforts to eliminate, consequently inflicting losses in the quantity and quality of the produce (Qasem and Foy, 2001; Rao, 2000). Weeds are quite harmful to wheat and cause a total loss of billion of rupees in Pakistan annually. Immense losses in wheat productivity in the world including Pakistan are inflicted due to weed competition which are far greater than from the combined effect of diseases and insects (Rao, 2000). In all over the world weed infestation is one of the main causes of low wheat yield, as it decreases wheat yield by 37 to 50% (Waheed *et al*., 2009).

Floristic diversity has been studied by several researchers including. Hadi and Ibrar (2015) in wheat crop of Kalash valley District Chitral Hindukush Range, Pakistan. Hussain *et al*. (2004) identified three weeds communitie in wheat fields of Mastuj Tehsil. 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 undertake 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.

**Fig 1. Map of District Charsadda, Khyber Pakhtunkhwa, Pakistan.**



## MATERIALS AND METHODS

Five wheat growing locations were randomly selected from the wheat growing area i.e. Tarnab area, Azeem Khan Pul area, Sardheri area, Kaptan Kali Nissata area and Sardaryab of the Tehsil Charsadda (Fig. 1). At each selected site, five wheat fields were randomly selected and were surveyed during 2013 using the Quadart Method. Five 50 $cm^2$ quadrats were randomly placed in each field. The identification of weed samples was done in the Department of Weed Science, The University of Agriculture Peshawar. The data were recorded by following Hussain *et al.* (2004). The biological spectra like Life Form, Leaf Size and Habit of weeds were also recorded and computed (Raunkiaer, 1934; Sher *et al.*, 2011). The Density $m^{-2}$, importance value and Importance Value-Constancy Index (IVCI) of the weed species. These parameters were computed with the following formulae:

**Density $m^{-2}$=**

$$\frac{\text{Number of plants of species present in all Quadrats X 100 X 100}}{\text{Total number of Quadrats studied X 50 X 50}}$$

**Relative Density (%) =**

$$\frac{\text{Mean of individual species } m^{-2}}{\text{Mean of all species } m^{-2}} \text{ X 100}$$

**Freqency (%) =**

$$\frac{\text{Number of Quadrats in which a given species was present}}{\text{Total number of Quadrats}} \text{ X100}$$

**Relative Frequency (%)**

$$\text{X} \quad \frac{\text{Frequency of given species x100}}{\text{Total frequency of all species}}$$

**Importance value** = $\frac{\text{Relative density + Relative frequency}}{2}$

**Importance value-Constancy index (IVCI) =**

Average Impotace value of all locations (AIV) X Constancy class value

## RESULT AND DISCUSSION

### Weeds in the Study area

The perusal of data in Table-1 exhibit that the cumulative number of weeds from the all locations there were weeds belonging to 18 families and 31 genera. Brassicaceae (5 spp.), Poaceae (4 spp.) and Fabaceae (4 spp.) were leading families, followed by Plantaginaceae, Polygonaceae, Caryophyllaceae and Asteraceae (2 spp. each). The remaining 11 families were represented by a single species each (Table-1). All of the top ranking families represented the dicots (broadleafs exept Poaceae (grasses) and Cperaceae (sedges) which were the monocots. The higher number of species in Brassicaceae, Poaceae and Fabaceae were competitive with the wheat crop might be due to the earlier space capture, rapid growth, higher fecundity, efficient dispersal of seeds and better competitive ability with wheat crop. The Family Impotance value (FIV) (Table-1) depicts Brassiaeae (70.45), Fabaceae (68.30), Plantaginaceae (61.55) and Poaeae (60.50) as the dominant families. These were followed by Polygonacea (30.45) and Asteracea (23.45). The remaining families possessed lower FIV (Table-1). Earlier studies of Jakhar *et al.* (2005), Qureshi *et al.* (2009), Hassan *et al.* (2010) and Sher *et al.* (2011) corroborate our inferences.

**Table- 1. Families, number of genera, species and Family Importance Value (FIV) of the weeds of wheat fields at 5 locations of Tehsil Charsadda, Khyber Pakhtunkhwa, Pakistan.**

| S.No. | Family | No. of Genera | No. of Species | Family Importance Value (FIV) |
|---|---|---|---|---|
| 1 | Brassicaeae | 5 | 5 | 70.45 |
| 2 | Fabaceae | 4 | 4 | 68.30 |
| 3 | Plantaginaceae | 1 | 2 | 61.55 |
| 4 | Poaceae | 4 | 4 | 60.50 |
| 5 | Polygoanceae | 2 | 2 | 30.45 |
| 6 | Asteraceae | 2 | 2 | 23.45 |
| 7 | Myrsinaceae | 1 | 1 | 11.00 |
| 8 | Caryophyllaceae | 2 | 2 | 8.11 |
| 9 | Euphorbiaceae | 1 | 1 | 8.80 |
| 10 | Ranunculaceae | 1 | 1 | 4.84 |
| 11 | Convolvulaceae | 1 | 1 | 2.93 |
| 12 | Papaveraceae | 1 | 1 | 2.43 |
| 13 | Cannabaceae | 1 | 1 | 1.45 |
| 14 | Amaranthaceae | 1 | 1 | 1.24 |
| 15 | Rubiaceae | 1 | 1 | 1.20 |
| 16 | Cyperaceae | 1 | 1 | 0.94 |
| 17 | Apiaceae | 1 | 1 | 0.84 |
| 18 | Oxalidaceae | 1 | 1 | 0.08 |

**Weed Density $m^{-2}$**

The data presented in Table-2 show the highest mean infestation of weeds at Tarnab area (557 $m^{-2}$). Azeem Khan Pul ranked second in this array (312), which was followed by Sardaryab area (154), Kaptan Kali Nissata area (134) and Sardheri area (114). *Poa annua* (96.5), *Veronica anagallis-aquatica* (46.8), *Melilotus indicus* (39.5) and *Polygonum barbatum* (23.5) got the highest weed density at Tarnab area, Azeem Khan Pul area, Sardheri area, Kaptan Kali area and Sardaryab area, respectively (Table-2). The mean account of flora ranks *Poa annua* and *Anagallis arvensis* with a mean density across the locations at 31.6 and 29.3 plants $m^{-2}$. *Veronica anagallis-aquatica* occupied third position (28.5), while *Coronopus didymus* (28.1) and *Melilotus indicus* (22.2) occupied $4^{th}$ and $5^{th}$ positions respectively. *Oxalis corniculata* emerged as the rarest wedd in the stydy area as it appeared just in one quarat at a sinle location (Table-2). The findings reveal that the variability existed among the different location as far as the number and the floristic composition of the wheat fields is concerned. Several researchers (Hanif *et al*., 2004; Muhammad *et al*., 2009; Hassan *et al*., 2010; Malik *et al*., 2012, Begum and Ahmad, 2018; Umer and Hussain, 2018) have advocated a varying diversity and density of weed flora in their studies on wheat.

**Relative Density %**

Based on relative Density, *Coronopus didymus* appears to be the most abundant (15.6%) contributing species of the wheat fields of Tarnab area. It was followed by *Anagallis arvensis* (10.8%), *Ranunculus muricatus* (6.88%), *Cynodon dactylon* (5.30%) and *Convolvulus arvensis* (5.26%) [Table-3]. *Veronica anagallis aquatica* topped the Azeem Khan Pul area (20.6%) followed by *Cynodon dactylon* (13.2%), *Poa annua* (11.5%), *Melilotus indicus* (9.26%), and *Anagallis arvensis* (8.18%). Whereas, Sardheri area was dominated by *Anagallis arvensis*

(40.4%) followed by *Euphorbia helioscopia* (15.2%), *Veronica polita* (13.1%) and *Cirsium arvense* (7.23%). Kaptan Kali was dominated by *Melilotus indicus (*29.3%) followed by *Euphorbia helioscopia* (15.4%), *Poa annua* (10.3%), *Veronica anagallis aquatic*a (8.19%) and *Galium aparine* (4.98%). *Polygonum barbatum* dominated Sardaryab area of 15.1% followed by *Ranunculus muricatus* (12.0%), *Euphorbia helioscopia* (10.8%), *Convolvulus arvensis* (8.16%) and *Coronopus didymus* (8.05%) [Table-3]. Earliar inferences of researchers like Khan *et al*. (2011), Umer and Hussain (2018) have also communicated a differential relative density of weeds in the different locations they studied.

**Frequency %**

Frequency indicates presence or absence of a species in any locality. Analysis of data revealed that *Coronopus didymus* (72%), *Euphorbia helioscopia* (72%), *Melilotus indicus* (96%) and *Raunculus muricatus* (64%) were the most frequent species of Tarnab area, Azeem Khan Pul area, Sardheri area, Kaptan Kali Nissata area and Sardaryab (Table-34. *Coronopus didymus* and *Euphorbia helioscopia* (72% ea.) got the same frequency while *Euphorbia helioscopia* was the most frequent species of the two localities i.e Azeem Khan Pul area and Sardheri area. The mean accounts ranked *Melilotus indicus* (55.2%), *Euphorbia helioscopia* (51.2%), *Anagallis arvensis* (43.2%), *Coronopus didymus* (41.6%) and *Veronica polita* (29.6%) most promising (Table-4). The data also revealed that some species are localized, while others omnipresent at all the locations. Evidently the phytosociological composition changed from one location to the other (Table-4) due to variability in soil type, soil fertility, field leveling and agricultural practices employed.. Our inferences are corroborated by the previous work of Iqbal *et al.* (2015) in their conclusions in the similar studies.

**Relative Frequency %**

Based on Relative frequency, *Coronopus didymus* appears to be the most frequent species with relative frequency of 12.2% in Tarnab area while *Anagallis arvensis* (10.2%), *Melilotus indicus* (10.2%) and *Poa annua* (10.2%) attaining the same relative frequency were ranked second in the same study area (Table-5). *Euphorbia heliscopia* is the most frequent species at Azeem Khan Pul area with a relative frequency of 11.5% followed by *Veronica anagallis aquatica* (10.8%), *Melilotus indicus* (9.61%), *Cynodon dactylon* (7.69%) and *Anagallis arvensis* (7.05%). In the Sardheri area, *Euphorbia helioscopia* got the highest relative frequency (15.7%) followed by *Veronica polita* (10.5%), *Cirsium arvense* (8.77%), *Melilotus indicus* (7.89%) and *Rumex dentatus* (6.14%). *Melilotus indicus* is ranked as the most frequent species of Kaptan Kali area with a relative frequency of 24.4% followed by *Rumex dentatus* (14.1%), *Medicago polymorpha* (7.07%), *Veronica anagallis aquatica* (6.06%) and *Euphorbia helioscopia* (5.05%). While, in Sardaryab area *Ranunculus muricatus* clinched the superiority appearing to be the most frequent species followed by *Veronica polita* (10.6%), *Polygonum barbatum* (9.84%), *Rumex dentatus* (9.09%) and *Convolvulus arvensis* (8.33%) [Table-4]. Based on mean relatve frequency *Melilotus indicus* emerged as the most frequent species with mean relative frequency of 11.29% followed by *Euphorbia helioscopia* (9.72%), *Anagallis arvensis* (8.32%*), Coronopus didymus* (8.148%) and *Poa annua* (5.87%) while *Oxalis corniculata* (0.15%), *Vicia sativa* (0.30%), *Avena fatua* (0.35%), *Malcolmia africana* (0.40%), *Stellaria media* (0.41%), *Alhagi camelorum* (0.61%), *Sorghum halepense* (0.62%) and *Lepidium virginicum* (0.64%) were the rare weeds in the mean performance aross all the locations (Table-5). These results are in a great analogy analogy with the previous work of Khan *et al*. (2011), Hussain *et al.* (2004) and Umer and Hussain (2018).

**Table-2. Weed Density m-$^2$ of various weed species in wheat across 5 locations in District Charsadda.**

| S.No. | Weed species | Tarnab | Azeem Khan Pul | Sardheri | Kaptan Kali | Sardaryab | Mean |
|---|---|---|---|---|---|---|---|
| 1 | *Convolvulus arvensis* L. | 29.3 | 0 | 1.28 | 0 | 12.6 | 8.64 |
| 2 | *Cynodon dactylon* (L.) Pers. | 29.6 | 41.2 | 0 | 2.72 | 1.12 | 14.9 |
| 3 | *Rumex dentatus* L. | 17.0 | 3.84 | 2.24 | 3.84 | 1.12 | 5.60 |
| 4 | *Coronopus didymus* L. | 87.4 | 18.5 | 1.28 | 20.8 | 12.4 | 28.1 |
| 5 | *Anagallis arvensis* L. | 60.5 | 25.6 | 46.8 | 4.48 | 9.12 | 29.3 |
| 6 | *Cirsium arvense* (L.) Scop. | 5.87 | 1.76 | 8.28 | 0 | 11.6 | 5.51 |
| 7 | *Euphorbia helioscopia* L. | 18.8 | 21.7 | 17.4 | 4.16 | 16.8 | 15.7 |
| 8 | *Stellaria media* L. | 3.36 | 0 | 0 | 0 | 0 | 0.67 |
| 9 | *Melilotus indicus* (L.)All. | 30.7 | 28.9 | 2.72 | 39.5 | 9.28 | 22.2 |
| 10 | *Poa annua* L. | 96.5 | 36.0 | 1.28 | 13.9 | 7.36 | 31.0 |
| 11 | *Veronica anagallis-aquatica* L. | 67.2 | 64.4 | 0.16 | 11.0 | 0 | 28.5 |
| 12 | *Polygonum barbatum* L. | 8.00 | 0 | 0 | 0 | 23.5 | 6.30 |
| 13 | *Ranunculus muricatus* L. | 38.4 | 7.84 | 0.96 | 0.80 | 18.7 | 13.3 |
| 14 | *Medicago polymorpha* L. | 0.53 | 17.4 | 0 | 4.00 | 0 | 4.39 |
| 15 | *Sisymbrium irio* L. | 9.7 | 19.2 | 4.16 | 0 | 0.16 | 6.64 |
| 16 | *Brassica campestris* L. | 0.32 | 5.92 | 1.28 | 0 | 0 | 1.50 |
| 17 | *Vicia sativa* L. | 0 | 0 | 0 | 0 | 0.64 | 0.12 |
| 18 | *Veronica polita* Fr. | 17.1 | 9.28 | 15.0 | 0.48 | 17.4 | 11.8 |
| 19 | *Chenopodium album* L. | 20.1 | 0.64 | 0 | 0.16 | 1.12 | 4.40 |
| 20 | *Fumaria indica* L. | 12.4 | 4.16 | 1.28 | 0 | 3.68 | 4.30 |
| 21 | *Cyperus rotundus* L. | 1.60 | 0.96 | 0.96 | 0 | 3.20 | 1.34 |
| 22 | *Lepidium virginicum* L. | 0 | 4.96 | 0 | 0 | 0 | 0.99 |
| 23 | *Cannabis sativa* L. | 1.06 | 0 | 1.28 | 0 | 4.64 | 1.39 |
| 24 | *Sorghum halepense* Pers. | 1.76 | 0 | 1.12 | 0 | 0 | 0.57 |
| 25 | *Scandix pectin veneris* L. Vill. | 0 | 0 | 3.68 | 0 | 0 | 0.73 |
| 26 | *Avena fatua* L. | 0 | 0 | 2.24 | 0 | 0 | 0.44 |
| 27 | *Sonchus asper* (L.) Hill. | 0 | 0 | 0.96 | 0.80 | 0 | 0.35 |
| 28 | *Malcolmia africana* (L.) R. Br | 0 | 0 | 0 | 0.48 | 0 | 0.09 |
| 29 | *Spergula arvensis* L. | 0 | 0 | 0 | 14.2 | 0 | 2.84 |
| 30 | *Alhagi camelorum* Fischer | 0 | 0 | 0 | 6.56 | 0 | 1.31 |
| 31 | *Galium aparine* L. | 0 | 0 | 0 | 6.72 | 0 | 1.34 |
| 32 | *Oxalis corniculata* L. | 0 | 0 | 0 | 0 | 0.16 | 0.03 |
| | TOTAL | 557 | 312 | 114 | 134 | 154 | 254 |

**Table-3. Relative Weed Density (%) of various weed species in wheat across 5 locations in District Charsadda.**

| S.No. | Weed species | Tarnab | Azeem Khan Pul | Sardheri | Kaptan Kali | Sardaryab | Mean |
|---|---|---|---|---|---|---|---|
| 1 | *Convolvulus arvensis* L. | 5.26 | 0 | 1.11 | 0 | 8.16 | 2.91 |
| 2 | *Cynodon dactylon* L. | 5.30 | 13.2 | 0 | 2.01 | 0.72 | 4.25 |
| 3 | *Rumex dentatus* L. | 3.05 | 1.22 | 1.94 | 2.85 | 0.72 | 1.96 |
| 4 | *Coronopus didymus* L. | 15.6 | 5.93 | 1.11 | 15.4 | 8.05 | 9.22 |
| 5 | *Anagallis arvensis* L. | 10.8 | 8.18 | 40.9 | 3.32 | 5.88 | 13.82 |
| 6 | *Cirsium arvense* (L.) Scop. | 1.05 | 0.56 | 7.23 | 0 | 7.54 | 3.28 |
| 7 | *Euphorbia helioscopia* L. | 3.37 | 6.96 | 15.2 | 3.08 | 10.8 | 7.88 |
| 8 | *Stellaria media* L. | 0.60 | 0 | 0 | 0 | 0 | 0.12 |
| 9 | *Melilotus indicus* (L.) All. | 5.50 | 9.26 | 2.37 | 29.3 | 5.99 | 10.48 |
| 10 | *Poa annua* L. | 17.3 | 11.5 | 1.11 | 10.3 | 4.75 | 8.99 |
| 11 | *Veronica anagallis-aquatica* L. | 12.0 | 20.6 | 0.13 | 8.19 | 0 | 8.18 |
| 12 | *Polygonum barbatum* L. | 1.43 | 0 | 0 | 0 | 15.1 | 3.31 |
| 13 | *Ranunculus muricatus* L. | 6.88 | 2.50 | 0.83 | 0.59 | 12.0 | 4.56 |
| 14 | *Medicago polymorpha* L. | 0.09 | 5.57 | 0 | 2.96 | 0 | 1.72 |
| 15 | *Sisymbrium irio* L. | 1.74 | 6.14 | 3.63 | 0 | 0.10 | 2.32 |
| 16 | *Brassica campestris* L. | 0.05 | 1.89 | 1.11 | 0 | 0 | 0.61 |
| 17 | *Vicia sativa* L. | 0 | 0 | 0 | 0 | 0.41 | 0.08 |
| 18 | *Veronica polita* Fr. | 3.07 | 2.96 | 13.1 | 0.35 | 11.2 | 6.14 |
| 19 | *Chenopodium album* L. | 3.61 | 0.20 | 0 | 0.11 | 0.72 | 0.93 |
| 20 | *Fumaria indica* L. | 2.23 | 1.33 | 1.11 | 0 | 2.37 | 1.41 |
| 21 | *Cyperus rotundus* L. | 0.28 | 0.30 | 0.83 | 0 | 2.06 | 0.69 |
| 22 | *Lepidium virginicum* L. | 0 | 1.58 | 0 | 0 | 0 | 0.32 |
| 23 | *Cannabis sativa* L. | 0.19 | 0 | 1.11 | 0 | 2.99 | 0.86 |
| 24 | *Sorghum halepense* (L.) Pers. | 0.31 | 0 | 0.97 | 0 | 0 | 0.26 |
| 25 | *Scandix pectin veneris* L. Vill. | 0 | 0 | 3.21 | 0 | 0 | 8.18 |
| 26 | *Avena fatua* L. | 0 | 0 | 1.95 | 0 | 0 | 0.39 |
| 27 | *Sonchus asper* (L.) Hill. | 0 | 0 | 0.83 | 0.59 | 0 | 0.28 |
| 28 | *Malcolmia africana* (L.) R. Br. | 0 | 0 | 0 | 0.35 | 0 | 0.07 |
| 29 | *Spergula arvense* L. | 0 | 0 | 0 | 10.5 | 0 | 2.10 |
| 30 | *Alhagi camelorum* Fischer | 0 | 0 | 0 | 4.84 | 0 | 0.97 |
| 31 | *Galium aparine* L. | 0 | 0 | 0 | 4.98 | 0 | 1.00 |
| 32 | *Oxalis corniculata* L. | 0 | 0 | 0 | 0 | 0.10 | 0.02 |

**Table -4. Frquency (%) of different weeds in wheat fields across 5 Locations of Tehsil Charsadda.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | *Convolvulus arvensis* L. | 28 | 0 | 08 | 0 | 44 | 16.0 |
| 2 | *Cynodon dactylon* L. | 16 | 48 | 0 | 16 | 12 | 18.4 |
| 3 | *Rumex dentatus* L. | 28 | 32 | 28 | 20 | 08 | 23.2 |
| 4 | *Coronopus didymus* L. | 72 | 28 | 04 | 56 | 48 | 41.6 |
| 5 | *Anagallis arvensis* L. | 60 | 44 | 64 | 20 | 28 | 43.2 |
| 6 | *Cirsium arvense* (L.) Scop. | 20 | 12 | 40 | 0 | 40 | 22.4 |
| 7 | *Euphorbia helioscopia* L. | 56 | 72 | 72 | 20 | 36 | 51.2 |
| 8 | *Stellaria media* L. | 12 | 0 | 0 | 0 | 0 | 2.4 |
| 9 | *Melilotus indicus* (L.) All. | 60 | 60 | 36 | 96 | 24 | 55.2 |
| 10 | *Poa annua* L. | 60 | 44 | 08 | 20 | 28 | 32.0 |
| 11 | *Veronica anagallis-aquatica* L. | 28 | 68 | 04 | 24 | 0 | 24.8 |
| 12 | *Polygonum barbatum* L. | 12 | 0 | 0 | 0 | 52 | 12.8 |
| 13 | *Ranunculus muricatus* L. | 16 | 44 | 12 | 04 | 64 | 28.0 |
| 14 | *Medicago polymorpha*L. | 04 | 28 | 0 | 28 | 0 | 12.0 |
| 15 | *Sisymbrium irio* L. | 20 | 44 | 16 | 0 | 04 | 16.8 |
| 16 | *Brassica campestris* L. | 08 | 28 | 08 | 0 | 0 | 8.8 |
| 17 | *Vicia sativa* L. | 0 | 0 | 0 | 0 | 08 | 1.6 |
| 18 | *Veronica polita* Fr. | 20 | 20 | 48 | 04 | 56 | 29.6 |
| 19 | *Chenopodium album*L. | 28 | 08 | 0 | 04 | 04 | 8.8 |
| 20 | *Fumaria indica*L. | 20 | 16 | 24 | 0 | 32 | 18.4 |
| 21 | *Cyperus rotundus*L. | 04 | 08 | 08 | 0 | 12 | 6.4 |
| 22 | *Lepidium virginicum* L. | 0 | 20 | 0 | 0 | 0 | 4.0 |
| 23 | *Cannabis sativa* L. | 08 | 0 | 20 | 0 | 24 | 10.4 |
| 24 | *Sorghum halepense* (L.) Pers. | 08 | 0 | 08 | 0 | 0 | 3.2 |
| 25 | *Scandix pectin veneris* L. Vill. | 0 | 0 | 24 | 0 | 0 | 4.8 |
| 26 | *Avena fatua* L. | 0 | 0 | 08 | 0 | 0 | 1.6 |
| 27 | *Sonchus asper* (L.) Hill. | 0 | 0 | 16 | 16 | 0 | 6.4 |
| 28 | *Malcolmia africana* (L.) R.Br. | 0 | 0 | 0 | 08 | 0 | 1.6 |
| 29 | *Spergula arvense* L. | 0 | 0 | 0 | 20 | 0 | 4.0 |
| 30 | *Alhagi camelorum* Fischer | 0 | 0 | 0 | 12 | 0 | 2.4 |
| 31 | *Galium aparine* L. | 0 | 0 | 0 | 28 | 0 | 5.6 |
| 32 | *Oxalis corniculata* L. | 0 | 0 | 0 | 0 | 04 | 0.8 |

**Table-5. Relative Frequency of various weed species in wheat fields across 5 locations in District Charsadda.**

| S.No. | Weed species | Tarnab | Azeem Khan Pul | Sardheri | Kaptan Kali | Sardaryab | Mean |
|---|---|---|---|---|---|---|---|
| 1 | *Convolvulus arvensis* L. | 4.76 | 0 | 1.75 | 0 | 8.33 | 2.97 |
| 2 | *Cynodon dactylon* L. | 2.72 | 7.69 | 0 | 4.04 | 2.27 | 3.34 |
| 3 | *Rumex dentatus* L. | 4.76 | 5.12 | 6.14 | 5.05 | 1.51 | 4.52 |
| 4 | *Coronopus didymus* L. | 12.2 | 4.48 | 0.87 | 14.1 | 9.09 | 8.15 |
| 5 | *Anagallis arvensis* L. | 10.2 | 7.05 | 14.0 | 5.05 | 5.30 | 8.32 |
| 6 | *Cirsium arvense* (L.) Scop. | 3.40 | 1.92 | 8.77 | 0 | 7.57 | 4.33 |
| 7 | *Euphorbia helioscopia* L. | 9.52 | 11.5 | 15.7 | 5.05 | 6.81 | 9.72 |
| 8 | *Stellaria media* L. | 2.04 | 0 | 0 | 0 | 0 | 0.41 |
| 9 | *Melilotus indicus* (L.) All. | 10.2 | 9.61 | 7.89 | 24.2 | 4.54 | 11.29 |
| 10 | *Poa annua* L. | 10.2 | 7.05 | 1.75 | 5.05 | 5.30 | 5.87 |
| 11 | *Veronica anagallis-aquatica* L. | 4.76 | 10.8 | 0.87 | 6.06 | 0 | 4.50 |
| 12 | *Polygonum barbatum* L. | 2.04 | 0 | 0 | 0 | 9.84 | 2.38 |
| 13 | *Ranunculus muricatus* L. | 2.72 | 7.05 | 2.63 | 1.01 | 12.1 | 5.10 |
| 14 | *Medicago polymorpha* L. | 0.68 | 4.48 | 0 | 7.07 | 0 | 2.45 |
| 15 | *Sisymbrium irio* L. | 3.40 | 7.05 | 3.50 | 0 | 0.75 | 2.94 |
| 16 | *Brassica campestris* L. | 1.36 | 4.48 | 1.75 | 0 | 0 | 1.52 |
| 17 | *Vicia sativa* L. | 0 | 0 | 0 | 0 | 1.51 | 0.30 |
| 18 | *Veronica polita* Fr. | 3.40 | 3.20 | 10.5 | 1.01 | 10.6 | 5.74 |
| 19 | *Chenopodium album* L. | 4.76 | 1.28 | 0 | 1.01 | 0.75 | 1.56 |
| 20 | *Fumaria indica* L. | 3.40 | 2.56 | 5.26 | 0 | 6.06 | 3.46 |
| 21 | *Cyperus rotundus* L. | 0.68 | 1.28 | 1.75 | 0 | 2.77 | 1.33 |
| 22 | *Lepidium* virginicum L. | 0 | 3.20 | 0 | 0 | 0 | 0.64 |
| 23 | *Cannabis sativa* L. | 1.36 | 0 | 4.38 | 0 | 4.54 | 2.06 |
| 24 | *Sorghum halepense* (L.) Pers. | 1.36 | 0 | 1.75 | 0 | 0 | 0.62 |
| 25 | *Scandix pectin veneris* L. Vill. | 0 | 0 | 5.26 | 0 | 0 | 1.05 |
| 26 | *Avena fatua* L. | 0 | 0 | 1.75 | 0 | 0 | 0.35 |
| 27 | *Sonchus asper* (L.) Hill. | 0 | 0 | 3.50 | 4.04 | 0 | 1.51 |
| 28 | *Malcolmia africana* (L.) R. Br. | 0 | 0 | 0 | 2.02 | 0 | 0.40 |
| 29 | *Spergula arvense* L. | 0 | 0 | 0 | 5.05 | 0 | 1.01 |
| 30 | *Alhagi camelorum* Fischer | 0 | 0 | 0 | 3.03 | 0 | 0.61 |
| 31 | *Galium aparine* L. | 0 | 0 | 0 | 7.07 | 0 | 1.41 |
| 32 | *Oxalis corniculata* L. | 0 | 0 | 0 | 0 | 0.75 | 0.15 |

**IMPORTANCE VALUE**

The analysis of data in Table-6 exhibit that based on average importance value *Anagallis arvensis* (11.0) was the dominant species followed by *Melilotus indicus* (10.8)*, Euphorbia heliscopia (*8.82)*, Coronopus didymus* (8.70) and *Poa annua* (7.43), while *Oxalis corniculata* (0.08), *Vicia sativa* (0.19), *Malcomia africana* (0.23), *Stellaria madia* (0.26), *Avena fatua* (0.37), *Sorghum halepense* (0.44), *Lepidium virginicum* (0.47), *Scandix pectin veneris* (0.84), *Sonchus asper* (0.89) and *Cyperus rotundus* (0.94) appear to be the unimportant or rare weeds of the wheat fields of Charsadda, Pakistan.

**WEEED COMMUNITIES**

Different weed communities were established on the bases of importance value Constancy index (IVCI) [Table-6]. *Coronopus-Poa-Anagallis* appear as a dominant and the problematic community at Tarnab area while at Azeem Khan Pul *Veronica-Coronopus-Melilotus* was the dominant weed community. In Sardheri area, *Anagallis-Euphorbia-Veronica* appeared as the dominated weed community. *Melilotus-Coronopus-Poa* and *Polygonum-Ranunculus-Veronica* were the dominant weed communities of Kaptan Kali and Sardaryab area respectively (Table-6). Waheed *et al.* (2009), Qureshi *et al.* (2009), Hassan *et al*. (2010) and Sher *et al.* (2011) have concluded varying communities of weeds in their respective study areas.

**Importance value-Constancy index (IVCI)**

Based on importance value constancy index, *Anagallis arvensis* (55), *Melilotus indicus* (54), *Euphorbia heliscopia* (44), *Coronpus didymus* (43.5) and *Poa annua* (37.1) were the dominant, problematic and abundant weeds species, while *Oxalis corniculata* (0.08), *Vicia sativa* (0.19), *Malcomia africana* (0.23), *Stellaria media* (0.26), *Avena fatua* (0.37), *Lepidium virginicum* (0.47), *Alhagi camelorum* (0.78), *Scandix pectin veneris* (0.84) and *Sorghum halepense* (0.88) were the most scarce and neglible weed species of the study area (Table-6 and Fig. 1). The earliar studies of Hussain *et al.* (2004) also documented the prevalance of *Mentha-Setaria-Convolvulus*, *Mentha-Silene-Hordeum* and *Convolvulus-Hordeum-Trifolium* Communities in Mastuj, Chitral, Pakistan (Hussain *et al*., 2004). The earliar studies of Hussain and his co-workers also documented the prevalance of *Setaria-Convolvulus-Mentha*, *Silene-Hordeum-Mentha* and *Hordeum-Trifolium-Convolvulus* Communities in Mastuj (Hussain *et al*., 2004), as based on IVCI. The Average Importance Value of *Anagallis arvensis, Melilotus indicus, Euphorbia helioscopia, Coronopus didymus, Poa annua, Oxalis corniculata*, *Vicia sativa*, *Malcomia africana*, *Stellaria madia*, *Avena fatua*, *Sorghum halepense*, *Lepidium virginicum*, *Scandix pectin veneris, Sonchus asper* and *Cyperus rotundus* weeds have also been communicated by Hanif *et al*. (2004).

**Biological spectrum of the Infesting Species**

The Biliogical spectra of the weeds in the target area are detailed in Table-7 and their Summary is provided in Table-8. The Life Form spectra comprised of 84.38% therophytes (18 spp.), 12.5% hemicryptophytes (4 spp.) and 3.13% Chamaephytes (1 sp.) [Table-8]. The preponderance of therophytes in their studies have also been documented by several workers including Sher *et al.* (2011) and Begum and Ahmad (2018). Whereas, the Leaf size spectra showed the predominance of microphylls (53.13%), comprising 17 species, followed by nanophylls (25%) consting 8 species. Whereas leptophylls and mesophylls were represented by 18.75% and 3.13%,, consisting 6 and 1 species, respectively (Table-8). Regarding the Habit of infesting species it was observed that the annual herbs (75%) representing 24 species overwhelmed the perennials. Creeping perennial herbs (21.88) consisted of 7 species, while one species represented creeping perennial shrubs (3.13%). The dominance of annuals could be attributed to the fact that under annual tillage regime the perennials are not successful to establish as their

perennating parts are disturbed by tillage, while the short lived annuals germinate, establish, set seed and perish. These findings are in a great analogy with the previous work of Khan *et al.* (2014), Hadi *et al.* (2015) Samad *et* al (2018) and Begum and Ahmad (2018). In their studies they have illustrated a varying composition of biological spectra in their findings.

**CONCLUSIONS**

In the study area 32 weed species belonging to 18 families were recorded. The predominant families were Brassicaeae (5 spp.), Poacea and Fabaceae (4 spp. ea.) followed by Polygonaceae, Asteraceae, Caryophlliceae and Plantaginaceae (2 spp. ea.), while the remaining families were represented by only one species each. A separate weed ommunity was established at each of the five locations. The Life Form spectra comprised of 84.38% therophytes (18 spp.), 12.5% hemicryptophytes (4 spp.) and 3.13% Chamaephytes (1 sp.). Whereas, the Leaf size spectra showed the predominance of microphylls (53.13%), comprising 17 species, followed by nanophylls (25%) consting 8 species.

**Table-6.Importance Value (IV), Average Importance Value (AIV), Constancy Classes and Importance value Constancy Index (IVCI) of various weeds.**

| S.No. | Weed species | IV and weed communities in 5 Locations | | | | | AIV | Constancy class | IVCI |
|---|---|---|---|---|---|---|---|---|---|
| | | Tarnab | Ahazeemk n Pul | Sardheri | Kaptan Kali | Sardaryab | | | |
| | | CPA‡ | VaCM | AEV | MCP | PRV | | | |
| 1 | *Anagallis arvensis* | 10.5**c†** | 7.61` | 27.4**a** | 4.18 | 5.59 | 11.0**a** | 5 | 55.0**a** |
| 2 | *Melilotus indicus* | 7.85 | 9.43**c** | 5.13 | 26.7**a** | 5.26 | 10.8**b** | 5 | 54.0**b** |
| 3 | *Euphorbia heliscopia*. | 6.44 | 9.24 | 15.5**b** | 4.06 | 8.83 | 8.80**c** | 5 | 44.0c |
| 4 | *Coronopus didymus* . | 13.9**a** | 5.21 | 0.99 | 14.7**b** | 8.57 | 8.70 | 5 | 43.5 |
| 5 | *Poa annua* | 13.7**b** | 9.28 | 1.43 | 7.69**c** | 5.02 | 7.43 | 5 | 37.1 |
| 6 | *Veronica polita* | 3.24 | 3.08 | 11.8**c** | 0.68 | 10.9**c** | 5.95 | 5 | 29.7 |
| 7 | *Veronica anagallis-aquatica* | 8.40 | 15.7**a** | 0.50 | 7.12 | 0 | 6.36 | 4 | 25.4 |
| 8 | *Ranunculus muricatus* | 4.80 | 4.77 | 1.73 | 0.80 | 12.1**b** | 4.84 | 5 | 24.2 |
| 9 | *Rumex dentatus* | 3.90 | 3.17 | 4.04 | 3.95 | 1.11 | 3.24 | 5 | 16.2 |
| 10 | *Cirsium arvense* | 2.22 | 1.24 | 8.00 | 0 | 7.55 | 3.80 | 4 | 15.2 |
| 11 | *Cynodon dactylon* . | 4.01 | 10.4**b** | 0 | 3.02 | 1.49 | 3.79 | 4 | 15.1 |
| 12 | *Sisymbrium irio* . | 2.57 | 6.59 | 3.57 | 0 | 0.43 | 2.63 | 4 | 10.5 |
| 13 | *Fumaria indica* . | 2.81 | 1.94 | 3.19 | 0 | 4.21 | 2.43 | 4 | 9.72 |
| 14 | *Convolvulus arvensis* | 5.01 | 0 | 1.43 | 0 | 8.24 | 2.93 | 3 | 8.79 |
| 15 | *Medicago polymorpha* | 0.38 | 5.03 | 0 | 5.01 | 0 | 2.08 | 3 | 6.24 |
| 16 | *Polygonum barbatum* | 1.73 | 0 | 0 | 0 | 12.5**a** | 2.85 | 2 | 5.70 |
| 17 | *Chenopodium album* . | 4.18 | 0.74 | 0 | 0.56 | 0.74 | 1.24 | 4 | 4.96 |
| 18 | *Cannabis sativa* | 0.77 | 0 | 2.75 | 0 | 3.77 | 1.45 | 3 | 4.35 |
| 19 | *Cyperus rotundus* | 0.48 | 0.79 | 1.29 | 0 | 2.16 | 0.94 | 4 | 3.76 |
| 20 | *Brassica campestris* | 0.70 | 3.19 | 1.43 | 0 | 0 | 1.06 | 3 | 3.18 |
| 21 | *Sonchus asper* | 0 | 0 | 2.17 | 2.31 | 0 | 0.89 | 2 | 1.78 |
| 22 | *Spergula arvensis* | 0 | 0 | 0 | 7.81 | 0 | 1.56 | 1 | 1.56 |
| 23 | *Galium aparine* | 0 | 0 | 0 | 6.02 | 0 | 1.20 | 1 | 1.20 |
| 24 | *Sorghum halepense* | 0.83 | 0 | 1.36 | 0 | 0 | 0.44 | 2 | 0.88 |
| 25 | *Scandix pectin veneris* | 0 | 0 | 4.23 | 0 | 0 | 0.84 | 1 | 0.84 |
| 26 | *Alhagi camelorum* | 0 | 0 | 0 | 3.94 | 0 | 0.78 | 1 | 0.78 |
| 27 | *Lepidium virginicum* . | 0 | 2.39 | 0 | 0 | 0 | 0.47 | 1 | 0.47 |
| 28 | *Avena fatua* | 0 | 0 | 1.85 | 0 | 0 | 0.37 | 1 | 0.37 |
| 29 | *Stellaria media* | 1.32 | 0 | 0 | 0 | 0 | 0.26 | 1 | 0.26 |
| 30 | *Malcolmia africana* | 0 | 0 | 0 | 1.18 | 0 | 0.23 | 1 | 0.23 |
| 31 | *Vicia sativa* | 0 | 0 | 0 | 0 | 0.96 | 0.19 | 1 | 0.19 |
| 32 | *Oxalis corniculata* | 0 | 0 | 0 | 0 | 0.43 | 0.08 | 1 | 0.08 |

‡Key to communities: **CPA**= *Coronopus-Poa-Anagallis;* **VaCM**= *Veronica anagallis aquatica-Coronopus-Melilotus*; **AEV**= *Anagallis-Euphorbia-Veronica*; **MCP**= *Melilotus-Coronopus-Poa*; **PRV**= *Polygonum-Ranunculus-Veronica.*

**†**a.b,c denote the First, Second and Third ranking species in the respective Importance Value, Average Importance Value and IVCI.

**Table-7. Biological Spectra in the phytosociology of wheat fields of District Charsadda.**

| S.No. | Weed Species | Biological Spectra | | |
|---|---|---|---|---|
| | | **Leaf Form** | **Leaf Size** | **Habit** |
| 1 | *Convolvulus arvensis* L. | Th. | Mic | CP. H |
| 2 | *Cynodon dactylon* (L.) Pers. | He | Mic | CP.H |
| 3 | *Rumex dentatus* L. | Th. | Mes | A. H |
| 4 | *Coronopus didymus* (L.) Sm. | Th | Lep | A. H.. |
| 5 | *Anagallis arvensis* L. | Th | Na | A.H. |
| 6 | *Cirsium arvense* (L.) Scop. | Th | Mic | CP.H |
| 7 | *Euphorbia helioscopia* L. | Th | Lep | A.H. |
| 8 | *Stellaria media* L. | Th | Na | A.H. |
| 9 | *Melilotus indicus* (L.) All. | Th | Na | A.H.. |
| 10 | *Poa annua* L. | Th | Mic | A.H. |
| 11 | *Veronica anagallis-aquatica* L. | Th | Na | CP.H. |
| 12 | *Polygonum barbatum* L. | Ch | Mic | A.H. |
| 13 | *Ranunculus muricatus* L. | Th | Lep | A. H. |
| 14 | *Medicago polymorpha* L. | Th | Mic | A. H. |
| 15 | *Sisymbrium irio* L. | Th | Lep | A.H. |
| 16 | *Brassica campestris* L. | Th | Mic | A.H. |
| 17 | *Vicia sativa* L. | Th | Mic | A. H. |
| 18 | *Veronica polita Fr.* | Th | Mic | A. H. |
| 19 | *Chenopodium album* L. | Th | Mic | A.H. |
| 20 | *Fumaria indica* L. | Th | Mic | A.H. |
| 21 | *Cyperus rotundus (*L.) Pers. | He | Lep | CP.H. |
| 22 | *Lepidium virginicum* L. | Th | Mic | A.H. |
| 23 | *Cannabis sativa* L. | Th | Lep | A. H. |
| 24 | *Sorghum halepense (*L.) Pers. | He | Mic | CP.H. |
| 25 | *Scandix pectin veneris* (L.) Vill. | Th | Mic | A.H. |
| 26 | *Avena fatua* L. | Th | Na | A.H. |
| 27 | *Sonchus asper* (L.) Hill. | Th | Mic | A.H. |
| 28 | *Malcolmia africana* (L.) R. Br. | Th | Mic | A. H. |
| 29 | *Spergula arvense* L. | Th | Na | A.H. |
| 30 | *Alhagi camelorum* Fischer | He | Na | CP. S. |
| 31 | *Galium aparine* L. | Th | Mic | A.H, |
| 32 | *Oxalis corniculata* L. | Th | Na | CP.H. |

**Habit:** A. H. = Annual herb, CP. H. = Creeping Perennial herb, CP. S= Creeping Perennial shrub
**Life form**:Th=Therophytes, He=Hemicryptophytes and Ch=Chamaephytes
**Leaf size:** AP=Aphyllous, Lep=Leptophyll, N=Nanophyll, Mic=Microphyll and Mes=Mesophyll.

**Table-8. Percentage distribution of Life forms, Leaf Size and Habit spectra of weeds in wheat in Tehsil Charsadda, Khyber Pakhtunkhwa, Pakistan.**

| S. No. | Classes | No. of species | %age |
|---|---|---|---|
| **Life Form** | | | |
| 1. | Therophytes | 18 | 84.38 |
| 2. | Hemicryptophtes | 4 | 12.50 |
| 3. | Chamaephytes | 1 | 3.13 |
| **Leaf Size** | | | |
| 1. | Nanophylls | 8 | 25.00 |
| 2. | Microphylls | 17 | 53.13 |
| 3. | Mesophylls | 1 | 3.13 |
| 4. | Leptophylls | 6 | 18.75 |
| **Habit** | | | |
| 1. | Annual Herbs | 24 | 75.00 |
| 2. | Creeping Perennial Herbs | 7 | 21.88 |
| 3 | Creeping Perennial Shrub | 1 | 3.13 |

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