WEEDS FLORA OF THE AGRICULTURAL UNIVERSITY PESHAWAR RESEARCH FARM

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ABSTRACT

Weeds intrusion cause negative impacts on biodiversity in the wild and crop productivity in the fields. Weeds have greater phenotypic plasticity and hence are more pliable to changing climate. They establish easily into new areas and, become invasive over the native vegetation. To study the adaptability of invasive weeds and their status among the native plant community, a field survey was carried out from July - September 2017 at New Developmental Farm (NDF), Malakandher, The University of Agriculture, Peshawar (UAP). Data were recorded from three sites i.e. field crop area, non-field, and orchards with a quadrate randomly thrown 50 times at different locations. A total of 39 weeds species from 16 families (14 dicots and 2 monocots) and 36 genera were identified. The major monocot family Poaceae contributed 10 species while among dicots, Asteraceae took the lead with 6 species. Among the weed species, 27 were annual and the rest 12 were perennial. Annuals were reported from all three sites, while perennials were found in the non-field area i.e. irrigation canals, field ridges, orchards, and undisturbed waste areas. Data regarding absolute and relative density, frequency and relative frequency and importance valve were recorded by the quadrate method. *Cynodon dactylon* had the highest relative density (27.21%), followed by *Digiteria sanguinalis* (14.87), *Cyperus rotundus* (12.96) and *Euphorbia prostrata* (5.12). *Parthenium hysterophorus* L. an invasive alien weed was recorded in almost all the sites with a density of (2.6 m^{-2}) in the non-field areas particularly, followed by (0.85 m^{-2}) in field crop and (0.8 m^{-2}) in orchards and with a mean density of (1.42 m^{-2}) and a relative density of (1.52%) across all locations. Similarly, another invasive weed *Broussonetia papyrifera* was recorded in the non-field area only with the lowest mean relative density of (0.07%). Mean distribution data showed the highest relative frequency for *Cynodon dactylon* (13.66%), followed by *D. sangunalis* (10.22), *C. rotundus* (7.86) and *S. halepense* (7.23), respectively. *Alhaji maurorum*, *Eclipta alba, Cucumis callosus, B. papyrifera, Withania somnifera* and *Boerhavia diffusa* showed the smallest relative frequency at all locations studied thereby indicating them as insignificant among the weed flora of the study area. Importance value data revealed that *C. dactylon, D. sangunalis, C. rotundus* and *S. halepense* having IV % of 34.03, 19.99, 16.89, and 10.17, respectively. Looking at the overall distribution of weeds flora in NDF-Malakandher, UAP during the summer season *C. dactylon* is distributed on roadsides, field ridges, irrigation channels, agricultural fields, orchards and wastelands, while *P. hysterophorus* being an invasive weed showed an increasing trend compared to its earlier status evident from the previous study.

Key words: Weed flora, Weeds distribution, density, frequency and importance value

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INTRODUCTION

The existing floristic information regarding different parts of the world is tremendously variable, hence a vast range of floras are available. Flora of an area is determined by using a blend of keys and descriptions for the explanation of plants of that particular area. A good flora is expected to deliver a service to the plant science personnel in dealing and identification of all plants mentioned in that flora on scientific and systematic basis.

Weeds are undesirable plants growing in fields affecting crops through competition for light, space, water and nutrients. Weeds are a major pest in cropping systems globally. Their infestation reduces yield and quality of the harvested product, increases production costs and may create health problems within the community. Weeds have been simply defined as plants that interfere with human activity by growing where they are not wanted. Weeds grow in crops, orchards, lawns and interfere with human welfares. Weeds can adapt themselves to a wide range of climatic conditions and having the ability to grow rapidly and can easily compete with field crops, vegetables and ornamental plants. Ranging from climbing vines and creeping ground covers to grasses and seaweed they can be found in every habitat. Besides direct competition with native plants, most of the weeds due to allelopathy have inhibitory effects on seed germination of many crops (Ligenfelter, 2017).

The hostile nature of weeds is evident from enormous seed production, vegetative reproduction, stress tolerance and high adaptability. Redroot pigweed can flower and produced seed when less than eight inches tall, similarly *Orobanche* spp. produce about 0.5 million seeds with greater persistence in soil. Likewise, Johnson grass and purple nutsedge spread through rhizome and tubers, respectively and are very difficult to manage. For proper weed management, the most important is to identify the weed, its life cycle, growing habit and its preferred habitat. Understanding weeds biology is very important for sound weeds management. Otherwise, a chaotic management attempt may further exacerbate the problems. Stewart (1972) prepared the first catalog of the flora of Pakistan which is the only representative literature covering almost all the plants of Khyber Pakhtunkhwa province.

Weeds seed mimicry facilitates weeds to spread with sowing crop seeds, while special shape and structure, tiny size, etc. help weeds seed to spread over large areas, whereas seed dormancy helps them to spread in time. Creeping roots and rhizomes are capable of growing many feet per year. Without proper management strategies, weeds threaten to displace native species and reduce the diversity of natural ecosystems from rangeland to lawn, field crops and vegetables. Application of herbicides kill the susceptible weeds, but repeated use may result in the development of weed resistance in weeds population (Vencill, 2011; Zimdahi, 2004). Besides yield reduction weeds serve as alternate hosts of harmful pathogen and insects of crops, while perennial weeds degrade grazing lands and reduce land value too. Wilson *et al*. (1990) claimed that globally there are approximately 250,000 species of plants; of those, about 3% or 8000 species are considered weeds.

Bio-invasions by non-native species represent one of the most important threats to natural ecosystems and plant biodiversity. The development of the world trade system speedup the spread of invasive alien species like *P. hysterophrous*. Since the existing local weed flora is already a threat to crop productivity, thus the introduction of alien species will further reduce crop yield drastically and consequently, the cost of production will be increased. Parthenium is a weed of national significance in Pakistan. Although, many parts of Khyber Pakhtunkhwa are infested with Parthenium weed, but Peshawar is highly affected by invading most of the open spaces, roadsides, field ridges and field crops and threatening the agro-ecosystem (Khan *et al*., 2014). The present study was carried out in NDF-Malakandher, UAP with the following objectives;

1. To record the prevalence and distribution of weeds in field crop, non-field and orchards.
2. To document the introduction, distribution and infestation of alien invasive weed species.
3. To classify the existing weeds on the bases of their habit, life cycle and noxiousness in field crops, non-crop areas and orchids.

MATERIALS AND METHODS

A field survey entitled "Weeds flora of the Agricultural University Peshawar, Research Farm" was carried out during July-September, 2017 in the NDF- Malakandher. NDF is located in the District Peshawar at 34 ºN latitude, 71 ºE longitudes with 450m and 1600km North of the Indian Ocean and thus has a continental climate. Winter in Peshawar valley commences from mid Nov to the end of March. Summer months are May to September. The mean maximum temperature in summer is over 40 °C with a mean minimum 25 °C, while in winter the mean maximum is 18.35 °C and mean minimum temperature is 4 °C. The winter rainfall shows a higher record during the months of February and April. The highest winter rainfall has been recorded in March, while the highest summer rainfall in the month of August. The average winter rainfall is higher than that of the summer. Based on a 30 year record, the average annual precipitation has been recorded as 400mm. The relative humidity varies from 46% in June to 76% in August (Wikipedia, 2017).

The study area NDF-Malakandher was divided into three sections i.e. Field crops, Non-Field area and Orchards. During survey a quadrate of 1x1 m^2 was used for sampling. All the details was noted on the spot in the field notebook. The survey was initiated from in July, 2017 and completed till September, 2017. During the course of time the distribution of weeds on road sides, field crops, wastelands, irrigation channels and orchards were recorded. Each sections was sampled through 50 quadrates randomly thrown along an inverted horizontal pattern in each site following the methodology of Thomas, (1985, 1991) and McCully *et al*. (1991) with slight modifications. The distance between each quadrate depended upon the size and shape of the field and any obstructions that may have been present in the field. The larger was the field, the greater was the distance between the quadrates. Average weeds density m^{-2} were directly recorded from number of plants per quadrate when averaged, while frequency was noted as percent of occurrence of a weed in all quadrates. Relative density (%), Relative frequency (%) and Importance Value % of weed species were indirectly computed from the same data as per given formulas as adopted from Hussain, (1989) and Hussain *et al.* (2004).

The impacts of Parthenium weed on biodiversity were assessed, using the importance value index to describe its importance. The importance value index is useful to compare the ecological significance of a particular species (Girma *et al.,* 2004; Hassan *et al.,* 2010). During the survey, all weed species were collected and identified from the Department of Weed Science, The Agriculture University Peshawar. The samples were deposited into the herbarium of the Department of Weed Science, The Agriculture University, Peshawar. Grower's perceptions about Parthenium weed were also recorded.

$$\text{Absolute Density (AD)} = \frac{\text{Total no. of individuals of a species in all quadrates}}{\text{Total no. of quadrates}}$$

$$\text{Relative Density (RD) (\%)} = \frac{\text{Mean of individual species}}{\text{Mean of total species}} \times 100$$

$$\text{Frequency (F) (\%)} = \frac{\text{Number of quadrates in which species Occurs}}{\text{Total no. of quadrates}} \times 100$$

$$\text{Relative Frequency (RF) (\%)} = \frac{\text{Frequency value of single species}}{\text{Total frequency}} \times 100$$

$$\text{Importance Value (IV) \%} = \frac{\text{Relative density \% + Relative frequency \%}}{2}$$

RESULTS AND DISCUSSION

A total of 39 weeds species were identified belongs to 16 plant families and 36 genera. Plant families include aizoaceae, amaranthaceae, asteraceae, convolvulaceae, poaceae, cucurbitaceae, cyperaceae, euphorbiaceae, malvaceae, nyctaginaceae, oxidillaceae and plantaginaceae. Majority of weeds were recorded from poaceae followed by asteraceae and euphorbiaceae, respectively. Similarly the lowest weeds species recorded in the aizoaceae, cucurbitaceae, malvaceae, nyctaginaceae, oxadillaceae and plantaginaceae, respectively. The whole communities consisted of angiosperms and there was no weed from other groups i.e. bryophytes, pteridophytes or gymnosperms. Majority of the plant families were from class dicotyledon, whereas two families (poaceae and cyperaceae) belonged to class monocot. Therefore, dicot families were the dominant group with 15 families out of total (16 families) as compared to monocot families. However, the contribution of a single monocot family (poaceae) was higher (10 species) than any of the dicot families. Major contribution among the dicot families was of asteraceae (6 species) (Table-1 & 7).

Among all the weeds 27 were annual and 12 were perennial. In dicot class *Euphorbia prostata*, *Malvastrum coromandelianum* and *Digera arvensis* while in monocot class *C. dactylon*, *D. sangunalis* and *C. rotundus* were the dominant weeds and posed a serious threat to native plant community. Among all the weeds species two alien invasive weeds species were recorded i.e. Parthenium weed and papermulberry. Both the species were recorded in non-field areas especially on ridges and road sides but Parthenium species abundance is greater than papermulberry (Zuberi *et al.,* 2014).

Annual weeds were abundant in almost all sections of the surveyed area while perennial weeds were found in the undisturbed land and perennial agro-ecosystem. The persistence of annual, biennial and perennial weeds depended on their resistance to management strategies and their ability to re-infest the soil. In case of perennial weeds the first infestation most probably depends on seeds, but establishment from vegetative propagules cannot be excluded. Prolific seeds production and persistence of seeds in soil seed bank is the major means of generally all weeds and particularly of annual weeds for their existence and survival. Weed seed production depends upon species type with biotic and abiotic stresses. Most of the weeds recorded in the surveyed area were herbs while few were shrubs. In agriculture fields majority of the recorded weeds were annual due to continuous soil disturbance for agriculture activities like sowing, ploughing, hoeing etc. However, in the perennial field crops (sugarcane etc.) perennial weed flora were dominant, whereas the weed flora of wasteland, field boundaries and road sides exhibited both annual and perennial weeds (Qureshi *et al.,* 2001).

Absolute Weed Density

The data showed that the highest density of *C. dactylon* (101.3m^{-2}) was recorded in non-field area followed by field crop (87.4m^{-2}) and orchards (77.7m^{-2}), respectively. Similarly the mean density across all the localities depicted that *C. dactylon* (24.88m^{-2}) was the major component of flora, followed by *D. sangunalis* (12.22m^{-2}) and *C. rotundus* (11.18m^{-2}).These results are in-line with that of Holm *et al.* (1997) who described *C. rotundus* and *C. dactylon*, the most abundant weeds species in the world. Similarly lowest mean density of (0.7m^{-2}) for

Alternanthera pungens, *Broussonetia papyrifera*, *Boerhavia diffusa* and *Alhagi maurorum* were found in non-field area like field ridges and field boundaries only. Whereas the highest infestation of *C. dactylon* was recorded in non-field area (42.65m^{-2}) followed by orchards (20.3m^{-2}) and field crops (11.7m^{-2}), respectively. The invasive alien weed species *P. hysterophorus* was recorded in almost all the localities with weed density of (2.6m^{-2}) in non-field area followed by field crop (0.85m^{-2}) and orchards (0.8m^{-2}), respectively. The mean density for *P. hysterophorus* was recorded as (1.42m^{-2}) (Table-2).

Relative Weed Density

Analysis of the data revealed that there was abundant weed growth. Highest relative density (42.10%) was recorded for *C. dactylon* in non-field areas followed by (26.13%) at orchards. While the lowest relative density (13.39%) of *C. dactylon* was recorded in field crops. The major weed communities prevailing in the study area were comprised of *Cynodon-Digiteria-Cyperus*. The dominance of *C. dactylon* prevail in non-fields, orchards and field crops. Means data shows that *C. dactylon* was the widespread with relative density of (27.21%), followed by *D. sanguinalis* (14.87%) and *C. rotundus* (12.96%), while *Alhagi-Boerhavia-brossunetia* with minimum mean relative density (0.07%), respectively. However, in field crops, maximum relative density of *C. rotundus* (23.40%) was recorded compared to other weeds (Table-3). The overall abundance of *C. dactylon* is greater but it is not so troublesome and problematic weed, due to less or no canopy over the crops and native plants and is less competitive due to slow growth rate as compared to annual and tall/erect growing weeds. Furthermore the mean density for alien invasive weeds *P. hysterophorus* and *B. papyrifera* are recorded, (1.52%) and (0.07%), respectively in non-field area as discussed by (Gul *et al.,* 2018; Khan *et al*., 2014).

Weed Frequency (%)

A huge infestation of *C. dactylon* weed was present in the whole research farm, UAP having mean frequency of (65%). It was one of the most abundant weed in study area. (Holm *et al*. 1977) reported that *C. dactylon* as one of the world's most troublesome weed of lawn, field crops, irrigation channels, road sides and field ridges. The data showed that highest frequency (75%) of *C. dactylon* was observed in non-field area i.e. field ridges, road sides and irrigation channels, followed by orchards (70%), while its minimum frequency (50%) was observed in field crops, followed by *Digitaria* (50%) and *Cyperus* (40%), respectively (Table-4).

Relative Frequency (%)

The data regarding relative frequency exhibited the prevalence of *C. dactylon* at all the locations studied. The highest relative frequency (17.05%) of *C. dactylon* was recorded in non-field sites, which is followed by (14.58%) and 9.35% in orchards and field crops, respectively. The data also illustrated that *C. dactylon* infestation was approximately consistent at non-field sites and orchards. However, minimum relative frequency (9.35%) was recorded in field crops. *Apluda mutica* and *Cucumis callosus* possessed the minimum relative frequency at most of the sites studied, thereby indicating them as insignificant among the weed flora of the study area (Table-5). *A. mutica* is restricted to the sides of water channels whereas *C. callosus* grows either in the waste land or under crop canopies and often climbs up the crops or it germinates later after the crop harvest in the fields.

Importance value (%)

Among the locations surveyed the highest importance value of (50.63%) was recorded for *C. dactylon*in non-field areas. i.e. field ridges, irrigation channels and road sides, which is followed by (33.42%) and (18.06%) in orchards and field crops, respectively. *C. dactylon* is ranked at the top as the most widespread weed at all the sites, because its mean importance value for all sites is the highest i.e. (34.03%) (Table-6). The data further illustrated that *Cynodon-Digiteria-Cyperus* community dominated in all the sites. Among them *C. dactylon* is wide spread in non-field area of new developmental farm, while *Digiteria* and

Cyperus dominated field crops and orchards.

Table-1. List of weeds and their habitat at NDF- Malakandher- UAP

S.No.	Scientific Name	Common name	Family	Growth habit	Life Cycle
1	*Cynodon dactylon*	Burmuda grass	Poaceae	Creeping herb	P
2	*Xanthium strumarium*	Common cocklebur	Asteraceae	Herb	A
3	*Rumex crispus*	Curly dock	Polygonaceae	Herb	P
4	*Euphorbia prostrate*	Prostrate spurge	Euphorbiaceae	Herb	A
5	*Parthenium hysterophorus*	Congress grass	Asteraceae	Herb	A
6	*Dichanthium annulatum*	Marvel grass	Poaceae	Herb	A
7	*Tribulus terrestris*	Puncture vine	Zygophyllaceae	Prostrate herb	A
8	*Alternanthera pungens*	Khaki weed	Amaranthaceae	Herb	A
9	*Imperata cylindrical*	Cogon grass	Poaceae	Herb	P
10	*Boerhavia diffusa*	Hog weed	Nyctaginaceae	Herb	A
11	*Sorghum halepense*	Johnson grass	Poaceae	Herb	P
12	*Cyperus rotundus*	Purple nutsedge	Cyperaceae	Herb	P
13	*Convolvulus arvensis*	Field bind weed	Convolvulaceae	Climbing herb	P
14	*Broussonetia papyrifera*	Pepper mulberry	Poaceae	Shrub	P
15	*Withania somnifera*	Ashwagandha	Solanaceae	Herb	A
16	*Amaranthus viridis*	Common reed	Amaranthaceae	Herb	A
17	*Verbena officinalis*	Common verbena	Verbenaceae	Herb	A
18	*Plantago lanceolata*	Narrow plantain	Plantaginaceae	Herb	A
19	*Echinochloa crus-galli*	Banryard grass	Poaceae	Herb	A
20	*Trianthema portulacastrum*	Horse purslane	Aizoaceae	Herb	A
21	*Dactyloctenium aegyptium*	Crowfoot grass	Poaceae	Herb	A
22	*Leptochloa chinensis*	Red springletop	Poaceae	Herb	A
23	*Digera arvensis*	False amaranth	Amaranthaceae	Herb	A
24	*Euphorbia heterophylla*	wild poinsettia	Euphorbiaceae	Herb	A
25	*Euphorbia hirta*	Asthama weed	Euphorbiaceae	Herb	A
26	*Aster subulatus*	Aster weed	Asteraceae	Herb	A
27	*Haloxylon salicornicum*	Haloxylon	Amaranthaceae	Sub shrub	P
28	*Malvastrum coromandelianum*	Broom weed	Malvaceae	Herb	A
29	*Alhagi maurorum*	Camel thorn	Asteraceae	Herb	P
30	*Digitaria sanguinalis*	Large crab grass	Poaceae	Herb	A
31	*Setaria viridis*	Bristle grass	Poaceae	Herb	A
32	*Setaria verticillata*	Bristly foxtail	Poaceae	Herb	A
33	*Polygonum persicaria*	Ladys thumb	Polygonaceae	Herb	A
34	*Eclipta alba*	bhringraj	Asteraceae	Herb	A
35	*Artemisia vulgaris*	Mugwort	Asteraceae	Herb	P
36	*Apluda mutica*	Mautritian grass	Poaceae	Herb	A
37	*Physalis angulate*	Wild tomato	Solanaceae	Herb	A
38	*Oxalis corniculata*	Wood sorrel	Oxadillaceae	Herb	A
39	*Cucumis callosus*	Musk melon	Cucurbitaceae	Herb	A

Table-2. Absolute weed density in field crops, non-field and orchards of NDF-UAP

S.No.	Weeds	Field Crop	Non-Field	Orchards	Mean
1	*Cynodon dactylon*	11.7	42.65	20.3	**24.88**
2	*Xanthium strumarium*	0	0.2	0.2	**0.13**
3	*Rumex crispus*	0	1.7	1.6	**1.10**
4	*Euphorbia prostrata*	5.35	5.45	3	**4.60**
5	*Parthenium hysterophorus*	0.85	2.6	0.8	**1.42**
6	*Dichanthium annulatum*	0	3.4	0	**1.13**
7	*Tribulus terrestris*	0	1.8	0	**0.60**
8	*Alternanthera pungens*	0	0.2	0	**0.07**
9	*Imperata cylindrical*	0.7	1.8	0	**0.83**
10	*Boerhavia diffusa*	0	0.2	0	**0.07**
11	*Sorghum halepense*	3.1	11.5	3.7	**6.10**
12	*Cyperus rotundus*	20.4	4.6	8.5	**11.18**
13	*Convolvulus arvensis*	3.3	2.5	0	**1.93**
14	*Broussonetia papyrifera*	0	0.2	0	**0.07**
15	*Withania somnifera*	0	0.8	0	**0.27**
16	*Amaranthus viridis*	0.4	0.2	0	**0.20**
17	*Verbena officinalis*	0	1.4	0	**0.47**
18	*Plantago lanceolata*	0.15	0.8	0	**0.32**
19	*Echinochloacrus-galli*	8.5	0	0	**2.83**
20	*Trianthema portulacastrum*	4.7	0	0	**1.57**
21	*Dactyloctenium aegyptium*	6.3	0	0.6	**2.30**
22	*Leptochloa chinensis*	5.5	0	0.6	**2.03**
23	*Digera arvensis*	3.65	0.45	1	**1.70**
24	*Euphorbia heterophylla*	0	0.4	2.8	**1.07**
25	*Euphorbia hirta*	0	0.4	2.2	**0.87**
26	*Aster subulatus*	0	1.2	0	**0.40**
27	*Haloxylon salicornicum*	0	1.3	0	**0.43**
28	*Malvastrum coromandelianum*	0	7.5	2.8	**3.43**
29	*Alhagi maurorum*	0	0.2	0	**0.07**
30	*Digitaria sanguinalis*	10.4	4.8	21.7	**12.32**
31	*Setaria viridis*	1.8	0	0.6	**0.80**
32	*Setaria verticillata*	0	0	2.7	**0.90**
33	*Polygonum persicaria*	0	0.4	0	**0.15**
34	*Eclipta alba*	0	0.4	0	**0.13**
35	*Artemisia vulgaris*	0	0.4	1.8	**0.73**
36	*Apluda mutica*	0	0	2.4	**0.80**
37	*Physalis angulata*	0.1	0	0.4	**0.17**
38	*Oxalis corniculata*	0	1.8	0	**0.60**
39	*Cucumis callosus*	0.4	0	0	**0.13**
	Total	**87.4**	**101.3**	**77.7**	

Table- 3. Relative weed density in field crop, non-field and orchids of NDF- UAP

S.No.	Weeds	Field Crop	Non-Field	Orchids	Mean
1	*Cynodon dactylon*	13.39	42.10	26.13	**27.21**
2	*Xanthium strumarium*	0.00	0.20	0.26	**0.15**
3	*Rumex crispus*	0.00	1.68	2.06	**1.25**
4	*Euphorbia prostrata*	6.12	5.38	3.86	**5.12**
5	*Parthenium hysterophorus*	0.97	2.57	1.03	**1.52**
6	*Dichanthium annulatum*	0.00	3.36	0.00	**1.12**
7	*Tribulus terrestris*	0.00	1.78	0.00	**0.59**
8	*Alternanthera pungens*	0.00	0.20	0.00	**0.07**
9	*Imperata cylindrica*	0.80	1.78	0.00	**0.86**
10	*Boerhavia diffusa*	0.00	0.20	0.00	**0.07**
11	*Sorghum halepense*	3.55	11.35	4.76	**6.55**
12	*Cyperus rotundus*	23.40	4.54	10.94	**12.96**
13	*Convolvulus arvensis*	3.78	2.47	0.00	**2.08**
14	*Broussonetia papyrifera*	0.00	0.20	0.00	**0.07**
15	*Withania somnifera*	0.00	0.79	0.00	**0.26**
16	*Amaranthus viridis*	0.46	0.20	0.00	**0.22**
17	*Verbena officinalis*	0.00	1.38	0.00	**0.46**
18	*Plantago lanceolata*	0.17	0.79	0.00	**0.32**
19	*Echinochloa crus-galli*	9.73	0.00	0.00	**3.24**
20	*Trianthema portulacastrum*	5.38	0.00	0.00	**1.79**
21	*Dactyloctenium aegyptium*	7.21	0.00	0.77	**2.66**
22	*Leptochloa chinensis*	6.29	0.00	0.77	**2.36**
23	*Digera arvensis*	4.18	0.44	1.29	**1.97**
24	*Euphorbia heterophylla*	0.00	0.39	3.60	**1.33**
25	*Euphorbia hirta*	0.00	0.39	2.83	**1.08**
26	*Aster subulatus*	0.00	1.18	0.00	**0.39**
27	*Haloxylon salicornicum*	0.00	1.28	0.00	**0.43**
28	*Malvastrum coromandelianum*	0.00	7.40	3.60	**3.67**
29	*Alhagi maurorum*	0.00	0.20	0.00	**0.07**
30	*Digitaria sanguinalis*	11.96	4.74	27.93	**14.87**
31	*Setaria viridis*	2.06	0.00	0.77	**0.94**
32	*Setaria verticillata*	0.00	0.00	3.47	**1.16**
33	*Polygonum persicaria*	0.00	0.44	0.00	**0.15**
34	*Eclipta alba*	0.00	0.39	0.00	**0.13**
35	*Artemisia vulgaris*	0.00	0.39	2.32	**0.90**
36	*Apluda mutica*	0.00	0.00	3.09	**1.03**
37	*Physalis angulata*	0.11	0.00	0.51	**0.21**
38	*Oxalis corniculata*	0.00	1.78	0.00	**0.59**
39	*Cucumis callosus*	0.46	0.00	0.00	**0.15**

Table-4. Frequency (%) of weeds in field, non-field and orchards of NDF-UAP

S.No	Weeds	Field Crop	Non-Field	Orchid	Mean
1	*Cynodon dactylon*	50	75	70	**65.00**
2	*Xanthium strumarium*	0	5	5	**3.33**
3	*Rumex crispus*	0	35	30	**21.67**
4	*Euphorbia prostrata*	30	30	20	**26.67**
5	*Parthenium hysterophorus*	15	25	10	**16.67**
6	*Dichanthium annulatum*	0	10	0	**3.33**
7	*Tribulus terrestris*	0	10	0	**3.33**
8	*Alternanthera pungens*	0	5	0	**1.67**
9	*Imperata cylindrica*	5	15	0	**6.67**
10	*Boerhavia diffusa*	0	5	0	**1.67**
11	*Sorghum halepense*	35	30	40	**35.00**
12	*Cyperus rotundus*	75	10	35	**40.00**
13	*Convolvulus arvensis*	40	30	0	**23.33**
14	*Broussonetia papyrifera*	0	5	0	**1.67**
15	*Withania somnifera*	0	5	0	**1.67**
16	*Amaranthus viridis*	5	0	0	**1.67**
17	*Verbena officinalis*	0	15	0	**5.00**
18	*Plantago lanceolata*	5	10	0	**5.00**
19	*Echinochloa crus-galli*	50	0	0	**16.67**
20	*Trianthema portulacastrum*	25	0	0	**8.33**
21	*Dactyloctenium aegyptium*	70	0	5	**25.00**
22	*Leptochloa chinensis*	30	0	5	**11.67**
23	*Digera arvensis*	45	5	20	**23.33**
24	*Euphorbia heterophylla*	0	10	25	**11.67**
25	*Euphorbia hirta*	0	5	30	**11.67**
26	*Aster subulatus*	0	10	0	**3.33**
27	*Haloxylon salicornicum*	0	5	0	**1.67**
28	*Malvastrum coromandelianum*	0	25	40	**21.67**
29	*Alhagi maurorum*	0	5	0	**1.67**
30	*Digitaria sanguinalis*	45	20	85	**50.00**
31	*Setaria viridis*	5	0	5	**3.33**
32	*Setaria verticillata*	0	0	15	**5.00**
33	*Polygonum persicaria*	0	15	0	**5.00**
34	*Eclipta alba*	0	5	0	**1.67**
35	*Artemisia vulgaris*	0	5	25	**10.00**
36	*Apluda mutica*	0	0	5	**1.67**
37	*Physalis angulata*	5	0	5	**3.33**
38	*Oxalis corniculata*	0	10	0	**3.33**
39	*Cucumis callosus*	0	0	5	**1.67**
	Total	**535**	**440**	**480**	

Table-5. Relative frequency (%) in field crops, non-field area and orchards of NDF- UAP

S.No	Weeds	Field Crop	Non-Field	Orchid	Mean
1	*Cynodondactylon*	9.35	17.05	14.58	**13.66**
2	*Xanthium strumarium*	0.00	1.14	1.04	**0.73**
3	*Rumex crispus*	0.00	7.95	6.25	**4.73**
4	*Euphorbia prostrata*	5.61	6.82	4.17	**5.53**
5	*Parthenium hysterophorus*	2.80	5.68	2.08	**3.52**
6	*Dichanthium annulatum*	0.00	2.27	0.00	**0.76**
7	*Tribulus terrestris*	0.00	2.27	0.00	**0.76**
8	*Alternanthera pungens*	0.00	1.14	0.00	**0.38**
9	*Imperata cylindrica*	0.93	3.41	0.00	**1.45**
10	*Boerhavia diffusa*	0.00	1.14	0.00	**0.38**
11	*Sorghum halepense*	6.54	6.82	8.33	**7.23**
12	*Cyperus rotundus*	14.02	2.27	7.29	**7.86**
13	*Convolvulus arvensis*	7.48	6.82	0.00	**4.76**
14	*Broussonetia papyrifera*	0.00	1.14	0.00	**0.38**
15	*Withania somnifera*	0.00	1.14	0.00	**0.38**
16	*Amaranthus viridis*	0.93	0.00	0.00	**0.31**
17	*Verbena officinalis*	0.00	3.41	0.00	**1.14**
18	*Plantago lanceolata*	0.93	2.27	0.00	**1.07**
19	*Echinochloa crus-galli*	9.35	0.00	0.00	**3.12**
20	*Trianthema portulacastrum*	4.67	0.00	0.00	**1.56**
21	*Dactyloctenium aegyptium*	13.08	0.00	1.04	**4.71**
22	*Leptochloa chinensis*	5.61	0.00	1.04	**2.22**
23	*Digera arvensis*	8.41	1.14	4.17	**4.57**
24	*Euphorbia heterophylla*	0.00	2.27	5.21	**2.49**
25	*Euphorbia hirta*	0.00	1.14	6.25	**2.46**
26	*Aster subulatus*	0.00	2.27	0.00	**0.76**
27	*Haloxylon salicornicum*	0.00	1.14	0.00	**0.38**
28	*Malvastrum coromandelianum*	0.00	5.68	8.33	**4.67**
29	*Alhagi maurorum*	0.00	1.14	0.00	**0.38**
30	*Digitaria sanguinalis*	8.41	4.55	17.71	**10.22**
31	*Setaria viridis*	0.93	0.00	1.04	**0.66**
32	*Setaria verticillata*	0.00	0.00	3.13	**1.04**
33	*Polygonum persicaria*	0.00	3.41	0.00	**1.14**
34	*Eclipta alba*	0.00	1.14	0.00	**0.38**
35	*Artemisia vulgaris*	0.00	1.14	5.21	**2.11**
36	*Apluda mutica*	0.00	0.00	1.04	**0.35**
37	*Physalis angulata*	0.93	0.00	1.04	**0.66**
38	*Oxalis corniculata*	0.00	2.27	0.00	**0.76**
39	*Cucumis callosus*	0.00	0.00	1.04	**0.35**

Table-6. Importance value (%) of weeds in field crops, non-field area and orchards of NDF-UAP

S.No.	Weed Species	Field Crop	Non-Field	Orchid	Mean
1	*Cynodon dactylon*	18.06	50.63	33.42	**34.03**
2	*Xanthium strumarium*	0.00	0.77	0.78	**0.51**
3	*Rumex crispus*	0.00	5.66	5.18	**3.61**
4	*Euphorbia prostrata*	8.93	8.79	5.94	**7.89**
5	*Parthenium hysterophorus*	2.37	5.41	2.07	**3.28**
6	*Dichanthium annulatum*	0.00	4.49	0.00	**1.50**
7	*Tribulus terrestris*	0.00	2.91	0.00	**0.97**
8	*Alternanthera pungens*	0.00	0.77	0.00	**0.26**
9	*Imperata cylindrica*	1.27	3.48	0.00	**1.58**
10	*Boerhavia diffusa*	0.00	0.77	0.00	**0.26**
11	*Sorghum halepense*	6.82	14.76	8.93	**10.17**
12	*Cyperus rotundus*	30.41	5.68	14.59	**16.89**
13	*Convolvulus arvensis*	7.51	5.88	0.00	**4.46**
14	*Broussonetia papyrifera*	0.00	0.77	0.00	**0.26**
15	*Withania somnifera*	0.00	1.36	0.00	**0.45**
16	*Amaranthus viridis*	0.92	0.20	0.00	**0.37**
17	*Verbena officinalis*	0.00	3.09	0.00	**1.03**
18	*Plantago lanceolata*	0.64	1.93	0.00	**0.86**
19	*Echinochloa crus-galli*	14.40	0.00	0.00	**4.80**
20	*Trianthema portulacastrum*	7.71	0.00	0.00	**2.57**
21	*Dactyloctenium aegyptium*	13.75	0.00	1.29	**5.01**
22	*Leptochloa chinensis*	9.10	0.00	1.29	**3.46**
23	*Digera arvensis*	8.38	1.01	3.37	**4.25**
24	*Euphorbia heterophylla*	0.00	1.53	6.21	**2.58**
25	*Euphorbia hirta*	0.00	0.96	5.96	**2.31**
26	*Aster subulatus*	0.00	2.32	0.00	**0.77**
27	*Haloxylon salicornicum*	0.00	1.85	0.00	**0.62**
28	*Malvastrum coromandelianum*	0.00	10.24	7.77	**6.00**
29	*Alhagi maurorum*	0.00	0.77	0.00	**0.26**
30	*Digitaria sanguinalis*	16.16	7.01	36.78	**19.99**
31	*Setaria viridis*	2.53	0.00	1.29	**1.27**
32	*Setaria verticillata*	0.00	0.00	5.04	**1.68**
33	*Polygonum persicaria*	0.00	2.15	0.00	**0.72**
34	*Eclipta alba*	0.00	0.96	0.00	**0.32**
35	*Artemisia vulgaris*	0.00	0.96	4.92	**1.96**
36	*Apluda mutica*	0.00	0.00	3.61	**1.20**
37	*Physalis angulata*	0.58	0.00	1.04	**0.54**
38	*Oxalis corniculata*	0.00	2.91	0.00	**0.97**
39	*Cucumis callosus*	0.46	0.00	0.52	**0.33**

Table-7. Check list of weeds distribution in various field crops, non-field area and orchards of NDF-UAP

S#	Scientific name	Maize	Rice	Cotton	Mung bean	Sun flower	Sesame	Peach	Plum	Apricot	Persimmon	Guava	Water channels	Road, field ridges
1	*Cynodon dactylon*	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	*Xanthium strumarium*	✓	×	✓	×	×	×	×	×	×	✓	×	×	×
3	*Rumex crispus*	×	×	×	×	×	×	×	✓	✓	✓	×	×	×
4	*Euphorbia prostrata*	×	×	×	✓	×	✓	✓	×	✓	×	×	✓	✓
5	*Parthenium hysterophorus*	×	×	×	✓	×	×	×	×	×	✓	✓	✓	✓
6	*Dichanthium annulatum*	×	×	×	×	×	×	×	×	×	×	×	✓	✓
7	*Tribulus terrestris*	×	×	×	×	×	×	×	×	×	×	×	✓	✓
8	*Alternanther apungens*	×	×	×	×	×	×	×	×	×	×	×	×	✓
9	*Imperata cylindrica*	×	✓	×	×	×	×	×	×	×	×	×	✓	✓
10	*Boerhavia diffusa*	×	×	×	×	×	×	✓	×	×	×	×	×	✓
11	*Sorghum halepense*	✓	×	✓	×	✓	✓	✓	✓	✓	×	✓	×	✓
12	*Cyperus rotundus*	✓	✓	✓	✓	✓	×	×	✓	×	✓	✓	✓	✓
13	*Convolvulus arvensis*	×	×	×	✓	×	✓	×	×	×	×	✓	✓	✓
14	*Broussonetia papyrifera*	×	×	×	×	×	×	×	×	×	×	×	×	✓
15	*Withania somnifera*	×	×	×	×	×	×	×	×	×	×	×	×	✓
16	*Amaranthus viridis*	✓	×	×	×	×	×	×	×	×	×	×	×	×
17	*Verbena officinalis*	×	×	×	×	×	×	×	×	×	×	×	✓	✓
18	*Plantago lanceolata*	×	×	×	✓	×	×	×	×	×	×	×	✓	✓
19	*Echinochloa crus-galli*	✓	✓	✓	✓	×	×	×	×	×	×	×	×	×
20	*Trianthema portulacastrum*	✓	×	×	×	×	×	×	×	×	×	×	×	×
21	*Dactyloctenium aegyptium*	✓	×	✓	×	✓	✓	×	×	×	✓	×	×	×
22	*Leptochloa chinensis*	✓	×	×	✓	×	×	×	✓	✓	×	×	×	×
23	*Digera arvensis*	✓	×	✓	✓	×	×	✓	✓	×	×	×	×	✓
24	*Euphorbia heterophylla*	×	×	×	×	×	×	✓	×	✓	×	×	×	✓
25	*Euphorbia hirta*	×	×	×	×	×	×	✓	✓	×	✓	✓	×	✓
26	*Aster subulatus*	×	×	×	×	×	×	×	×	×	×	×	✓	×
27	*Haloxylon salicornicum*	×	×	×	×	×	×	×	×	×	×	×	✓	✓
28	*Malvastrum coromandelianum*	×	×	×	×	×	×	✓	✓	×	✓	×	✓	×
29	*Alhagi maurorum*	×	×	×	×	×	×	×	×	×	×	×	✓	✓
30	*Digitaria sanguinalis*	×	×	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
31	*Setaria viridis*	×	✓	✓	×	×	×	×	×	×	✓	×	×	×
32	*Setaria verticillata*	×	×	×	×	×	×	✓	×	×	✓	✓	×	×
33	*Polygonum persicaria*	×	×	×	×	×	×	×	×	×	×	×	×	×
34	*Eclipta alba*	×	×	×	×	×	×	×	×	×	×	×	×	×
35	*Artemisia vulgaris*	×	×	×	×	×	×	×	×	✓	✓	×	×	×
36	*Apluda mutica*	×	×	×	×	×	×	×	×	×	✓	×	×	×
37	*Physalis angulate*	×	×	×	×	✓	×	×	×	×	✓	×	×	×
38	*Oxalis corniculata*	×	×	×	×	×	×	×	×	×	×	×	✓	×
39	*Cucumis callosus*	×	×	×	×	✓	×	×	✓	×	×	×	×	×

CONCLUSION AND RECOMMENDATIONS

A total of 39 weeds species were documented during the survey. Among them 27 weeds species were annual and 12 were perennial and there was no biennial species found. Mostly the annual weeds were found frequent with dense stands in field crops. The monocot class was represented by poaceae and cyperaceae only among which *C. dactylon* dominated the whole vegetation, in almost all the surveyed sites, followed by *Digitaria* and *Cyperus* in the summer field crops and orchards with minimum abundance in non-field area. Whereas the lowest abundant species were *Alhaji-Borhavia-Cucumis*. Two alien invasive weeds recorded were Parthenium weed and paper mulberry. Parthenium weed was abundant and widespread on field ridges and compared to paper mulberry which is recorded with lowest frequency. The obnoxious invasive Parthenium weed is well established in research farm which grows in almost all habitats probably on the road sides, field ridges, water channels and orchards. Therefore, an appropriate Parthenium weed management strategy is necessary to stop further spread. More detailed study should be carried out to document the winter weeds of research farm. A manual for weeds identification and management should be prepared for future reference. Complete biology and ecology of weeds should be described with integrated management practice. As invasive weeds are widely spreading in NDF- UAP so proper management plan should be implanted to reduce their spread further.

REFERENCES CITED

Girma, B., Y. Kumelachew and B. Taye. 2004. Proc. National Conf. on Forest resources of Ethiopia: Status, challenges and opportunities, 27-29 November 2002. 272 pp.

Gul, B., Ahmad, I., Khan, H., Zeb, U., & Ullah, H. 2018. Floristic inventory of wild plants of Peshawar university campus. Acta Ecologica Sinica, 38(6): 375-380.

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

Holm, L. G.; Plucknett, D. L.; Pancho, J. V.; Herberger, J. P. 1977. The World's Wort Weeds. 0824802950. pp. 609.

Hussain, F. 1989. Field and Laboratory Manual of Plant Ecology. University Grants Commission, Islamabad, pp. 155-156.

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

Khan, H., K.B. Marwat, G. Hassan and M.A. Khan. 2013. Socio-economic impacts of parthenium weed in Peshawar valley, Khyber Pakhtunkhwa. Pak. J. Weed Sci. Res., 19(3): 275-293.

Khan, H., K.B. Marwat, G. Hassan, M.A. Khan and S. Hashim. 2014. Distribution of parthenium weed in Peshawar valley, KPK-Pakistan. Pak. J. Bot., 46(1): 81-91.

Ligenfelter, D.D. 2017. Introduction to Weeds: What are weeds and why do we care? Article. Penn State Extension.2pp.

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

Qureshi, R., Bhatti, G. R., & Ghanghro, A. S. 2001. Survey of weed communities of sugarcane (*Saccharum officinarum* L.) crop in district Sukkur, Sindh, Pakistan. Hamdard Medicus, 44(2): 107-111.

Stewart, R. R. 1972. An Annotated Catalogue of the Vascular Plants of West Pakistan and Kashmir (Flora of West Pakistan), Fakhri Printing Press, Karachi.

Thomas, A. G. 1985. Weed survey system used in Saskatchewan for cereal and oilseed crops. Weed Sci. 33 (1):34-43.

Thomas, A. G. 1991. Floristic composition and relative abundance of weeds in annual crops of Manitoba. Can. J. Plant Sci.71 (3):831-839.

Vencill, W. Grey, T. and Culpepper, S. 2011.Department of crop and soil sciences, University of Geogia USA.

Wikipedia. The Encyclopedia. http://en.wikipedia.org/wiki/Peshawar. Accessed on April 25, 2019

Wilson, B. J. 1985. Effect of seed age and cultivation on seedling emergence and seed decline of *Avena fatua* L. in winter barley. Weed Research, 25(3): 213-219.

Zimdahl, R. L. 2004. Weed-crop competition-a review, 2nd ed.Pud.Ames.IA.220pp.

Zuberi, M. I., Gosaye, T., & Hossain, S. 2014. Potential threat of alien invasive species: *Parthenium hysterophorus* L. to subsistence agriculture in Ethiopia. Sarhad J. of Agriculture, 30 (1):117-125.