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Noxious Weeds of Winter Crops in District Chakwal, Pakistan*

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Abstract: To identify the noxious and ecologically operative weeds in winter crops of the district Chakwal, two weed surveys were carried out at various sites during Dec., 1999 and March, 2000. *Asphodelus tenuifolius*, *Medicago denticulata* and *Carthamus oxycantha* were three top ranking weeds in gram fields with importance values 61.09, 32.96 and 30.48, respectively. In lentil fields *A. tenuifolius* (54.44), *C. oxycantha* (42.58) and *Emexs australis* (42.12) were dominant weeds during Dec., 1999 and March, 2000. The three most noxious weeds in the mustard fields were *A. tenuifolious*, *Convolvulus arvensis* and *Centaurea iberica* with importance values 63.87, 42.24 and 32.74, respectively. In wheat fields three species exhibiting the highest importance values were *Convolvulus arvensis* (53.41), *Fumaria indica* (45.55) and *Galium aparine* (35.48). The overall noxious weeds were *A. tenuifolius* (51.39), *Convolvulus arvensis* (36.81), *F. indica* (32.80), *C. oxycantha* (29.91), *Medicago denticulata* (28.37), *Pentanema vestitum* (28.16), *C. iberica* (27.47), *E. australis* (24.63), *Cousinia thomsonii* (24.25), *G. aparine* (23.39), *Vicia monantha* (21.76) and *Calendula arvensis* (21.24). Asteraceae, Papilionaceae and Poaceae were the most important families with importance values 193.00, 115.34 and 105.92, respectively. Most of these weeds were annuals and can be controlled by eradicating them before flowering.

Key words: Noxious weeds, gram, lentil, mustard, wheat, winter crops, Chakwal

Introduction

District Chakwal lies on the main historic route from the old Taxila to Jehlum. It comprises of three tehsils namely Chakwal, Tala Gang and Choa Saiden Shah. Of the total 16,52,000 acres area of the district, 8,20,000 acres is cultivated (Anonymous, 2000). Cropping pattern varies from area to area. However, the major crops of winter season are gram (*Cicer arietinum* L.), lentil (*Lens culinaris* Medic.), mustard (*Brassica campestris* L.) and wheat (*Triticum aestivum* L.). The yields of these crops are much less than the other parts of the country. In addition to factors such as poor planning, use of marginal land, poor land preparation, use of unimproved crop varieties, lack of fertilizer utilization, lack of plant protection measures and shortage of suitable machinery for planting, harvesting and threshing, poor weed management is major constraint hampering the yields of these crops. Weeds are natural hazards to the interests and activities of man (Mortimer, 1990). These have been described as alien, invasive, annoying, troublesome, aggressive, useless and damaging. Thus weeds are plant species defined by human values rather than biological characteristics. Weeds cause direct losses by depriving crops of water, light and mineral nutrients (Reddy and Reddi, 2001), exhibit allelopathy (Tefera, 2002; Singh *et al*., 2003), harbour insects, pests and diseases (Majid *et al*., 1998).

The investigated area is rainfed and therefore, the soil is relatively drier than the average soil condition. Scarcity of water, one of the ecological problems in the area, creates competition

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for soil moisture between the weeds and crops. Shortage of moisture and moderate depth to bed rocks are the major factors limiting the production (Malik, 1999). For any management practice aimed at controlling the weeds, their proper identification and ecological status must be known so as to point out the noxious and ecologically operative weeds. Weed surveys are useful for determining the occurrence and relative importance of weed species in crop production (Frick and Thomas, 1992).

Owing to the aforesaid significance of weeds and weed surveys, the present study was undertaken to determine the noxious weeds, based on their importance values in the winter crops (gram, lentil, mustard and wheat) of district Chakwal. Family importance value was also calculated. This information may be useful to resource managers and regulatory officials in assessing which weeds are problematic in adjacent geographic areas and researchers to help select which weeds to target with new management strategies.

Materials and Methods

In District Chakwal, winter crops are usually sown in November/December and harvested in May/June. Therefore, to have a complete idea of weed dynamics two surveys were carried out. First survey was conducted in December, 1999 when the crops were at seedling stage while, the second survey was done when these crops were at flowering stage in March, 2000.

Within the three tehsils of District Chakwal, 12 localities, where gram, lentil, mustard and wheat were grown regularly and maximum production was reported in last five years, were selected within the radius of 40 km from their respective tehsils. These sites included, Bhaun, Kalar Kahar, Bochal, Dudyal, Pindi Gugran, Balkasar (Tehsil Chakwal), Jahtla, Kot Sarang, Taman, Puchnand (Tehsil Tala Gang), Ratucha and Dulmyal (Tehsil Choa Saiden Shah). All these sites were rainfed and no herbicide was used during the study period. Ten fields of each crop at these sites were chosen randomly and quantitatively analysed following the methodology of Thomas (1985) and McCully *et al*. (1991) with some modifications. Five quadrats (each 1×1 m) were laid in each field. The distance between quadrats was directly proportional to the size and shape of the field. The field uniformity, density and herbage coverage of each weed species was recorded within each quadrat. Field uniformity and density were measured as outlined by Thomas (1985), while, herbage coverage and importance value was calculated following Smith and Smith (1998).

Field Uniformity (FU) was calculated as percentage of the total number of quadrats sampled in which a species occurred (Thomas, 1985).

$$FUk = \frac{\sum_{1}^{n}\sum_{1}^{5} Xij}{5n} \times 100$$

Where FUk is the field uniformity for species k, Xij is the presence (1) or absence (0) of species k in quadrat j in field i and n is number of field surveyed.

Density (D) of each species in a field was calculated by summing the number of plants in all quadrats and dividing by area of 5 quadrats (Thomas, 1985).

$$Dki = \frac{\sum_{1}^{5} Zj}{Ai}$$

Where Dki is the density (numbers m^{-2}) of species k in field i, Zj is the number of plants of a species in quadrat j and Ai is the area in m^2 of 5 quadrats in field i.

Herbage coverage was determined ensuing Smith and Smith (1998) by estimating how much percent area of quadrat was covered by all individuals of a species as viewed from above. Thus herbage cover of a weed in a field was calculated by summing % herbage coverage of species in all quadrats and dividing by number of quadrats.

$$Hcki = \frac{\sum_{1}^{5} Cj}{5n}$$

Where Hcki is the herbage coverage (in % m^{-2}) of species k in field i, Cj is the % herbage coverage of all individuals of a species in quadrat j and n is the number of fields.

The importance value of species was calculated following Smith and Smith (1998). The importance value of each species was calculated by assuming that the field uniformity, density and herbage coverage measures were equally important in describing the relative importance of weed species. This was calculated as follow:

$$\text{Relative field uniformity for species k (RUk)} = \frac{\text{Field unifirmity value of species k}}{\text{Field unifirmity for all species}} \times 100$$

$$\text{Relative Density for species k (RDk)} = \frac{\text{Density value of species k}}{\text{Density value for all the species}} \times 100$$

$$\text{Relative herbage coverage of species k (RCk)} = \frac{\text{Herbage coverage value of species k}}{\text{Herbage coverage value for all the species}} \times 100$$

Each of these three relative values indicate one aspect of the importance of species in the community but a better comparative picture can be painted by adding these relative values for every species to get importance values.

$$\text{Importance value of species k (IVk)} = RUk + RDk + RCk$$

A maximum value of 300 would be possible if only one species found in all the fields that were surveyed. Mean importance values of each species in each crop was calculated by dividing sum of importance value (IV) of a species by number of sites at which species was recorded. Family importance value based on the sum of importance values of species present in a family was also calculated. Mean IV of each species for four crops was also calculated to determine the noxious weeds of winter crops as a whole. The nomenclature followed was that of Stewart (1972), Nasir and Ali (1971-1993) and Ali and Qaiser (1994-2003).

Results and Discussion

A total of 78 species representing the 28 families were recognized as weeds in gram, lentil, mustard and wheat crops of district Chakwal. Among them 66 species belonged to dicots while 12 species represented the monocots (Table 1). There were 47 weed species in gram fields of area

Table 1: Importance values of weeds in gram, lentil, mustard and wheat crops of District Chakwal

Sr. No.	Names of the species	Family	Importance value (IV)				Mean IV
			Gram	Lentil	Mustard	Wheat	
1	*Achyranthus aspera* L.	Amaranthaceae			6.28		6.28
2	*Adhatoda vasica* Nees.	Acanthaceae			25.43	8.44	16.93
3	*Aerva javanica* (Burm.F) Juss.	Amaranthaceae	9.15			11.83	10.49
4	*Amaranthus viridis* L.	Amaranthaceae			8.09	2.14	5.11
5	*Anagallis arvensis* L.	Primulaceae	20.59	16.37	23	14.45	18.60
6	*Arnebia hispidissmima* (Lehm) D.C.	Boraginaceae	2.94				2.94
7	*Artemesia scoparia* Waldst & Kit.	Asteraceae	6.67	2.2	22.04	8.86	9.94
8	*Asphodelus tenuifolius* Cavan.	Liliaceae	61.09	54.44	63.87	26.17	51.39
9	*Astragalus augaeus* Burnge.	Papilionaceae	5.33		12.78	16.39	11.5
10	*Avena fatua* L.	Poaceae		6.31			6.31
11	*Boerhaavia diffusa* Auct Plur.	Nyctaginaceae			12.55		12.55
12	*Buglossoides arvensis* (L.) Johnston.	Boraginaceae	9	10.61	15.2	23.01	14.45
13	*Calatropis procera* (Willd.) R.Br.	Asclepiadaceae	17.93		1.36		9.64
14	*Calendula arvensis* L.	Asteraceae	23.21	29.8	23.45	8.5	21.24
15	*Cannabis sativa* L.	Cannabaceae				4.81	4.81
16	*Carthamus oxycantha* M.B.	Asteraceae	30.48	42.58	29.88	16.72	29.91
17	*Cenchrus ciliaris* L.	Poaceae	27.6	4.1			15.85
18	*C. setigerus* Vahl.	Poaceae				11.5	11.5
19	*Centaurea iberica* Trev. ex. Spreng.	Asteraceae		35.25	32.74	14.44	27.47
20	*Chenopodium album* L.	Chenopodiaceae	19.43	22.39	16.35	21.4	19.89
21	*C. ambrosioides* L.	Chenopodiaceae				20.39	20.39
22	*C. murale* L.	Chenopodiaceae	15.79	10.76	15.45	11.49	13.37
23	*Cirsium arvense* (L.) Scop.	Asteraceae		11.3	9.21	27.74	16.08
24	*Citrullus colocynthis* (L.) Schard.	Cucurbitaceae		3.1			3.1
25	*Convolvulus arvensis* L.	Convolvulaceae	15.62	36	42.24	53.41	36.81
26	*Conyza ambigua* D.C.	Asteraceae	1.78		6.69		4.23
27	*Coronopus didymus* (L.) Sm.	Brassicaceae	8.64		1.48	7.83	5.98
28	*Cousinea tthomosonii* C.B. Clarke.	Asteraceae	14.24	37.49	26.54	18.74	24.25
29	*Cynodon dactylon* (L.) Pers.	Poaceae	4.87	19.45	11.56	3.78	9.91
30	*Cynoglossum lanceolatum* Forssk.	Boraginaceae				10.83	10.83
31	*Dactyloctenium aegyptium* (L.) P.Beaur	Poaceae	4.54	3.87	11.43		6.61
32	*Datura stramonium* L.	Solanaceae	2.13		8.27	16.65	8.96
33	*Desmostachya bipinnata* (L.) Stapf.	Poaceae			5.24		5.24
34	*Dicanthium annulatum* (Frossk) Stapf.	Poaceae	6.33	8.19	8.35	6.41	7.32
35	*Dicliptera bupleuroides.* Nees.	Acanthaceae				6.01	6.01
36	*Digera muricata* (L.) Link.	Amaranthaceae	12.13		7.78	30.03	16.64
37	*Echinochloa colonum* (L.) Link.	Poaceae	9.61			18.35	9.61
38	*Eleusine indica* (L.) Gaertn.	Poaceae	3.55				3.55
39	*Emex australis* Steinch.	Polygonaceae	14.85	42.12	23.2	18.35	24.63
40	*Eragrostis poaeoides* P.Beauv.	Poaceae	6.72	17.81	14.34	3.37	10.56
41	*Euphorbia dracunculoides.* Lam.	Euphorbiaceae		26.15		8.71	17.43
42	*E. helioscopia* L.	Euphorbiaceae	15.69	15.37	13.72	13.67	14.61
43	*E. prostrata* Ait.	Euphorbiaceae	5.23		3.95	2.01	3.73
44	*Fumaria indica* (Hausskn.) H.N.	Fumariaceae	20.21	33.12	32.34	45.55	32.8
45	*Galium aparine* L.	Rubiaceae		9.7	25.01	35.48	23.39
46	*Heliotropium europeaeum* L.	Boraginaceae	9.95	19.3	19.35	10.41	14.75
47	*Ipomoea eriocarpa* R.Bv.	Convolvulaceae	5.56				5.56
48	*Lathyrus aphaca* L.	Papilionaceae	3	8.3	15.1	9.77	9.04
49	*L. sativus* L.	Papilionaceae	22.47	23.42	16.17	16.12	19.54
50	*Launaea nudicaulis* N.K.F. (nonless)	Asteraceae	23.17	28.91	16.88	14.63	20.89
51	*Malva parviflora* L.	Malvaceae	12.3	9.38	11.92	13.64	11.81
52	*Malvastrum tricuspidatum* (Ait) A. Gray.	Malvaceae				16.64	16.64
53	*Medicago denticulata* Willd.	Papilionaceae	30.96	28.03	25.6	28.92	28.37
54	*Melilotus parviflora* L.All.	Papilionaceae				6.06	6.06
55	*Neslia apiaculata* Fisch, Mey and Ave. Lall.	Brassicaceae				6.06	6.06
56	*Orobanche aegyptiaca* Pers.	Orobanchaceae		4.62	9.67		7.14
57	*Otostegia limbata* (Btr.) Boiss.	Labiatae		19.17		5.06	11.95
58	*Oxalis pes-carpae* L.	Oxalidaceae			15.59	8.31	11.95
59	*Pentanema vestitum* (Wall. ex.DC) Ling.	Asteraceae		38.66	30	15.82	28.16
60	*Portulaca oleracea* L.	Portulacaceae				2.93	2.93
61	*Pupalia lappacea* (L.) Juss.	Amaranthaceae				6.12	6.12
62	*Rhynchosia capitata* (Heyne ex Roth) D.C.	Papilionaceae	23.53		1.4		12.46

Table 1: Continued

Sr. No.	Names of the species	Family	Importance value (IV)				Mean IV
			Gram	Lentil	Mustard	Wheat	
63	*Rumex dentatus* L.	Polygonaceae	17.65				13.91
64	*Silene arenosa* C.Koch.	Caryophyllaceae	24.1	10.6	11.2	10.77	16.38
65	*Sisymbrium irio* L.	Brassicaceae			13.93	19.63	20.33
66	*Solanum nigrum* L.	Solanaceae				26.73	0.73
67	*S. xanthocarpum* Schrad & Wendil.	Solanaceae	19.48			0.73	19.48
68	*Sonchus asper* (L.) Pers.	Poaceae	13.33	5.33	13.2	1.63	8.37
69	*Sorghum halepense* (L.) Pers.	Poaceae	17.32	30.11	19.2	11.96	19.64
70	*Spergula fallax* (Lowe) E.H. L.Krause.	Caryophyllaceae	4.62	9.9			7.26
71	*Stellaria media* (L.) Cyr.	Caryophyllaceae			19.18	14.7	16.94
72	*Tribullus terrestris* L.	Zygophyllaceae			3.36		3.36
73	*Trichodesma indicum* (L.) Cyr.	Boraginaceae			19.15	9.6	14.37
74	*Trifolium polycerata* L.	Papilionaceae	19.99	17.73	18.4	16.33	18.11
75	*Veronica agrestis* Auct. non.L.	Scrophulariaceae		6.5	2.69	11	6.73
76	*Vicia monantha* L.	Papilionaceae	21.55	21.04	22.27	22.2	21.76
77	*Withania somnifera* (L.) Dunal.	Solanaceae	12.44	4.55		3.87	6.95
78	*Xanthium strumarium* L.	Asteraceae	2.9				2.9

surveyed. *Asphodelus tenuifolius*, *Medicago denticulata* and *Carthamus oxycantha* were three top ranking weeds in gram with importance values 61.09, 32.96 and 30.48, respectively. Besides these, *Anagallis arvensis*, *Calendula arvensis*, *Lathyrus sativus* and *Vicia monantha* were also prevalent weeds of gram fields (Table 1).

Lentil fields had 42 species. Of them *A. tenuifolius* (54.44), *C. oxycantha* (42.58) and *Emexs australis* (42.12) were dominant weeds in lentil fields. Among others, *Centaurea iberica*, *Fumaria indica*, *M. denticulata*, *Pentanema vestitum*, *Sorghum halepense* and *V. monantha* were most important (Table 1).

Fifty three species of weeds were recorded in the mustard fields. The three noxious weeds were *A. tenuifolious*, *Convolvulus arvensis* and *C. iberica* with importance values 63.87, 42.24 and 32.74, respectively. The other problematic weeds of mustard fields were *Calendula arvensis*, *E. australis*, *F. indica*, *Galium aparine*, *M. denticulata*, *C. oxycantha* and *V. monantha* (Table 1).

In all 59 weed species were recorded in wheat fields of district Chakwal. Three species exhibiting the highest importance values were *Convolvulus arvensis* (53.41), *F. indica* (45.55) and *G. aparine* (35.48). *A. tenuifolius*, *Cirsium arvense*, *Chenopodium album*, *Digera muricata*, *M. denticulata*, *Sisymbbrium irio* and *V. monantha* also had handsome importance values in the wheat fields. The dominance of these weeds might be due to excellent growth behaviour, fabulous seed production, spectacular competitive ability and high physiological efficiency.

The mean importance values of weed species revealed that *A. tenuifolius*, *Convolvulus arvensis*, *F. indica*, *C. oxycantha* and *M. denticulata* were top five noxious weeds of winter crops in district Chakwal. These had importance values 51.39, 36.81, 32.80, 29.91 and 28.37, respectively. Along with these species, *P. vestitum*, *C. iberica*, *E. australis*, *Cousinia thomsonii*, *G. aparine*, *V. momantha* and *Calendula arvensis* also showed enough importance values.

Most of the sites were dominated by *A. tenuifolius* during both the surveys. This might be due to its wide ecological amplitude as it can grow both on light and heavy soils (Gupta, 1987), has low water requirement (Ashiq *et al*., 1996) and develop thick stands with adequate moisture (Gupta, 1987). It is note worthy that there was heavy down pour before second survey. Thus, difference in moisture level might have played a catalytic role in changing ecological status of different weed species during both the surveys. According to Stefanic *et al*. (2005) notable fluctuations in weed communities correspond with variation in weather patterns and management practice. Recently, Batlla and Benech-Arnold (2006) suggested that fluctuations in soil water content could be an additional factor affecting dormancy and weed emergence patterns under field conditions.

Table 2: Families arranged in descending order on the basis of their importance values

Sr. No.	Family	No. of species	Importance value
1	Papilionaceae	7	193
2	Asteraceae	11	115.34
3	Poaceae	11	105.92
4	Boraginaceae	6	68.83
5	Chenopodiaceae	3	53.65
6	Liliaceae	1	51.39
7	Convolvulaceae	2	42.37
8	Amaranthaceae	5	44.64
9	Caryophyllaceae	3	40.58
10	Euphorbiaceae	3	35.22
11	Solanaceae	4	36.12
12	Fumariaceae	1	32.8
13	Brassicaceae	3	32.37
14	Polygonaceae	2	35.69
15	Rubiaceae	1	23.39
16	Malvaceae	2	28.45
17	Acanthaceae	2	22.94
18	Primulaceae	1	18.6
19	Oxalidaceae	1	11.95
20	Nyctaginaceae	1	12.55
21	Labiateae	1	11.95
22	Asclepiadaceae	1	9.46
23	Orobanchaceae	1	7.14
24	Scrophulariae	1	6.73
25	Cannabinaceae	1	4.81
26	Zygophyllaceae	1	3.36
27	Cueurbitaceae	1	3.1
28	Portulaceae	1	2.93

Cirsium arvense and *Emex australis* were spreading aggressively in the crops. These weeds were well adapted under the prevailing environmental conditions of the area. It was probably due to the current cropping system that left unused resources, a niche vacuum within which weeds have adapted over short and long time periods. Weeds are well adapted because they produce excess, highly fit, offspring that can survive. Weeds are well adapted because they are highly diverse in terms of genotype, phenotype and fitness. This weed biodiversity and fecundity allows them to successfully exploit the niche vacuum left vacant in managed habitats. According to Radosevich and Holt (1984) the concept of niche denotes specialization and this specialization probably results from competition in a community. Key concepts in this statement are co-existence of species and species competition in a community (FAO, 1994).

A deadly weed *Parthenium hysterophorus* was recorded through out the study area, particularly along the road sides and field margins in form of thick stands. There is a strong likelihood that it will migrate from field margins into fields in the near future and become the part of cropping system.

Most of the noxious weeds were annuals. Any effort for controlling them must be made before flowering and one has to move quickly to successfully interrupt the cycle of seed production. Competition of weeds reduces the available resources of the environment. The observed dominance of some weeds might be due to their excellent competitive capability. *Asphodelus* and *Medicago* have better competitive capacity owing to strong under ground parts (Hussain *et al*., 1988). *Convolvulus arvensis*, a perennial herb, rapidly colonize the area because of high rate of seed production and extensive root system (Holm *et al*., 1977).

Many weeds were recorded from all the four crops. This shows their wide range of ecological amplitude. A weed may be regularly recorded in many crops provided their ecological ranges and phenological cycles overlap with each other (Hussain and Malik, 1986).

According to family importance value Asteraceae, Papilionaceae and Poaceae were leading with importance values 193, 115.34 and 105.92, respectively (Table 2). Other families with importance value up to 50 were Boraginaceae (68.83), Chenopodiaceae (53.65) and Liliaceae (51.39) (Table 2). The

family with high importance value was most important although it had less number of species e.g., the family Papilionaceae had importance value 115.34 with only 7 species but Poaceae had importance value 105.92 with 11 species. This is because species occurring in different families differ in their ecological status. A family with a single species had a high importance value as compared to families with more than one species e.g., Liliaceae had importance value of 51.39 with one species, i.e., *A. tenuifolious*.

Some of the recorded species such as *Cynodon* (Cho and Young, 1975), *Dicanthium* (Drivi and Hussain, 1979), *Euphorbia* (Hussain and Khattak, 1985), *Eragrotis* (Hussain *et al*., 1984), *Rumex* (Khan, 1983), C*irsium* (Hussain *et al*., 1987) have been recognized as allelopathic. *Cirsium arvense* was considered as noxious weed in 34 states of United States (Eskelsen and Grabtree, 1995). Recently *C. arvense*, *Convolvulus arvensis*, *S. halepense* and *Centaurea* spp. were reported among the 10 most noxius weeds in United States (Skinner *et al*., 2000). Some of the weeds (*Cynodon dactylon*, *Convolvulus arvensis*, *S. halepense*, *Portulaca oleracea*, *Elusine indica* and *C. album*) were placed among 18 worst weeds of the world (Holm *et al*., 1977). Gafoor *et al*. (1987) listed *S. halepense*, *C. dactylon*, *Convolvulus arvensis*, *Desmostachya bipinnata* and *C. oxycantha* as ten most important weeds of Pakistan.

Weeds are as old as the evolution of man and crops and have evolved parallel with the latter (Hussain *et al*., 1982). The present study reported the noxious weeds of winter crops in district Chakwal of Pakistan. There is crucial need to control them as the area is rainfed and in such environment even a small quantity of moisture taken away by weeds could prove detrimental to crops (Chaudhri, 1987). According to Radosevich and Holt (1984) weeds and crops co-exist and we want to avoid the co-existence with weeds. Thus weed management should maximize the resources allocated to crop plants and minimize those available for weeds. An integrated weed management could be useful in this aspect.

References

Ali, S.I. and M. Qaiser, 1994-2003. Flora of Pakistan. Karachi University, Karachi.

Anonymus, 2000. Annual Report. Deputy Director Agriculture Chakwal, Government of Punjab.

Ashiq, M., M.M. Nayyar and M.L. Shah, 1996. Weeds of the crops and their control. Ayub Agriculture Research Institute, Faisalabad, Pakistan.

Batlla, D. and R.L. Benech-Arnold, 2006. The role of fluctuations in soil water content on the regulation of dormancy changes in buried seeds of *Polygonum aviculare* L. Seed Sci. Res., 16: 47-59.

Chaudhri, M.Y., 1987. The weeds- a constraint to productivity. Prog. Farm., 7: 6-9.

Chou, C. and C. Young, 1975. Phtotoxic subtance in twelve sub-tropical grasses. J. Chem. Ecol., 1: 183-193.

Dirvi, G.A. and F. Hussain, 1979. Allelopathic effects of *Dicanthium* (Forss K.) Stapf. on some cultirated plants. Pak. J. Sci. Ind. Res., 22: 194-197.

Eskelsen, S. and G.D. Grabtree, 1995. The role of allelopathy in buck wheat (*Fagopyrum sagittatum*) inhibition of canada thistle (*Cirsium arvense*) weed. Weed Sci., 43: 70-74.

FAO., 1994. Weed Management for Developing Countries. Food and Agriculture Organization of the United Nations, Rome 120.

Frick, B. and A.G. Thomas, 1992. Weed survey in different tillage systems in South Western, Ontaria, field crops. Can. J. Plant Sci., 72: 1337-1347.

Gafoor, A., K.A. Shad and M.A. Sher, 1987. Ten most important weeds of Pakistan. Prog. Farm., (PARC), 7: 17-20.

Gupta, O.P., 1987. Predominant weeds of Indian Agriculture. Advances In Weed Science. A case of Indo-Pak Subcontinent. Proceedings of Pak-Indo-US Weed Control Workshop, NARC, Islamabad, pp: 309-317.

Holm, L.M., D.L. Plucknett, J.V. Pancho and J. Herberger, 1977. The World's Worst Weeds. University Press of Hawaii, Honolulu.

Hussain, F. and S.K. Khattak, 1985. Allelopathic effect of Pakistani Weeds. *Euphorbia helioscopia*. 1st Nat. Weed Sci. Workshop. N.A.R.C., Islamabad.

Hussain, F. and Z.H. Malik, 1986. Distribution of some weeds in maize fields of Kotli, Azad Kalhmir. Sar. J. Agric., 2: 561-569.

Hussain, F., S.R. Chughtai and A.A. Dasti, 1982. Occurrence and identification of weeds in tobacco (*Nicotiana rustical*.) fields of Pishin (Baluchistan). Pak. J. Agric. Res., 3: 195-201.

Hussain, F., T.W. Khan and A. Hussain, 1987. Allelopathic effects of *Cirsium arvense* (L) Scop. Mod. Trends Plant Sci. Pak., pp: 24-28.

Hussain, F., M.Z. Qureshi and S. Shaukat, 1988. Studies on some weeds in wheat fields of Hazra. District Attak. Pak. J. Agric. Res., 10: 273-278.

Hussain, F., M.I. Zaidi and S.R. Chughtai, 1984. Allelopathic effects of Padistani weeds: *Eragrostis poaeoides* P. Beauv. Pak. J. Sci. Ind. Res., 27: 159-164.

Khan, F.M., 1983. Allelopathic effects of *Rumex dentatus* L. M.Sc. Thesis, Peshwar Unversity, Peshwar.

McCully, K.V., M.G. Sampson and A.K. Watson, 1991. Weed survey of Nova Scotia lowbush bluebery (*Vaccinium angustifolium*) fields. Weed Sci., 39: 180-185.

Majid, A., R.A. Shad and S. Islam, 1998. Enhancing wheat production with better weed management. Sci. Technol. Develop., 4: 14-20.

Malik, A.K., 1999. Annual report. Soil and Water testing laboratory Chakwal. Punjab, Pakistan.

Mortimer, A.M., 1990. The Biology of Weeds. In: Hance, R.J. and K. Holly (Eds.), Weed Control Handbook: Principles, 8th Edn., Blackwell Scientific publications. pp: 1-42.

Nasir, E. and S.I. Ali, 1971-1993. Flora of Padistan No. 1-172. Pak. Agric. Res. Council, Islamabad.

Radosevich, S.R. and J.S. Holt, 1984. Weed Ecology Implications for Vegetation Management. John Wiley and Sons, New York.

Reddy, T.Y. and G.H.S. Reddi, 2001. Principles of Agronomy. Kalyani Publishers, Ludhiana.

Singh, H.P., D.R. Batish, S. Kaur and R.K. Kohli, 2003. Phytotoxic interference of *Ageratum conyzoides* with wheat (*Triticum aestivum*). J. Agron. Crop Sci., 189: 341-346.

Skinner, K., L. Smith and P. Rice, 2000. Using noxious weed lists to prioritize targets for developing weed management strategies. Weed Sci., 48: 640-644.

Smith, R.L. and T.H. Smith, 1998. Elements of Ecology, The Benjamin/Cummings Publishing Company, Inc. 2725 Sand Hill Road, Menlo Park, pp: 267-312.

Stefanic E., I. Stefanic and A.J. Murdoch, 2005. Response of a weed community to different management practice in field bean. J. Plant Dis. Prot., 112: 437-446.

Stewart, R.R., 1972. An Annotated Catalogue of Vascular plants of West Pakistan and Kashmir. Fakhri Printing Press, Karachi, Pakistan.

Tefera, T., 2002. Allelopathic effects of *Parthenium hysterophorus* extracts on seed germination and seedling growth of Eragrostis tef. J. Agron. Crop Sci., 188: 306-310.

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