Pak. J. Bot., 41(1): 239-245, 2009.

WEED COMMUNITIES OF WHEAT CROP IN DISTRICT TOBA TEK SINGH, PAKISTAN

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Abstract

Weed communities of wheat crop were determined using quadrate method at 5 different wheat growing localities of District Toba Tek Singh, during Rabi season 2006-07. A total of 38 weed species distributed across 35 genera and 17 families were recorded. Grassy weeds were constantly present in all the selected sites. *Phalaris minor* and *Avena fatua* were found the most dominant and frequent weed species with an average frequency of 84 and 72% respectively. The dominant families in terms of species were Asteraceae (7 spp.), Fabaceae, Poaceae (6 spp. each) and Chenopodiaceae (4 spp.). Based on Importance Value Index (IVI), five communities viz., 1) *Avena-Phalaris-Chenopodium* in Gojra, 2) *Phalaris-Avena-Polypogon* in Kamalia, 3) *Phalaris-Spergula-Avena* in Pir Mahal, 4) *Polypogon-Avena-Phalaris* in Sandhelian Wali and 5) *Avena-Polypogon-Chenopodium* in Toba Tek Singh were established.

Introduction

Wheat bears a key position and the most important cereal and staple food crop of Pakistan sharing 13.7% to the value added in agriculture and 3% to GDP. It is cultivated over an area of 8303 thousand hectares (Anon., 2005). Pakistan is the 10th largest wheat producing country, contributing about 2% of global wheat supply.

Weed infestation is one of the major impediments to wheat yield including diseases, pest and climatic influences. They consume available moisture, nutrients and compete for space and sunlight with crop plants and result in yield reduction (Khan *et al*., 2004). They are constant component of our agro-ecosystem and are generally controlled using mechanical method (Powell & Justum, 1993). However, many seeds of exotic species are introduced in many regions accidentally and some of them may become component of natural flora of the area (Werger, 1997; Jauzein, 1998; Maillet & Lopez-Garcia, 2000). It is estimated that in Pakistan, the annual losses in wheat grains due to weeds could be amounting to more than Rs. 28 billion (Hassan & Marwat, 2001).

It has long been recognized that man made activities are exposing the environment to invasion by alien species, which is attributed to habitat heterogeneity, frequent and diverse disturbances, and intensive propagule pressure typical of that environment (Gilbert, 1989; Kowarik, 2003). Weeds decrease the crop yield by competing for water, nutrients, space and light; whereas, some weeds also have allelopathic effects on crops (Shah & Khan, 2006). They compete for available N supply and light in the early growth stage (Cousens, 1996) and for soil moisture during grain filling, reducing both vegetative dry matter and grain yield (Mason & Madin, 1996). Previously, Qureshi & Bhatti (2001a, 2001b and 2001c), Qureshi et al., (2001a, 2001b) and Qureshi (2006) have reported floristic and phytosociological account of the weeds of wheat, onion, sugarcane and tomato crops from Sukkur and Rahim Yar Khan districts respectively. Various studies on

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weeds of wheat crop have been reported from different corners of the country i.e., Dir (Ayaz *et al.*, 1993), Chitral (Hussain *et al.*, 2004), Khairpur (Jakhar *et al.*, 2005), Toba Tek Singh (Mohammad *et al.*, 2005) and Sawat (Naveed & Hussain, 2007). Present paper reports the distribution of weed species and their possible association within the study area and will be helpful for recognizing the severity of weed infestation in wheat crop and weed competition in the area.

Materials and Methods

Five wheat growing localities viz.: 1) Gojra, 2) Kamalia, 3) Pir Mahal, 4) Sandhelian Wali and 5) Toba Tek Singh, all within the radius of 20 Km^2 from Toba Tek Singh were surveyed during 2006-07. The plant species were identified with the help of authentic available literature (Nasir & Ali, 1972-1994; Ali & Qaiser, 1995-2007).

Fifty quadrates each measuring $1m^2$ size were randomly placed in each locality for density, frequency and cover of each weed species. These values were computed to get Importance Value Index (IVI). Weed communities were constructed from selected study sites having highest IVI. Each weed community was named on the basis of first three dominants (Qureshi & Bhatti, 2001a). Local inhabitants were interviewed to get vernacular names of these weeds.

Results and Discussion

Weed flora of the study area is comprised of 38 species including 8 monocots distributed across 35 genera and 17 families. The dominant families contributing to weed flora were Asteraceae (7 spp.) followed by Fabaceae, Poaceae (6 spp. each) and Chenopodiaceae (4 spp.) while, other families had fewer species (Table 1). The weed species *Phalaris minor* and *Avena fatua* were found the most frequent with an average frequency of 84% and 72% respectively (Table 2). On the basis of IVI, five weed communities determined in all the five localities are 1) *Avena-Phalaris-Chenopodium* in Gojra, 2) *Phalaris-Avena-Polypogon* in Kamalia, 3) *Phalaris-Spergula-Avena* in Pir Mahal, 4) *Polypogon-Avena-Phalaris* in Sandhelian Wali and 5) *Avena-Phalaris-Chenopodium* in Toba Tek Singh were recognized (Table 2). The dominant species within these communities were *Phalris minor, Polypogon fugax, Avena fatua, Spergula arvensis* and *Chenopodium album*. The total importance value (TIV) was in the order of Kamalia (135.81) > Gojra (127.2) > Sandhelian Wali (116.01) > Pir Mehal (111.21) and Toba Tek Singh (107.52). Within the sites, Gojra and Toba Tek Singh possessed the same type of weed communities. This resemblance could be due to similar nature of soil and climatic conditions. The total importance value (TIV) was higher in Gojra than the Toba Tek Singh.

The most frequently distributed species was *Phalaris minor* with a constancy percentage of 84, followed by *Avena fatua, Polypogon fugax, Carthamus oxycantha, Rumex dentatus, Convolvulus arvensis, Melilotus indica* and *Spergula arvensis* with the constancy percentages ranging from 43-72 (Table 2). The other widespread weed species found in all sites were *Chenopodium album, C. ficifolium, Cirsium arvense, Cynodon dactylon, Phalaris minor* and *Polypogon fugax* due to the best adaptability in different edaphic and environmental conditions. Similar study conducted by Waheed *et al*., (2009) in wheat fields of district Rahim Yar Khan has reflected same weed community composition except *Chenopodium ficifolium* species that has not been recorded in that study.

Table 1. Share of plant families in the weed flora of wheat crop in District Toba Tek Singh.

S. No.	Family	No. of species	% Age
1.	Asteraceae	7	18.4
2.	Fabaceae	6	15.8
3.	Poaceae	6	15.8
4.	Chenopodiaceae	4	10.5
5.	Caryophyllaceae	2	5.3
6.	Convolvulaceae	2	5.3
7.	Apiaceae	1	2.6
8.	Boraginaceae	1	2.6
9.	Brassicaceae	1	2.6
10.	Cyperaceae	1	2.6
11.	Euphorbiaceae	1	2.6
12.	Fumariaceae	1	2.6
13.	Liliaceae	1	2.6
14.	Polygonaceae	1	2.6
15.	Primulaceae	1	2.6
16.	Solanaceae	1	2.6
17.	Verbenaceae	1	2.6

The highest number of weeds were observed in Sandhelian Wali (34 spp.), followed by Kamalia (33 spp.) (Table 2). Due to loamy nature of soils and well irrigated areas, almost equal numbers of weeds were recorded from aforementioned localities, while less number of weeds were found in Gojra (16 spp.). It may be attributed to saline nature of soil and less water availability for irrigation.

Hussain (1983) reported that weed species with high percentage of density and frequency might exert competitive and allelopathic stress to reduce growth and yield of associated crop. The weed flora composition of these communities has definitely negative impact for lowering the yield and its yield components. The weeds with less importance values cannot be underestimated in their impact upon desired crop yield and its yield components due to their possible allelopathic effects (Qureshi & Bhatti, 2001a).

Parthenium hysterophorus is reported as an emerging weed in the study area though it is well known weed and has already worldwide distribution in many countries of the world (Williams and Grovers, 1980). This species like other Asteraceous species has minute seeds armed with hairy attachment facilitating its dispersal by wind. It is therefore, spreading at an alarming pace in various parts of the country (Shah & Khan, 2006). Personal communication with the farmers indicated that this species has been observed in the area for last three years. They further reported that this species can be controlled only in very early growth stages through chemical spray.

Avena ftua and *Phalaris minor* are very noxious and constant weeds of wheat crop recorded from different parts of the country (Qureshi & Bhatti, 2001, Hassan *et al.*, 2003; Marwat *et al.*, 2006). Moreover, these weeds are hardy in nature and wide ecological amplitude. These weeds have been reported to cause highest yield reduction in wheat crop (Wilson, 1985; Marwat *et al*., 2006).

It is generally considered that yield losses in wheat crop are either due to high population of weeds or environmental influences. The heavy weed pressure not only reduces grain yield significantly, but also has a detrimental effect on the following crops due to an unmanageable weed population (Lemerle *et al*., 1996).

Table 2. Weed species, their vernacular names, Importance Value Index (IVI) and constancy of weeds of wheat crop in Toba Tek Singh District.

S. No.	Botanical name	Family	Local name	IVI/Localities/community					Constancy
				G	K	P	S	T	
				APC	PAP	PSA	PoAP	APC	
1.	*Alhagi maurorum* Medic.	Fabaceae	Juwanha	2.88	0	1.17	2.58	0	16
2.	*Anagalis arvensis* Linn.	Primulaceae	Bili Buti	5.28	3.54	5.28	4.68	0	31
3.	*Asphodelus tenuifolius* Cavan.	Liliaceae	Piazi	4.44	4.68	5.73	0	0	21
4.	*Avena fatua* Linn.	Poaceae	Jangli Jai	42.6*	40.47**	32.7***	38.04**	43.71*	72
5.	*Carthamus oxycantha* Linn.	Asteraceae	Pohli	5.19	3.54	9.12	6.03	6.03	54
6.	*Centella asiatica* (Linn.) Urban	Apiaceae	Mandi Buti	0	5.07	4.86	0	0	10
7.	*Chenopodium album* Linn.	Chenopodiaceae	Bathu	38.73***	4.41	7.83	12	21.63***	33
8.	*Chenopodium ficifolium* Sm.	Chenopodiaceae	Bathu	19.5	3.54	7.83	5.4	6.27	27
9.	*Chenopodium murale* Linn.	Chenopodiaceae	Karund	0	2.22	3.93	4.26	7.59	18
10.	*Cirsium arvense* (Linn.) Scope.	Asteraceae	Leh	7.11	5.28	12.33	5.49	9.96	16
11.	*Convolvulus arvensis* Linn.	Convolvulaceae	Lehli	16.29	5.58	11.43	9.54	9.18	45
12.	*Conyza canadensis* (Linn.) Conquist.	Asteraceae	Gidar Buti	0	2.37	0	2.4	0	8
13.	*Coronopus didymus* (Linn.) Smith.	Brassicaceae	Jangli Halon	0	6.45	6.18	8.22	0	11
14.	*Cressa cretica* Linn.	Convolvulaceae	Rudranti	0	0	5.28	0	0	5
15.	*Cynodon dactylon* (Linn.) Pers.	Poaceae	Khabbal Ghaas	15.45	13.2	16.32	17.28	13.26	39
16.	*Cyperus rotundus* Linn.	Cyperaceae	Dela	0	7.95	7.32	7.35	0	33
17.	*Dichanthium annulatum* (Forsskal) Stapf.	Poaceae	Wansi Ghaas	0	3.06	9.69	6.6	0	22
18.	*Eclipta prostrata* (Linn.) Linn.	Asteraceae	Daryai Buti	0	3.06	0	0	0	8
19.	*Euphorbia protrata* Ait.	Euphorbiaceae	Hazar Dani	0	5.22	0	3.69	6.96	12
20.	*Fumaria indica* (Haussk.) Pugsely.	Fumariaceae	Shahtara	2.85	3.93	0	4.14	0	10
21.	*Heliotropium europeum* Linn.	Boraginaceae	Hathi Sund	0	2.07	6.27	3.12	5.64	6
22.	*Lathyrus aphaca* Linn.	Fabaceae	Jangli Matar	0	4.08	0	2.76	0	9

Table 2 (Cont'd.).

S. No.	Botanical name	Family	Local name	IVI/Localities/community					Constancy
				G	K	P	S	T	
				APC	**PAP**	**PSA**	**PoAP**	**APC**	
23.	*Launaea procumbens* (Roxb) Ramayya & Rajagopal.	Asteraceae	Dudak	0	2.22	0	2.25	6.57	19
24.	*Leptochloa panicea* (Retz.) Ohwi.	Poaceae	Kalar Ghaas	0	0	9.78	2.58	3.72	28
25.	*Medicago polymorpha* Linn.	Fabaceae	Mena	0	7.08	7.11	9.36	8.79	28
26.	*Melilotus alba* Medik.	Fabaceae	Sinjhi	0	3.24	0	4.53	0	12
27.	*Melilotus indica* (Linn.) All.	Fabaceae	Sinjhi	26.25	28.59	11.85	10.11	19.74	45
28.	*Parthenium hysterophorus* Linn.	Asteraceae	----	0	5.46	7.2	8.13	0	18
29.	*Phalaris minor* Retz.	Poaceae	Dumbi Sitti	45.87**	58.95*	42.39*	35.76***	71.7	84
30.	*Phyla nodiflora* (Linn.) Green.	Verbenaceae	Bukan	0	3.9	3.45	3.54	0	10
31.	*Polygonum plebejum* R. Br.	Polygonaceae	Hazar Dani	9.81	5.94	0	3.24	0	8
32.	*Polypogon fugax* Nees ex Steud.	Poaceae	Phamb	31.65	36.39***	23.55	42.21*	42.18**	67
33.	*Rumex dentatus* Linn.	Chenopodiaceae	Jangli Palak	17.55	7.77	5.28	5.67	6.03	52
34.	*Solanum nigram* Linn.	Solanaceae	Mako	0	2.22	0	2.25	0	5
35.	*Sonchus asper* (Linn.) Hill.	Asteraceae	Dodak	4.05	2.22	0	3.45	3.93	11
36.	*Spergula arvensis* Linn.	Caryophyllaceae	----	0	0	36.12**	23.34	7.11	43
37.	*Vaccaria pyramidata* Medik.	Caryophyllaceae	Takla	0	3.93	0	0	0	8
38.	*Vicia hirsuta* (Linn.) S.F. Gray.	Fabaceae	Jangli Matri	4.5	2.37	0	0	0	9
				300	300	300	300	300	
			TIV	**127.2**	**135.81**	**111.21**	**116.01**	**107.52**	
	Total No. of species			**16**	**33**	**26**	**34**	**19**	

Key: *, **, *** indicate 1st, 2nd and 3rd dominants within each locality; G= Gojra; K= Kamalia; P= Pir Mahal; S= Sandhilian Wali and T= Toba Tek Singh. Communities: APC= *Avena-Phalaris-Chenopodium;* PAP= *Phalaris- Avena- Polypogon;* PSA= *Phalaris- Spergula-Avena;* PoAP= *Polypogon- Avena- Phalaris;* APC= *Avena-Phalaris-Chenopodium.*

Many weeds ripened and harvested with the wheat result in an amalgamation of their seeds with wheat grains. The species *Asphodelus tenuifolius*, *Avena fatua* and *Convolvulus arvensis* are obnoxious weeds to wheat crop. These species are also reported from Sukkur (Qureshi & Bhatti, 2001a) and Khairpur (Jakhar *et al.*, 2005). These weeds have similar maturity time as wheat crop and are usually harvested along with wheat. As a result, they are disseminated/mixed with the wheat grains. The authors are of the view that this is the main reason for their consistency.

It is very difficult for the farmers to identify the obnoxious weeds due to their resemblance with the wheat plants in early stages, as the fields of this area are severely infested with the Monocot weeds especially *Phalaris minor, Avena fatua* and *Polypogon fugax*. These weed species were also reported from Sukkur (Qureshi & Bhatt, 2001a) Khirpur (Jakhar *et al.*, 2005) and Rahim Yar Khan (Qureshi, 2006).

From this study it is clearly evident that wheat crop in this area is heavily infested with weeds that may cause huge losses to yield of wheat crop. The weed species dominantly inhabiting this area are common problems in almost all wheat growing areas of Punjab including Rahim Yar Khan, Bahawalpur (unpublished data) and Toba Tek Singh. It is suggested that this problem must be addressed by all the concerned quarters to eradicate/control these weeds by adapting appropriate measures including cultural, mechanical, biological and chemical methods that would give huge boost to the wheat yield and will enable the nation to ascertain the food security to the masses.

Acknowledgements

The authors are thankful to Mr. Zunnurain (Field Assistant, FSC&RD, T.T. Singh) for help in data collection. The authors are also thankful to Dr. Abdul Khaliq Chaudhry and Prof. Dr. Farrukh Hussain for their encouragement and support in write up.

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(Received for publication 11 October 2008)