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WEED COMMUNITY DYNAMICS IN WHEAT CROP OF DISTRICT RAHIM YAR KHAN, PAKISTAN

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Abstract

A phytosociological survey of weeds was conducted during 2002 to check the severity of competition in wheat crop of district Rahim Yar Khan. A total of 37 weed species belonging to 33 genera and 17 families were recorded from the area under investigation. Five weed communities viz., 1) *Phalaris-Cirsium-Avena* in Bhong, 2) *Avena-Polypogon-Melilotus* in Hamidabad, 3) *Phalaris-Convolvulus-Chenopodium* in Machhka, 4) *Polypogon-Avena-Melilotus* in Rahim Yar Khan and 5) *Spergula-Rumex-Phalaris* in Tarinda Sawa-e-Khan were determined during this period. The dominant weed species among these communities were *Avena fatua, Chenopodium album, Cirsium arvense, Convolvulus arvensis, Coronopus didymus, Cynodon dactylon, Dichanthium annulatum, Melilotus indica, Phalaris minor, Polygonum plebejum, Polypogon fugax, Rumex dentatus and Spergula arvensis.* Grassy weeds were uniformly distributed throughout the selected areas in which *Phalaris minor* was found the most dominant and frequent weed species with Importance Value Index (IVI) of 55.13 and constancy percentage of 88. Other weed species such as *Avena fatua, Polypogon fugax, Melilotus indica, Cirsium arvense, Chenopodium album* and *Cynodon dactylon* were also uniformly observed with IVI ranging from 6.70-44.45%. *Frankenia pulverulenta* is proposed as a new emerging weed in saline sodic soils in the study area. This weed species has not been reported earlier as a weed in Pakistan.

Introduction

Wheat (*Triticum aestivum* L.) is the major staple food crop of Pakistan. Although wheat production has increased from last decade in our country but average yield does not go beyond 30-35% of its optimum potential and this rate is very low as compared to other developed countries of the world (Hussain *et al.*, 2007). Wheat yield is stagnant for the last seven years while population has increased with a rate of at least 2.5% per annum, from 137 million to 160 million between 1999-00 and 2005-06. To meet the rising demand, wheat production should be 18.86 million tons against present 16.8 million, a shortfall of 2.36 million tons (Hassan, 2007).

Weed intervention is one of the most important but less recognized constraints, causing low yield of wheat in Pakistan (Qureshi & Bhatti, 2001a). Weeds compete with the crop plants for nutrients, moisture, light, CO_2 and space, whereas many weeds also possess allelopathic effects against crops. The yield reduction due to weeds could be 17-50% in wheat grain (Anon., 1998). Marwat *et al*., (2006) stated that with the advent of short duration varieties, weeds infestation has become even more severe and the annual losses to wheat crop in Pakistan on monetary basis could be amounting to Rs. 28 billions.

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Weeds lower crop yield, increase cost to control insects and plant diseases, give poor quality products and create more water management problems and lower human efficiency (Shah & Khan, 2006). They further stated that besides contaminating seeds, weeds provide habitat for harmful insects and organisms and may also act as alternate hosts for pathogens and other organisms. Some of the weeds may be poisonous to livestock. The seeds of weeds may remain dormant and viable for 30-40 years and hard seed coat of the seed can resists adverse climate, diseases and soil conditions (Oudejan, 1994).

Keeping in view the importance of weeds, this study was conducted in district Rahim Yar Khan in order to record level of weed infestation in wheat crop of the area. Previously Qureshi & Bhatti (2001a, 2001b, 2001c) and Qureshi *et al.* (2001a, 2001b) have published floristic and sociological account of weeds of wheat, onion, sugarcane and tomato crops in Sukkur district. Various studies have been reported on the weeds of wheat crop from different ecological zones of the country (Ayaz *et al.*, 1993, 1995; Hussain *et al.*, 1993, 2003, 2004, 2007; Kakar *et al.*, 2001; Qureshi & Arain, 2003; Cheema *et al.*, 2005; Jakhar *et al.*, 2005; Mohammad *et al.*, 2005; Naveed & Hussain, 2007). Present study reports the current status of weed species that is their identification, distribution, association and constancy. The information about weed communities and their associations resulted from analytical values like density, frequency and cover was helpful for recognizing the severity of weed infestation in the area under investigation.

Materials and Methods

Five wheat cultivated localities viz.: 1) Bhong, 2) Hamidabad, 3) Machhka, 4) Rahim Yar Khan and 5) Tarinda Sawa-e-Khan of district Rahim Yar Khan all within radius of 10 km of Rahim Yar Khan city were surveyed during January to February 2002. Weed species were identified with the help of available literature (Jafri, 1966; Matthew, 1983; Nasir & Ali, 1972-1994; Ali, & Qaiser, 1995-2002).

Fifty quadrates each measuring $1m^2$ size were randomly placed in each locality for estimating density, frequency and cover %age of each weed species. Relative density, frequency and cover were computed to obtain Importance Value Index (IVI). Each weed community was named based on highest IVI with the first three dominants. Based on frequency %age, weed species were classified into Rare (1-20%), Occasional (21-40%), Frequent (41-60%), Abundant (61-80%) and Very Abundant (81-100%) after Hussain (2007).

Results

1. Weed flora: During the survey, 37 weed species belonging to 33 genera and 17 families were recorded. The major families which contributed to the weed flora of wheat crop were Poaceae (9 spp., 24.3%), Fabaceae (5 spp., 13.5%) and Asteraceae, Chenopodiaceae (4 spp., 10.8% each) (Table 1). Other families had fewer species.

2. Weed communities: Five weed communities viz., 1) *Phalaris-Cirsium-Avena* in Bhong, 2) *Avena-Polypogon-Melilotus* in Hamidabad, 3) *Phalaris-Convolvulus-Chenopodium* in Machhka, 4) *Polypogon-Avena-Melilotus* in Rahim Yar Khan and 5) *Spergula-Rumex-Phalaris* in Tarinda Sawa-e-Khan were determined (Table 2). In addition to major communities, *Coronopus-Polypogon- Cynodon* in Bhong, *Chenopodium-Cynodon-Dichanthium* in Hamidabad, *Cirsium-Melilotus-Polygonum* in Machhka, *Cynodon-Polygonum-Cirsium* in Rahim Yar Khan and *Cirsium-Melilotus-Cynodon* in Tarinda Sawa-e-Khan were found sub-communities in these areas.

Table 1. Share percentage of plant families in the weed flora of wheat crop in district RahimYar Khan.

S. No.	Family	No. of species	Percentage
1.	Poaceae	9	24.3
2.	Fabaceae	5	13.5
3.	Asteraceae	4	10.8
4.	Chenopodiaceae	4	10.8
5.	Convolvulaceae	2	5.4
6.	Solanaceae	2	5.4
7.	Boraginaceae	1	2.7
8.	Brassicaceae	1	2.7
9.	Caryophyllaceae	1	2.7
10.	Cyperaceae	1	2.7
11.	Euphorbiaceae	1	2.7
12.	Frankeniaceae	1	2.7
13.	Fumariaceae	1	2.7
14.	Liliaceae	1	2.7
15.	Polygonaceae	1	2.7
16.	Primulaceae	1	2.7
17.	Verbenaceae	1	2.7

Based on IVI, the dominant weed species among these communities were *Avena fatua, Chenopodium album, Cirsium arvense, Convolvulus arvensis, Coronopus didymus, Cynodon dactylon, Dichanthium annulatum, Frankenia pulverulenta, Melilotus indica, Polygonum plebejum, Polypogon fugax, Rumex dentatus* and *Spergula arvensis*. Grassy weeds were uniformly distributed throughout the selected areas in which *Phalaris minor* was found as the most dominant and frequent weed species with IVI of 55.13 and frequency percentage of 88 (Table 2). Other weed species such as *Avena fatua, Polypogon fugax, Melilotus indica, Cirsium arvense, Chenopodium album* and *Cynodon dactylon* were also uniformly observed with the IVI ranging from 10.95-44.45. The dominance of the determined communities was more or less same in all five localities. This could be due to similar nature of soils and climatic conditions of the selected areas.

The highest number of weeds (27 spp.) were recorded from Bhong. It was followed by Machhka (26 spp.), Tarinda Sawa-e-Khan (23 spp.), Hamidabad (22 spp.) and Rahim Yar Khan (20 spp.) during this period (Table 2). In addition, Total Importance Value (TIV) of weeds was also recorded from Rahim Yar Khan (TIV= 134.25) followed by Bhong (TIV= 119.28), Tarinda Sawa-e-Khan (TIV= 113.3), Machhka (TIV= 111.25) and Hamidabad (TIV= 110.3) (Table 2).

3. Constancy: *Phalaris minor* and *Melilotus indica* were observed very widespread species infesting the whole study area (Table. 2). These weed species showed highest frequency percentage and placed in Very Abundant (VA) class. Whereas, six species such as *Avena fatua, Desmostachya bipinnata, Chenopodium album, Convolvulus arvensis, Polypogon fugax* and *Cynodon dactylon* were marked as Abundant (A) in the area with the frequency percentages ranging from 62-78. The other weeds like, *Lathyrus aphaca, Rumex dentatus, Cyperus rotundus, Chenopodium murale, Spergula arvensis* and *Asphodelus tenuifolius* were Frequent (F) with frequency percentages ranging from 41-56 (Table 2). In all, there were equal number of weeds classified under Abundant and Frequent classes (16%) whereas, almost equal number of weed species were grouped under Occasional and Rare.

Table 2. Showing Importance Value Index (IVI) of weeds of wheat crop in district Rahim Yar Khan.

S. No.	Botanical name	Family	IVI/Localities/community					Constancy
			B	H	M	R	T	
			PCA	APM	PCC	PAM	SRP	
1.	*Alhagi maurorum* Medic.	Fabaceae	8.65	6.65	0.00	6.76	7.75	35
2.	*Anagalis arvensis* Linn.	Primulaceae	2.10	0.00	2.65	0.00	0.00	36
3.	*Asphodelus tenuifolius* Cavan.	Liliaceae	10.24	0.00	3.50	3.25	0.00	41
4.	*Avena fatua* Linn.	Poaceae	28.25 [c]	40.90 [a]	3.57	44.45 [b]	8.75	78
5.	*Chenopodium album* Linn.	Chenopodiaceae	13.43	15.56	26.25 [c]	11.96	6.70	69
6.	*Chenopodium ambrioides* Linn.	Chenopodiaceae	0.00	0.00	8.95	0.00	4.45	25
7.	*Chenopodium murale* Linn.	Chenopodiaceae	6.75	3.75	0.00	0.00	5.98	49
8.	*Cirsium arvense* (Linn.) Scope.	Asteraceae	35.90 [b]	4.56	25.15	11.65	16.12	38
9.	*Convolvulus arvensis* Linn.	Convolvulaceae	3.21	0.00	34.25 [b]	8.75	3.75	65
10.	*Coronopus didymus* (Linn.) Smith.	Brassicaceae	17.01	0.00	12.75	0.00	0.00	35
11.	*Cressa cretica* Linn.	Convolvulaceae	0.00	0.00	0.00	0.00	4.75	15
12.	*Cynodon dactylon* (Linn.) Pers.	Poaceae	15.00	13.97	10.65	13.65	10.95	62
13.	*Cyperus rotundus* Linn.	Cyperaceae	9.41	6.75	4.65	8.75	0.00	51
14.	*Desmostachya bipinnata* (Linn.) Stapf.	Poaceae	5.50	0.00	5.67	0.00	6.65	76
15.	*Dichanthium annulatum* (Forsskal) Stapf.	Poaceae	13.97	12.86	9.75	0.00	6.65	35
16.	*Eclipta prostrata* (Linn.) Linn.	Asteraceae	0.00	3.21	7.78	3.65	0.00	22
17.	*Eragrostis minor* Host.	Poaceae	6.45	5.69	4.54	0.00	6.78	33
18.	*Euphorbia prostrata* Ait.	Euphorbiaceae	2.75	6.76	5.45	7.87	6.45	8
19.	*Frankenia pulverulenta* Linn.	Frankeniaceae	0.00	0.00	0.00	0.00	25.95	11
20.	*Fumaria indica* (Haussk.) Pugsely.	Fumariaceae	4.53	0.00	3.57	0.00	0.00	16

Table 2. (Cont'd.).

S. No.	Botanical name	Family	IVI/Localities/community					Constancy
			B	H	M	R	T	
			PCA	APM	PCC	PAM	SRP	
21.	*Heliotropium europeum* Linn.	Boraginaceae	2.54	3.75	4.56	0.00	2.95	6
22.	*Lathyrus aphaca* Linn.	Fabaceae	4.54	7.98	8.65	0.00	4.65	56
23.	*Launaea procumbens* (Roxb) Ramayya & Rajagopal.	Asteraceae	3.50	0.00	0.00	6.67	0.00	12
24.	*Leptochloa panicea* (Retz.) Ohwi.	Poaceae	0.00	0.00	0.00	0.00	11.75	5
25.	*Melilotus alba* Medik.	Fabaceae	5.75	11.45	0.00	6.76	0.00	2
26.	*Melilotus indica* (Linn.) All.	Fabaceae	13.65	33.65 [c]	18.90	42.45 [c]	15.89	83
27.	*Phalaris minor* Retz.	Poaceae	55.13 [a]	22.65	50.75 [a]	31.88	32.75 [c]	88
28.	*Phragmites karka* (Retz.) Trin.	Poaceae	0.00	0.00	0.00	13.21	0.00	25
29.	*Phyla nodiflora* (Linn.) Green.	Verbenaceae	4.25	23.45	7.98	7.87	0.00	11
30.	*Polygonum plebejum* R. Br.	Polygonaceae	0.00	16.78	14.45	12.45	0.00	15
31.	*Polypogon fugax* Nees ex Steud.	Poaceae	15.14	35.75 [b]	12.65	47.35 [a]	26.85	65
32.	*Rumex dentatus* Linn.	Chenopodiaceae	4.50	15.76	3.75	0.00	38.80 [b]	55
33.	*Solanum nigram* Linn.	Solanaceae	2.00	0.00	4.56	0.00	0.00	27
34.	*Solanum surattense* Burm.f.	Solanaceae	0.00	0.00	0.00	4.95	0.00	22
35.	*Sonchus asper* (Linn.) Hill.	Asteraceae	3.75	4.67	4.62	0.00	2.93	18
36.	*Spergula arvensis* Linn.	Caryophyllaceae	0.00	0.00	0.00	0.00	41.75 [a]	49
37.	*Vicia hirsuta* (Linn.) S.F. Gray.	Fabaceae	2.10	3.45	0.00	5.67	0.00	22
			300.00	300.00	300.00	300.00	300.00	
		TIV	**119.28**	**110.3**	**111.25**	**134.25**	**113.3**	0
Total number of weeds			**28**	**22**	**26**	**20**	**23**	0

Key: a, b and c indicate 1st, 2nd and 3rd dominants within each locality.
B= Bhong; H= Hamidabad; M= Machhka; R= Rahim Yar Khan & T= Tarinda Sawa-e-Khan
Communities: PCA= *Phalaris-Cirsium-Avena*; APM= *Avena-Polypogon-Melilotus*; PCC= *Phalaris-Convolvulus-Chenopodium*; PAM= *Polypogon-Avena-Melilotus*; SRF= *Spergula-Rumex-Phalaris*

Discussion

Hussain (1983) has stated that the species with high IVI and frequency might exert competition to reduce growth and yield of associated crop; however weeds with less IVI cannot be underestimated in their importance due to possible allelopathic effects on cultivated crop.

The noxious weeds have certain specific characteristics that help their survival better than other weeds. These characteristics may be deep root system (eg., *Alhagi maurorum, Desmostachya bipinnata, Phragmites karka*), different modes of propagation like suckers, bulbs and corns (eg., *Desmostachya bipinnata, Cynodon dactylon, Cyperus rotundus, Phragmites karka* and *Alhagi maurorum*) and twining habit (eg., *Convolvulus arvensis, Lathyrus aphaca*). These competitive characteristics enable them to consume large amount of habitat resources and deprive the cultivated plants. Mostly these weeds were observed in Kacha (flooded) areas like Bhong and Machhka. They obtain high moisture from these areas and flourish rapidly due to favorable climate.

The losses caused to agricultural crops by noxious weeds like *Avena fatua, Cyperus rotundus* and *Chenpodium album* are significant (Marwat *et al.*, 2006). It has been reported that increasing the density of *Phalaris minor* to 200 plants m^{-2} decreased the grain yield of wheat by 36% (Anon., 1992).

Qureshi & Arain (2003) have reported that many weeds such as *Asphodelus tenuifolius, Avena fatua, Carthamus oxycantha* and *Convolvulus arvensis* ripened and harvested with the wheat resulting in mixing of their seeds with wheat grains. Due to larger seed size, these seed cannot be separated from wheat seed. Such wheat grains are being used as wheat seeds resulting in their reappearance with wheat crop in the next growing season. The continuity of this phenomenon will increase the weed infestation and directly influences the crop production. Likewise, weeds like *Convolvulus arvensis, Lathyrus aphaca* and *Vicia hirsuta* climb over crop plants causing difficulty to cultural operations, harvesting and threshing. These widespread weeds have been reported from different areas of Pakistan (Ayaz *et al.*, 1995; Qureshi & Bhatti, 2001a; Hussain *et al.* 2003; Jakhar *et al.*, 2005; Cheema *et al.*, 2005; Hussain *et al.*, 2004; Naveed *et al.*, 2007).

In spite of their negative impact on yield, weeds have been used by local people for various purposes. For example *Avena fatua, Chenopodium album, Phalaris minor* and *Polypogon fugax* are extensively exploited as fodder/forage for livestock. *Chenopodium album* is cooked as vegetable. Local inhabitants utilize them for their daily requirements, which ultimately results to keep them under control.

Conclusion

The present study suggests that a variety of weeds are infesting the wheat crop quite heavily in district Rahim Yar Khan. The identified weed communities may cause great losses to yield of wheat crop. For acquiring the better yield, it is necessary to take appropriate measures including cultural, mechanical, biological and chemical for their control. This information regarding weed biology can be helpful for the selection of weed control methods.

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