

WEED DIVERSITY IN WHEAT FIELDS OF UPPER INDUS PLAINS IN PUNJAB, PAKISTAN

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ABSTRACT

Transact walks were carried out through randomly selected wheat fields of Upper Indus Plains, Punjab, Pakistan. Dominant weed in each wheat field was found different although general weed flora did not show much variability and in total 105 weed species belonging to 33 families were enlisted in these fields. Among these, sixty two species of 25 families were recorded in non- saline irrigated, seventy two of 25 families in riverian non-irrigated and fifty eight of 22 families in partially saline irrigated wheat fields. *Anagallis arvensis* L., *Avena fatua* L., *Chenopodium album* L., *Convolvulus arvensis* L., *Coronopus didymus* (L.) Smith, *Cynodon dactylon* (L.) Pers., *Medicago polymorpha* L., *Melilotus indica* (L.) All., *Phalaris minor* Retz. and *Rumex dentatus* L. were recorded from all fields. Some weeds like *Arundo donax* L., *Equisetum debile* L., *Lotus corniculata* L., *Persicaria barbata* (L.) Hara., *Phragmites karka* Trin ex Steud., *Saccharum bengalense* Retz., *Saccharum spontaneum* L., *Tamarix dioca* Roxb., *Typha angustata* Bory & Chaub. and *Veronica polita* Fries. were found dominant in riverian wheat fields, while *Alhagi maurorum* Medic., *Conyza ambigua* L., *Desmostachya bipinnata* (L.) Stapf. and *Erythrea ramosissima* (Vill.) Pers. were the inhabitants of both partially saline and riverians wheat fields. The weeds like *Atriplex schugnanica* Ilgin, *Cotula hemispherica* (Roxb.) Wall., *Cynoglossum micranthum* Desf., *Goldbachia laevigata* (M. Bieb.) D.C., *Heliotropium europaeum* L., *Heliotropium undulatum* Vahl., *Potentilla supina* L., *Salsola imbricata* Forssk, *Spergularia arvensis* L., *Spergularia marina* (L.) Grisch and *Sueda fructicosa* Forssk. were commonly found in partially saline soils and hence could be declared as more salt tolerant weed species as compared to other weeds. The early growing weeds like *Asphodelus tenuifolius* Cav. was not recorded during recent surveys except only at one site in village Mohlanwal. The ecological and management status of wheat fields could be responsible for weed diversity.

Key words: Indus plains, Pakistan, Punjab, salinity, weed diversity, wheat.

INTRODUCTION

Weeds are adapted to varying climatic and soil conditions. These are distributed everywhere and no crop is free of weeds. Weeds

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rob crops for soil nutrients and water, and compete with them for light, carbon dioxide and growing space. Weeds are silent robbers and hidden gangsters that upset the biological organization by encroaching the habitat of crops. When man first started deliberately growing plants for food, the concept of weeds as unwanted plants, reducing crop yield through competition was born (Hashim and Marwat, 2002). Weeds are the major pests of crop husbandry and are managed properly for realizing higher yield (Hassan and Marwat, 2001). Ross and Lembi (1999) defined weeds as the plants that interfere with the growth of desirable plants and that are unusually competitive, persistent and pernicious. They interfere with human activities and as a result are undesirable. These are plants, which are more harmful, even after their possible beneficial effects, undesirable in a particular situation and their removal is a source of economic, social, aesthetic and medical relief for human beings (Shad, 1994). Most of the weeds are either grasses belonging to the family Poaceae, sedges of family Cyperaceae or broad-leaved weeds of other monocot and dicot families of angiosperms. The number of weeds infesting the crop-fields is very large and the weed flora varies not only from area to area and season to season but also from field to field depending upon several factors. About 80 weeds are of prime importance in Pakistan in various crops.

Many present day's weeds (being the alien and invasive), viz. *Galium aparine*, *Lolium temulentum*, *Parthenium hysterophorus* L. etc. did not exist in the wilderness some years back. Such weeds were either brought by different invaders inadvertently or through seed import. The Onion Couch variety is a weed of arable land on medium textured soils (Khan, 1987). Major weeds of wheat reported by Oerke et al. (1994) include *Avena* spp., *Elytrigia repens*, *Cirsium arvensis* and *Convolvulus arvensis*. Major weeds of wheat in Australia are *Bromus diandrus*, *Lolium rigidum* and *Phalaris paradoxa*. *Phalaris minor* is a major problem of wheat in Pakistan. Other weeds associated with spring sown crops include *Polygonum* spp., *Chenopodium album*, *Stellaria media* and *Galeopsis tetrahit* (Salonen, 1992). Surveys of weeds of wheat in the United Kingdom identified *Avena* spp., *Elytrigia repens*, *Alopecurus myosuroides*, *Poa* spp., and *Bromus sterilis* as the predominant grass weeds and *Galium aparine*, *Viola arvensis*, *Stellaria media*, *Myosotis arvensis*, *Lamium purpureum*, *Veronica persica* and *Matricaria* spp. as the dominant annual broad-leaved weeds of winter wheat (Froud-Williams and Chancellor, 1982; Chancellor and Froud-Williams, 1984; Whitehead and Wright, 1989). In Southern Spain, Saavedra et al. (1989) reported that the most frequent grass weeds are *Avena sterilis*, *Lolium rigidum*, *Phalaris* spp., *Cynodon dactylon* and *Bromus diandrus*.

Bread wheat (*Triticum aestivum* L.) is a king cereal crop in all the agroecological zones of the World. It is staple food of masses and enjoys the pivotal position in the Pakistan agricultural system and occupying the largest area in Punjab, Pakistan of wheat cultivation during 2005-08 which was 6.10 million hectares ; producing 15.36 million tons. It contributes a major share of the agricultural economy of the country, providing around 72% of wheat to the national food basket every year.

Indus Plains is the most prosperous agricultural region of Pakistan and formed by the Indus River and its five tributaries, the Jhelum, Chenab, Ravi, Sutlej and Beas. It is extremely flat and has an average gradient towards the sea of only 19 centimetres per kilometre (Ghassemi *et al.*1995). The Indus River plains covers 1,48,000sq.km stretching over 1600 km across the length of the country from Sindh province in the East through the plains of Punjab to the mountains in the North East. The area north of Mithan Kot forms the Upper Indus Plain and is very fertile because of the soil brought in by the Indus River. A number of canals criss-cross the area, adding to the fertility of the land and producing cash crops. The prevailing arid to semi-arid environmental conditions with annual rainfall less than 254 mm over a vast area of Indus Plain resulting a greater evapotranspiration than precipitation and provides an ideal situation for the cultivation of wheat.

Little information is available in literature on the distribution of weeds in different habitats i.e. non saline & partially saline (irrigated) and riverian (non-irrigated) wheat fields. The present ecological studies on weedy species in this area are highly desirable and crucial in order to understand their mode of occurrence and persistence in nature, limit of their ecological distribution that might help to provide a base for the future extensive work on biology, ecology and ethnobotany. It was therefore, considered worthwhile to carry out the present investigation.

MATERIALS AND METHODS

Three main land forms of Punjab, i.e. Non-saline & partially saline(irrigated) and riverian (non-irrigated) in Faisalabad, Gujranwala, Kasur, Lahore, Okara and Sheikhpura districts of Upper Indus Plains, Punjab, Pakistan were visited frequently during 2005-10. The voucher specimens were collected and pressed in newspapers with the help of plant presser. Their common names were enquired from local people; locality and date of collection were recorded. News papers were changed from time to time to absorb water from the plants. The individual plant species were photographed as well as mounted on the herbarium sheets of standard size (35x40cm). The botanical

identification of weeds was accomplished from Dr. Sultan Ahmed Herbarium, Department of Botany, GC University, Lahore and National Herbarium, Islamabad. Nomenclature used have followed the Flora of Pakistan by Nasir and Ali (1970-2007) and Flora of West Pakistan by Stewart (1972). An up-to-date inventory of existing weedy species in different wheat fields was prepared alphabetically and voucher numbers were assigned to each of the weeds.

RESULTS AND DISCUSSION

Wheat was the major Rabi crop growing in these months throughout the present study area. Weeds inventory survey was conducted and presented in Table 1. A total of 105 weed species belonging to 33 families were enlisted in wheat fields of all agroecological conditions. Among these, sixty two species of 25 families were recorded in non- saline irrigated, seventy two of 25 families in riverian non-irrigated and fifty eight of 22 families in partially saline irrigated wheat fields. Some weeds like *Anagallis arvensis* L., *Avena fatua* L., *Chenopodium album* L., *Convolvulus arvensis* L., *Coronopus didymus* (L.) Smith, *Cynodon dactylon* (L.) Pers., *Medicago polymorpha* L., *Melilotus indica* (L.) All., *Phalaris minor* Retz. and *Rumex dentatus* L. were commonly found in almost all the fields from January to April. On the other hands weeds like *Arundo donax* L., *Equisetum debile* L., *Lotus corniculata* L., *Persicaria barbata* (L.) Hara., *Phragmites karka* Trin ex Steud., *Saccharum bengalense* Retz., *Saccharum spontaneum* L., *Tamarix dioica* Roxb., *Typha angustata* Bory & Chaub. and *Veronica polita* Fries. were only restricted to riverian wheat fields. *Atriplex schugnanica* Ilgin, *Cotula hemispherica* wall., *Cynoglossum micranthus* Desf., *Goldbachia laevigata* D.C., *Heliotropium europaeum* L., *Heliotropium undulatum* Vahl., *Potentilla supina* L., *Salsola imbricate* Forssk, *Spergula arvensis* L., *Spergularia marina* Griseb and *Sueda fruticosa* Forssk were identified from partially saline wheat fields while *Alhagi maurorum* Medic., *Conyza ambigua* L., *Desmostachya bipinnata* (L.) Stapf. and *Erythraea ramosissima* (Vill.) Pers. were the inhabitants of both patially saline and riverians wheat fields.

The most widespread weed species studied by Ahmad (1992), Marwat et al. (1993), Kaya and Zengin (2000), Khan et al. (2004) and Quershi and Memon (2008) were *Orobancha* spp., *Aeginetia* spp., *Christisonia* spp., *Cistanche* spp., *Loranthus* spp., *Arceuthobium* spp., *Viscum* spp. *Korthelsella* spp., *Monotropa* spp. *Cuscuta* spp. *Anagallis arvensis*, *Buglossoides arvensis*, *Fumaria indica*, *Maloclmia Africana*, *Convolvulus arvensis*, *Sinapis arvensis*, *Avena fatua*, *Chenopodium album*, *Anchusa azurea*, *Vaccaria pyramidata* var. *pyramidata*, *Vaccaria hispanica*, *Cirsium arvense* ssp. *vestitum*, *Polygonum*

convolvulus, *Fallopia convolvulus*, *Cephalaria syriaca*, *Atriplex patula*, and *Centaurea depressa*; *Trianthema* sp., *Phalaris minor*, *Cyperus* sp., *Echinochloa* sp. *Cyperus rotundus* L., *Brachiaria eruciformis* Griseb., *Dactyloctenium aegyptium* Willd, *Trianthema portulacastrum* L., *Eclipta prostrata* Ait., *Euphorbia hirta* Forssk., *Rhynchosia minima* DC. and *Cucumis melo* Naudin. Danijela and Zoran (2004) revealed that *Convolvulus arvensis* was the most prevalent weed.

Parthenium hysterophorus L. is rapidly replacing the local flora in the study area while *Desmostachya bipinnata* Stapf., *Saccharum bengalense* Retz., *Saccharum spontaneum* L. and *Tamarix dioca* Roxb. restrict the spread of this weed. This confirms the findings of Javaid and Anjum (2005). *Saccharum spontaneum* L. indicated a low diversity because of the dry and harsh environment present in the agro-ecosystem. From a comparison of current status of weed infestation it becomes very clear that due to change in cropping pattern, the early growing weeds like *Asphodelus tenuifolius* sometime very common in wheat fields have become almost weeds of the past, as we did not examine it during recent surveys but only at one site in village Mohlanwal, district Lahore and nowhere else. It is inferred that greater weed diversity was noted from non-irrigated riverian wheat fields. This contradict the findings of Paradkar, 1995, who reported that *Cynodon dactylon*, *Chenopodium album*, *Melilotus alba*, *Gnaphalium polycaulon*, *Anagallis arvensis*, *Sisymbrium irio* and *Vicia angustifolia* were the dominant weeds of irrigated wheat and major weeds of unirrigated wheat were *Cynodon dactylon*, *Gnaphalium polycaulon*, *Vicia angustifolia* and *Chenopodium album*, about 50% fewer weed species than in irrigated wheat. Dominant weed in each wheat field was found different although general weed flora did not show much variability. The ecological and management status of wheat fields could be responsible for weed diversity.

Table-1. Weed diversity in wheat fields of different agro-ecological conditions.

S.No	Botanical Name	Local Name	Family	Distribution		
				NS	PS	R
1	<i>Achyranthes aspera</i> L.	Puthkanda	Amaranthaceae	√		
2	<i>Ageratum conyzoides</i> L.	Nilum	Asteraceae	√		
3	<i>Agrostis pilosula</i> Trin.		Poaceae			√
4	<i>Alhagi maurorum</i> Medic.	Jawain	Papilionaceae		√	√
5	<i>Anagallis arvensis</i> L.	Bilibooti	Primulaceae	√	√	√
6	<i>Anethum graveolens</i> L.	Sowa, Soe	Umbelliferae	√		
7	<i>Arundo donax</i> L.	Narri	Poaceae			√
8	<i>Asphodelus tenuifolius</i> Cav.	Piazi, Bhugat	Asphodelaceae	√		
9	<i>Atriplex schugnanica</i> Ilgin	Kalar Boti	Chenopodiaceae		√	
10	<i>Avena fatua</i> L.	Jangli javi,	Poaceae	√	√	√
11	<i>Avena sativa</i> L.	Oat, Javi	Poaceae	√	√	√

S.No	Botanical Name	Local Name	Family	Distribution		
				NS	PS	R
12	<i>Brassica juncea</i> (L.) Czern.	Toria	Brassicaceae	√	√	√
13	<i>Brassica rapa</i> subsp. <i>compestris</i> (L.) Clap.	Sarson	Brassicaceae	√	√	√
14	<i>Bulboschoenus affinis</i> (Roth) Dr. (Syn. <i>Scirpus maritimus</i> L.)	Deela,	Cyperaceae		√	
15	<i>Calotropis procera</i> (Ait.) Ait.f.	Aak	Asclepiadaceae	√	√	√
16	<i>Cannabis sativa</i> L.	Bhang	Cannabaceae	√		
17	<i>Carthamus oxycantha</i> Bieb.	Pohli	Asteraceae	√	√	√
18	<i>Chenopodium album</i> L.	Bathu	Chenopodiaceae	√	√	√
19	<i>Chenopodium murale</i> L.	Krund	Chenopodiaceae	√	√	√
20	<i>Chrozophora tinctoria</i> Sensu St.	Unth chara	Euphorbiaceae			√
21	<i>Cichorium intybus</i> L.	Kasni	Asteraceae	√		√
22	<i>Cirsium arvensis</i> (L.) Scop. (Syn. <i>Breea/Nicus arvensis</i> L.)	Kandyari	Asteraceae	√	√	√
23	<i>Convolvulus arvensis</i> L.	Lehli	Convolvulaceae	√	√	√
24	<i>Conyza ambigua</i> L.	Paleet	Asteraceae		√	√
25	<i>Conyza canadensis</i> (L) Cronquist (Syn. <i>Erigeron canadensis</i> L.)	Mereri	Asteraceae	√	√	
26	<i>Coronopus didymus</i> (L.) Smith	Jangli halan	Brassicaceae	√	√	√
27	<i>Cotula hemispherica</i> (Roxb.) Wall. ex Benth. & Hook. f.		Asteraceae		√	
28	<i>Croton bonplandianum</i> Baill.		Euphorbiaceae			√
29	<i>Cynodon dactylon</i> (L.) Pers.	Ghass	Poaceae	√	√	√
30	<i>Cynoglossum micranthum</i> Desf.		Boraginaceae		√	
31	<i>Cyperus iria</i> L.		Cyperaceae			√
32	<i>Cyperus rotundus</i> L.	Deela, metha	Cyperaceae	√	√	√
33	<i>Desmostachya bipinnata</i> (L.) Stapf.	Dhabb	Poaceae		√	√
34	<i>Dichanthium annulatum</i> (Forssk.) Stapf.	Palwan	Poaceae			√
35	<i>Echinops echinatus</i> Roxb.	Brugh	Asteraceae	√		√
36	<i>Equisetum debile</i> Roxb.	Horsetail	Equisetaceae			√
37	<i>Eruca sativa</i> Mill.	Tara mira	Brassicaceae	√	√	√
38	<i>Erythraea ramosissima</i> (Vill.) Pers.		Gentianaceae		√	√
39	<i>Euphorbia helioscopia</i> L.	Chandni buti	Euphorbiaceae	√	√	
40	<i>Euphorbia prostrata</i> Ait.	Lal Dodak	Euphorbiaceae	√	√	
41	<i>Fumaria indica</i> (Hausk.) Pugsley.	Pit papra or Shahtra	Fumariaceae	√	√	√
42	<i>Galium aparine</i> L.	Catchweed	Rubiaceae	√	√	√
43	<i>Goldbachia laevigata</i> (M.Bieb.) DC.	Khulef	Brassicaceae		√	
44	<i>Heliotropium europaeum</i> L.	Karera	Boraginaceae		√	
45	<i>Heliotropium undulatum</i> Vahl.	Hathi Sunda	Boraginaceae		√	
46	<i>Lactuca scariola</i> L.	Salad	Asteraceae	√		
47	<i>Lathyrus aphaca</i> L.	Jangli matter	Papilionaceae	√	√	√
48	<i>Lathyrus sativus</i> L.	Jangli matter	Papilionaceae	√		
49	<i>Launaea procumbens</i> (Roxb.)	Pili dodhak	Asteraceae	√		

S.No	Botanical Name	Local Name	Family	Distribution		
				NS	PS	R
	Ramayya & Rajagopal					
50	<i>Linum usitatissimum</i> L.	Alsi	Linaceae	√		
51	<i>Lolium temulentum</i> L.	Rye grass	Poaceae	√	√	√
52	<i>Lotus corniculata</i> L.	Kasni	Papilionaceae			√
53	<i>Malcolmia africana</i> (L.) R. Br.	Chambar	Brassicaceae	√	√	
54	<i>Malva parviflora</i> L.	Sonchal	Malvaceae	√	√	√
55	<i>Mazus pumilus</i> (Burm.f.) Van Steenis (Syn. <i>Mazus rugosus</i> L)		Scrophulariaceae	√		
56	<i>Medicago lupulina</i> L.	Safaid maina	Papilionaceae		√	√
57	<i>Medicago polymorpha</i> L. (Syn. <i>Medicago denticulata</i> Willd)	Maina	Papilionaceae	√	√	√
58	<i>Melilotus alba</i> Desf.	Senji	Papilionaceae			√
59	<i>Melilotus indica</i> (L.) All. (Syn. <i>Melilotus parviflora</i> Desf.)	Senji	Papilionaceae	√	√	√
60	<i>Mentha royleana</i> Benth.	Podina Sufaid	Labiatae	√		
61	<i>Nicotiana plumbaginifolia</i> Viv.	Jngli taboco	Solanaceae			√
62	<i>Oxalis corniculata</i> L.	Khatti booti	Oxalidaceae	√		√
63	<i>Papaver somniferum</i> L.	Post	Papaveraceae			√
64	<i>Parthenium hysterophorus</i> L.	Congrass	Asteraceae	√	√	√
65	<i>Persicaria barbata</i> (L.) Hara (Syn. <i>Polygonum barbatum</i> L.)	Mirchi	Polygonaceae			√
66	<i>Phalaris minor</i> Retz.	Dumbi grass	Poaceae	√	√	√
67	<i>Phragmites australis</i> (Cav.) Trin ex Steud.	Dila	Poaceae			√
68	<i>Phragmites karka</i> Trin ex Steud	Naru, Nara	Poaceae			√
69	<i>Poa annua</i> L.	Barik grass	Poaceae	√	√	√
70	<i>Polygonum plebejum</i> R.Br.	Drank	Polygonaceae	√	√	√
71	<i>Polygonum monspeliensis</i> (L.) Desf.	Malhar, Dumbhi	Poaceae	√	√	√
72	<i>Potentilla supina</i> L.	Dodi	Rosaceae		√	
73	<i>Ranunculus muricatus</i> L.	Butter cup	Ranunculaceae	√		
74	<i>Ranunculus scleratus</i> L.	Galdhania	Ranunculaceae	√	√	√
75	<i>Rumex dentatus</i> L.	Jangli palak	Polygonaceae	√	√	√
76	<i>Saccharum bengalense</i> Retz .	Kana, Munj,	Poaceae			√
77	<i>Saccharum spontaneum</i> L.	Kahi	Poaceae			√
78	<i>Salsola imbricata</i> Forssk.	Lani	Chenopodiaceae		√	
79	<i>Saponaria hispanica</i> (Miller) Rauschert (Syn. <i>Vaccaria hispanica</i> Miller)	Bara talkla	Caryophyllaceae			√
80	<i>Schoenoplectus mucronatus</i> (L.) Pallarin Verh. (Syn. <i>Scirpus mucronatus</i> L.)	Zard deela	Cyperaceae		√	
81	<i>Setaria pumila</i> (poir.) Roem. & Schult. (Syn. <i>Setaria glauca</i> (L.) P. Beauv.	Bankangni	Poaceae	√	√	√
82	<i>Setaria verticillata</i> (L.) P. Beauv.	Yellow foxtail	Poaceae			√
83	<i>Silene conoidea</i> L.	Chhota takla	Caryophyllaceae	√	√	√
84	<i>Sinapis alba</i> L. (Syn. <i>Brassica alba</i> L.)	Safed rai	Brassicaceae	√		√

S.No	Botanical Name	Local Name	Family	Distribution		
				NS	PS	R
85	<i>Sisymbrium irio</i> L.	Khub kalan	Brassicaceae			√
86	<i>Solanum nigrum</i> L.	Mako	Solanaceae	√	√	√
87	<i>Sonchus arvensis</i> L.	Pili dudhi	Asteraceae	√	√	√
88	<i>Sonchus asper</i> L.	Dodak	Asteraceae	√		√
89	<i>Sonchus oleraceus</i> L.	Dodak	Asteraceae	√		
90	<i>Spergula arvensis</i> L.	Kalri booti	Caryophyllaceae		√	
91	<i>Spergularia marina</i> (L) Grisch	Spurry	Caryophyllaceae		√	
92	<i>Stellaria media</i> L.	Gandel	Caryophyllaceae	√		
93	<i>Sueda fruticosa</i> Forssk.	Lana	Chenopodiaceae		√	
94	<i>Tamarix dioica</i> Roxb.	Pilchi	Tamaricaceae			√
95	<i>Tribulus terrestris</i> L.	Bakhra	Zygophyllaceae		√	√
96	<i>Trifolium pratense</i> L.	Shatala	Papilionaceae	√		√
97	<i>Trifolium repense</i> L.	Shatali	Papilionaceae	√		√
98	<i>Trigonella monantha</i> C.A. Meyer	Maini	Papilionaceae	√	√	√
99	<i>Typha angustata</i> Bory & Chaub.	Dab	Typhaceae			√
100	<i>Veronica anagallis aquatica</i> L.		Scrophulariaceae		√	
101	<i>Veronica polita</i> Fries. (Syn. <i>Veronica agrestis</i> L.)		Scrophulariaceae			√
102	<i>Vicia hirsuta</i> Kock.	Revari	Papilionaceae			√
103	<i>Vicia sativa</i> L.	Matra	Papilionaceae	√		√
104	<i>Withania somnifera</i> (L.) Dunal.	Asgandh	Solanaceae	√		
105	<i>Xanthium strumarium</i> L	Chhota datura	Asteraceae	√		√
Tot.	105		33	62	58	72

NS: Non-Saline wheat fields, PS: Partially Saline wheat fields, R: Riverian wheat fields, √: Indicates Occurrence.

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