ECOLOGICAL ASPECTS OF WEEDS IN COTTON FIELDS OF DISTRICT LASBELA BALOCHISTAN, PAKISTAN.

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ABSTRACT

The present study pertains to assess the composition of weed communities in cotton (Gossypium hirsutum) fields of District Lasbela, Balochistan. Assessments were made in terms of species composition, and distribution in different areas of Lasbela District. Plant communities in cotton crop systems were evaluated in terms of relative frequency, relative cover, relative density and importance index for each species. Study areas were also compared in terms of species diversity by the Sampson's diversity index. Forty-one weed species were reported from the study area of which ten belonging to monocot families, and thirty-one to dicot families. The most common weeds were Cyperus rotundus (I.V. 44.89±7.18), Cynodon dactylon (I.V. 38.60±9.34), Panicum capillare (I.V. 37.52±14.98), Euphorbia prostrata (I.V. 29.08±6.25) Cressa cretica (I.V. 24.46±14.16), and Trianthema portulacastrum (I.V. 23.15±6.84). There is also evidence that some weed species are more favored by specific field conditions such as salinity, although the causes of this selective behavior are not fully studied in this paper. The presence of Cressa cretica with higher importance value index (24.46±14.16) clearly indicated the presence of salinity in these study areas.

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Key words: Lasbela, Weed, Cotton, *Cyperus rotundus*, *Panicum capillare*, *Cressa cretica.*

Ecology of weeds in cotton fields of district Lasbela Balochistan

INTRODUCTION

Weeds are the invasive, undesirable, persistent and pernicious plants (Ross and Lembi, 1999) and are capable to alter the hydrology, nutrient distribution and carbon sequestration in natural habitats (Polley *et al.,* 1997). Assessment and evaluation of weed dynamics is necessity for establishment of priority research areas and extension services (McCloskey, *et al*., 1998). Weed invasion in arable lands, their impacts on cop yield and environment has been the focus of interest for many researchers globally (Tahira *et al*., 2010), as the extent and rapid increase of invasive plants is one of the major threats to biodiversity and ecosystems worldwide (Drake *et al*., 1989).

Weeds are recognized as significant constraints in agricultural lands; which compete with crops for limited nutrient resources, water, space and Carbon dioxide and are major factors for reduced crop yield (Pragada & Venkaiah 2012). According to Qureshi, (2004) weeds consume three to four times more nitrogen, potassium and magnesium than a weed- free crop. Weeds not only impair the quality and quantity of crops but also interfere with human activities by acting as host for different pathogens, ultimately resulting in increased cost of pest/diseases control, increased water management problems (Shah & Khan., 2006). Weed management and elimination will become the source of socioeconomic, aesthetic and medical relief for human beings (Malik *et al.,* 2012).

Considerable scientific studies (Waheed et al., 2009; Memon *et al*., 2007; Memon and Bhatti, 2001; Bhatti *et al.,* 1993; Hussain *et al.,* 1987; Brohi & Makhdoom, 1987) have been reported for weed dynamics in different provinces of Pakistan, results reveals that weed invasion in crop production systems has become one among sever problems for growers. Several new weed species present in agricultural lands are either brought by different invaders, which did not exist in the local some years back (Malik *et al.,* 2012). According to Tauseef *et al*., (2012) the losses in cotton yields due to weeds could be in the range of 50 to 70%. Recognizing the severity of weed infestation and its consequences on corps and ecosystem, first time present study was conducted in areas under cultivation for cotton crops of district Lasbela, Balochistan. Scientific literature is silent about the weed dynamics in

croplands of Balochistan Province, which is approximately 43% of geographical area of the country.

District Lasbela with total area of 12,574 square kilometers is 7th largest district of Balochistan. Geographically district lies between 65°12'11" to 67°25'39" East longitudes and 24°53'2" to 26°39'20" North latitudes on southern coast. The district has central alluvial lowland drained by the Porali and Kud Rivers suitable for cultivation. Climate of the area is typical dry and hot. The prevailing arid to semi-arid environmental conditions with annual rainfall less than 200 mm for a long period resulting a greater evapo-transpiration than precipitation and provides an ideal situation for cotton cultivation. Total reported area for cotton under cultivation was 32745 Hectares, while production was 174501 in 2010-11 (Anonymous, 2012). History of continuous cotton cultivation in district Lasbela is relatively short; according to field information continuous cotton cropping in the study area is not more than 10 years (Abid Hussian: Personal communication, 2013).

The objective of the present study is to determine the ecological attributes of weeds in cotton cultivated lands of district Lasbela, Balochistan. The present study is an initiative to investigate and document the ecological behavior of weeds in cotton fields of the region. Therefore information about weed communities and their associations may provide a baseline and model for future explorations in relatively juvenile agriculture lands.

MATERIALS AND METHODS

Four cotton cultivated tehsils viz.: Bela, Lakhra, Uthal and Windar, of district Lasbela Balochistan were surveyed during the months of June-July 2013 for samples and data collection regarding weeds.

Fifty, one-meter square quadrates in five different cultivated fields located at a considerable distance of each tehsil, were randomly placed. Weed species in each quadrate were identified and their density, frequency and cover percentage were recorded. Each quadrat consisted of 2 adjacent cotton rows by 30 cm of row. With a province-wide average row spacing of about 30 centimeters, an average of 10 m^2 was surveyed in each field. All weeds in each quadrate were identified, measured, and recorded for subsequent data entry and analysis. Unrecognized weed species with their family and genera were properly identified with the help of flora of Pakistan. (Flora of Pakistan online accessed August 15th 2013). In order to compute and evaluate the analytical attributes of weeds, such as species density, abundance, diversity, dominance and the Important Value Index (IVI), standard phytosociological

principle given by Curtis and McIntosh (1950) were applied using following relationships:

$$\text{Relative Density (RD)} = \frac{\text{Density of A Species}}{\text{Total Density of all Species}} \times 100 \quad (1)$$

$$\text{Relative Frequency} = \frac{\text{Frequency value of A Species}}{\text{Total of all frequency values for all species}} \times 100 \quad (2)$$

$$\text{Relative Cover (RC)} = \frac{\text{Cover of A Species}}{\text{Total Cover of all Species}} \times 100 \quad (3)$$

$$\text{Importance Value Index (IVI)} = RD + RC + RF \quad (4)$$

Simpson (1949) formulated the following formula for diversity:

$$D = \sum_{i=1}^{s} \left[\frac{n_i(n_i-1)}{N(N-1)}\right] \qquad t = 1 - - - - - -, s \quad (5)$$

where n_i = Importance value of each species.
N = Total importance value of all species.
S = Number of species.

RESULTS AND DISCUSSIONS:

The analysis of data revealed considerable variation in weed composition that grown in cotton fields of Lasbela District. A total of 41 weed species belonging to 18 families were recorded in the study areas (Table-1). Some of the most serious weeds are those that belong to monocotyledous families (Cyperaceae and Poaceae, average I.V.I. 24.56 and 14.97 respectively). On the other hand broad-leaved weed, which belong to sixteen families, only Aizoaceae, Convolvulaceae, Euphorbiaceae and Papilionaceae showed serious concerns in cotton fields of Lasbela District. (Table 1). The highest number of weed species was found in families Poaceae (8 species), Asteraceae, Euphorbiaceae, and Mimosaceae (three of each) (Table-1). The number of herbaceous weeds recorded in the present study constitutes about 22 species (53.65%), while creepers were 9 (21.95%), followed by herbaceous with woody stem were 6 (14.63%) and 4 species belonged to woody trees (9.75%) (Table 1). The presence of trees at juvenile stages in the agriculture fields of Lasbela District was the result of recent acquirement of previously desolated areas, which were infested with shrubs and small tress, for the agricultural purposes. The most common trees, which were found at juvenile stages in

cotton fields of Lasbela District, were *Acacia nilotica* (average I.V.I. 0.84±0.65), *Prosopis cineraria* (average I.V.I. 2.69±3.29), *P. juliflora* (average I.V.I. 2.82±0.54) and *Ziziphus jujuba* (average I.V.I. 0.25±0.25) (Table-1). The creepers belong to monocotyledous families (Cyperaceae and Poaceae) which showed serious concerns as a weed across the globe.

The results of present study showed that *Cyperus rotundus* Linn. is one of serious perennial weeds in cotton growing areas of Lasbela District. The data presented in the Table 1 revealed that *C. rotundus* demonstrated the highest average I.V.I. value (44.89±7.18). Analysis of I.V.I. values at different localities of Lasbela District is shown in Table 2, revealed that *C. rotundus* is uniformly distributed in cotton fields of these areas (63.47; Bela, 37.68; Lakhra, 48.12; Uthal and 30.3; Winder areas). It is because of its extensive rhizomes and tubers system, which protect it from cultural and chemical practices. Although this plant produces seeds but it is mainly propagated through tubers which remain viable in soil for many years and causes severe threat to the crop (Memon and Bhatti 2001). It was suggested that raw crops particularly cotton and potatoes are more seriously affected by *C. rotundus* than cereal and forage crops (Tauseef *et. al.* 2012). Similarly unleveled fields, standing waters and rainfall during the month of June may also increased *C. rotundas* population in poorly drained fields. Cotton as a cash crop in Lasbela District introduced ten years ago and the application of herbicides is not common in these fields (Abid Hussian, personal communication, 2013). The common practice in these fields is hand-weeding which provides opportunities for *C. rotundus* to become well established in cotton fields because it is mainly grow by rhizomes and tubers system which are not affected by hand-weeding.

The second dominant species was *Cynodon dactylon,* which is one of the most troublesome, creeping-perennial, widely distributed and highly competitive weed, which is mainly propagated by rhizomes. The results of present study revealed that this plant demonstrate average I.V.I. 38.60±9.34 (Table 2). Similarly *C. dactylon* showed uniformity in distribution in different cotton growing areas of Lasbela District (29.93; Bela, 54.08; Lakhra, 16.36; Uthal, and 54.04; Winder areas, (Table 1, Fig. 1). Similar results were observed by Tauseef *et. al.* (2012) and Hussain and Khan (1987) who reported weed diversity in cotton growing districts of the Punjab where *Cyperus rotundus*, and *Cynodon dactylon*, along with other weed species were dominant weed species.

The present study reveals that *Panicum capillare* is the third dominate species, which showed average I.V.I. values 37.52±14.98. Except Winder area, where it showed low I.V.I. value 5.34, it was uniformly distributed in different parts of Lasbela District (40.27; Bela, 77.45; Lakhra and 25.74; in Uthal areas, Table 1. and Fig. 1). *P. capillare* is an introduced annual grass weed which is native to North America (Clements *et. al*. 2004). Because of high seed production, persistent seed bank, tumbling nature of seed dispersing mechanism, and the ability to resist different herbicides contribute to the success of this plant to become troublesome weed in Lasbela District. Although *P. capillare* aggressively spreading in different crops of Lasbela District, its actual impact on crop yield is not well documented. There is paucity of scientific studies regarding the taxonomy and distribution of *P. capillare* and to our knowledge it is the first report of presence of *P. capillare* in cotton field in Pakistan. According to Dore and McNeill (1980) this grass weed normally distributed in its natural habitat along beaches, and rarely exceeds 30 cm in height. The Lasbela District is located on southern part of Pakistan along with Arabian Sea and becoming an ideal place for *P. capillare* to widespread in cotton fields. Although it is a warm season annual grass but it occurs across a wide-range of moisture levels and temperatures (Berg 1995, Darbyshire and
Cayouette1995). Despite the widespread distribution and high seed production it was believed that *P. capillare* appears to be relatively a poor competitor and based on relative competitive ability it was ranked four weedy species when compared with *Amaranthus retroflexus* L., *Chenopodium album* L. and *Setaria viridis* (L.) P. Beauv. (Clements *et. al*. 2004). Compared with *C. rotundus* and *C. dactylon*, which are perennials and mainly propagated through tubers and rhizomes, *P. capillare* is an annual and only grows through seeds. Because of these characteristics it was observed that *P. capillare* more susceptible to interspecific competition than to intraspecific competition. (Clements *et. al*. 2004).

Euphorbia prostrata is another weed which shown constancy in distribution in different cotton fields of Lasbela District (Bela; 32.22, Lakhra; 42.6, Uthal; 28.91 and Winder; 12.52, Table. 1) The overall average I.V.I. of *E. prostrata* was 29.08±6.25 (Table 2).

Results of present study revealed that *C. cretica* has an I.V.I. value of 24.46±14.16 (Table-2). Although *C. cretica* is less aggressive than the grass species but the saline environmental conditions, which are prevailing in study areas favor it to compete with cotton crops. From the results it is clear that *C.*

cretica is dominant in saline area and Lakhra which is affected by salinity showed the higher I.V.I. value of 64.55 followed by Bela (23.65), Windar (8.64) and Uthal (1.02) (Table 1, Fig. 1.). *Cressa cretica* L. is common rhizomatous perennial halophyte shrubs, which normally grow in coastal salt marsh communities of southern Pakistan. It normally propagates vegetatively, however it also produces large number of seeds (Aziz, 1994). *C. cretica*, is reported to produce a lot of seeds and can persist through the summer if in shade (Khan, 1991). It was suggested that monsoon rains considerably reduced the salinity and improve soil moisture conditions that resulted some seeds of *C. cretica* germinated but the seedlings died either due to burial under sand or increased dehydration due to rapid disappearance of rain water (Aziz, 1994). It is clear from the results of present study, which revealed that the salinity in soil is comparatively lower in Uthal and Winder areas compared with Lakhra and Bela Tehsils which showed higher I.V.I. values compared with former ones (data presented elsewhere). Moreover, because *C. cretica* is a true halophyte, which under normal soil condition cannot compete with non-halophytes that may be another reasons, due to which in Uthal and Winder areas it showed lower importance values.

Memon and Bhatti (2001) reported that *Trianthema portulacastrum* was most dominated and common weed in cotton fields of Khairpur area of Sindh Province. This weed is strong competitor for nutrients because it occupies more spaces under the aerial parts of cotton crop. The results of present study revealed that *T. portulacastrum* has an average I.V.I. value of 23.15±6.84 (Table 1). Based on these results even though this plant did not show a serious threat to cotton crop but it is considered a poisonous plant and have the ability of producing more than 50,000 seeds per year (Memon and Bhatti 2001). Similarly the uniform distribution (Bela; 8.26 Lakhra; 22.67, Uthal; 41.38 and Winder; 20.29, Table 1, Fig. 1) may show some alarming situation particularly for future forecast of this plant being a serious threat.

The results of present study showed a list of plants, which were for the first time reported, as a weed in cotton field of Pakistan and *Phragmites karka* is one of them. Memon (2000) reported the presence *P. karka* in wheat crop fields of Pakistan. In Lakhra Tehsil of Lasbela District, Field no. 4 showed the presence of *P. karka* as dominant species (Average I.V.I. 12.95 Table 1. Fig. 1 (b)). The farmers of said field informed that they acquired this field few years back and it was the second time they growing cotton on that field. Although *P. karka* was reported in any other fields during the present study but its presence in Lakhra area may cause some serious concerns because of lacking

of application of herbicides traditions may help this plant to be serious threat in future.

Fig. 2. presents a comparison of diversity of weed flora of Lasbela District. The results of present study showed the highest diversity index of 12 in the field 3 of Uthal Tehsil (Fig. 2). In general there is uniformity in diversity indices among different fields of Lasbela District. Growing cotton, as a cash crop in Lasbela District is a recent phenomenon and lack of interest and higher cost of herbicides, shifts the interest of farmers from synthetic chemicals to cultural and mechanical practices. It was suggested that conventional and integrated weed management with limited use of chemical herbicides had increased the weed pressure. According to Mayor and Dessaint (1998) the weed community showed higher diversity and density in agriculture fields where farmers emphasized on decreased herbicide used and more focus on cultural and mechanical controls. Menalled *et al*., (2001) Thorne *et al*., (2007) and Wortman *et al.,* (2010) were also observed the similar results. According to Wortman *et al.* (2010) the weed seed-bank diversity was higher in an organic green manure system compared with manure-based organic and conventional treatments. Similarly Hawes *et al*. (2010) demonstrated that reduced management intensity, measured as herbicide and fertilizer use, increased density and diversity of the weed seed bank, as well as emerged weed flora in Scottish Farmland.

CONCLUSIONS:

The economy of Pakistan depend upon the production of its cash crops but due to population pressure and losing of farmlands in cotton growing areas there is need to acquired agricultural lands. Lasbela District can be utilized as a cotton growing area because of availability of vast farmlands, transport facilities and located in proximity of Karachi city. However weed is the biggest contributor in the loss of total crop production. Weeds compete nutrients, water, solar radiations, space and other growing factors, which reduced the productivity of crops. It is important to understand the ecological behavior of weeds, which helps to eradicate these unwanted plants in an agriculturally new area of Lasbela District.

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Table 1. Average Importance Value Index (IVI) of weeds in cotton fields of District Lasbela, Balochistan.

Name of Species	Bela	Lakhra	Uthal	Winder
	Cr-Pc-Ep	Pc-Cc-Cd	Cr-Tp-Ei	Cd-Da-Cr
1. *Abutilon indicum* (Linn.) Sweet	0	6.61	2.84	1.07
2. *Abutilon pakistanicum* Jafri & Ali	0	0	0	10.49
3. *Acacia nilotica* (Linn.) Delile.	0.61	0	2.77	0
4. *Achyranthes aspera* Linn.	0	2.55	2.31	0
5. *Alhagi maurorum* Medic.	2.45	47.63	0.55	0
6. *Amaranthus viridis* Linn.	14.5	6.51	13.76	0
7. *Chrozophora oblongifolia* (Del.) Adr. Juss. ex Sp.	0	0	0	8.26
8. *Brachiaria reptans* (Linn.) Gardner & Hubbard	0	0	21.89	11.59
9. *Calotropis procera* (Ait.) Ait.	0	0	2.04	0
10. *Cenchrus biflorus* Roxb.	0	0	0	7.68
11. *Chenopodium album* Linn.	0	0	2.62	0
12. *Convolvulus arvensis* Linn.	9.89	10.03	3.12	21.94
13. *Conyza canadensis* (L.) Cronquist	0	0	0.58	0
14. *Cressa cretica* Linn.	23.65	64.55	1.02	8.64
15. *Cucumis prophetarum* Linn.	1.04	0	0	0
16. *Cynodon dactylon* (Linn.) Pers.	29.93	54.08	16.36	54.04
17. *Cyperus arenarius* Retz.	0	0	0	16.88
18. *Cyperus rotundus* Linn.	63.47	37.68	48.12	30.3
19. *Dactyloctenium aegyptium* (Linn.) Willd.	13.63	19.05	17.38	30.58
20. *Digera muricata* (L.) Mart.	0	4.8	1.69	0
21. *Eclipta prostrata* (L.) Linn.	3.04	2.53	27.53	0

22. *Euphorbia clarkeana* Hook.	2.34	0	0.84	0
23. *Euphorbia prostrata* Ait.	32.22	42.69	28.91	12.52
24. *Eleusine indica* (Linn.) Gaertn.	0	0	34.92	1.86
25. *Chloris barbata* Sw.	0	0	0.66	0
26. *Heliotropium curassavicum* L.	0.77	11.54	0	2.85
27. *Launaea nudicaulis* (L.) Hook.f.	1.7	0	4.38	7.98
28. *Malvastrum coromandelianum* (L.) Garcke.	2.56	0	4.36	0
29. *Panicum capillare* Linn.	40.27	77.45	25.74	5.34
30. *Phragmites karka* (Retz.) Trin. ex Steud.	0	12.95	0	0
31. *Portulaca oleracea* Linn.,	2.48	0	2.49	2.7
32. *Prosopis cineraria* (Linn.) Druce	0	4.79	0	13.99
33. *Prosopis juliflora* (Swartz) DC.	0	2.41	1.78	2.76
34. *Cassia holosericea* Fresen.	0	0	4.07	0
35. *Solanum surattense* Burm.	0.81	4.84	0	0
36. *Suaeda fruticosa* Forssk. ex J. F. Gmelin	5.51	14.88	9.68	3.88
37. *Tribulus terrestris* Linn.,	0	0	2.28	4.02
38. *Withania somnifera* (L.) Dunal.	0	3.64	0	0
39. *Trianthema portulacastrum* Linn.	8.26	22.67	41.38	20.29
40. *Ziziphus jujuba* Mill.,	1	0	0	0
41. *Zygophyllum simplex* Linn.	0	0	3.42	5.72

Abbreviation: Cr = *Cyperus rotundus*, Pc = *Panicum capillare*, Ec = *Eclipta prostrata*, Cc = *Cressa cretica*, Cd = *Cynodon dactylon*, Tp = *Trianthema portulacastrum*, Ei = *Eleusine indica*, Da = *Dactyloctenium aegyptium*

Table 2. The I.V.I of the different families of weeds in cotton fields in Lasbela District, Balochistan.

S. No	Family	Weed species	Average I.V. ± S.E.	I.V. Family
1	Aizoaceae	*Portulaca oleracea*	1.91±0.64	**12.5**
2		*Trianthema portulacastrum*	23.15±6.84	
3	Amaranthaceae	*Achyranthes aspera*	1.21±0.70	**4.95**
4		*Amaranthus viridis*	8.69±3.41	
5		*Digera muricata*	2.26±0.99	
6	Asclepiadaceae	*Calotropis procera*	0.51±0.51	**0.51**
7	Asteraceae	*Conyza canadensis*	0.14±0.14	**3.97**
8		*Eclipta prostrata*	8.27±6.45	
9		*Launaea nudicaulis*	3.51±1.74	
10	Boraginaceae	*Heliotropium curassavicum*	3.79±2.65	**3.79**
11	Caesalpiniaceae	*Cassia holosericea*	1.01±1.01	**1.01**
12	Chenopodiaceae	*Chenopodium album*	0.65±0.65	**4.06**
13		*Suaeda fruticosa*	7.48±2.14	
14	Convolvulaceae	*Convolvulus arvensis*	11.24±3.91	**17.85**
15		*Cressa cretica*	24.46±14.16	
16	Cucurbitaceae	*Cucumis prophetarum*	0.25±0.25	**0.25**
17	Cyperaceae	*Cyperus arenarius*	4.23±4.23	**24.56**
18		*Cyperus rotundus*	44.89±7.18	
19	Euphorbiaceae	*Chrozophora oblongifolia*	2.06±2.06	**10.64**
20		*Euphorbia clarkeana*	0.79±0.55	
21		*Euphorbia prostrata*	29.08±6.25	
22	Malvaceae	*Abutilon indicum*	2.62±1.44	**2.32**
23		*Abutilon pakistanicum*	2.62±2.62	
24		*Malvastrum coromandelianum*	1.73±1.06	
25	Mimosaceae	*Acacia nilotica*	0.84±0.65	**2.12**
26		*Prosopis cineraria*	2.69±3.29	
27		*Prosopis juliflora*	2.82±0.54	
28	Papilionaceae	*Alhagi maurorum*	12.65±11.66	**12.65**
29	Poaceae	*Brachiaria reptans*	8.36±5.26	**14.97**

30		*Cenchrus biflorus*	1.92±1.92	
31		*Chloris barbata*	0.16±0.16	
32		*Cynodon dactylon*	38.60±9.34	
33		*Dactyloctenium aegyptium*	20.51±3.57	
34		*Eleusine indica*	9.19±8.58	
35		*Panicum capillare*	37.52±14.98	
36		*Phragmites karka*	3.24±3.24	
37	Rhamnaceae	*Ziziphus jujuba*	0.25±0.25	**0.25**
38	Solanaceae	*Solanum surattense*	1.41±1.15	**1.16**
39		*Withania somnifera*	0.91±0.91	
40	Zygophyllaceae	*Tribulus terrestris*	1.57±0.97	4.37
41		*Zygophyllum simplex*	7.17±1.62	

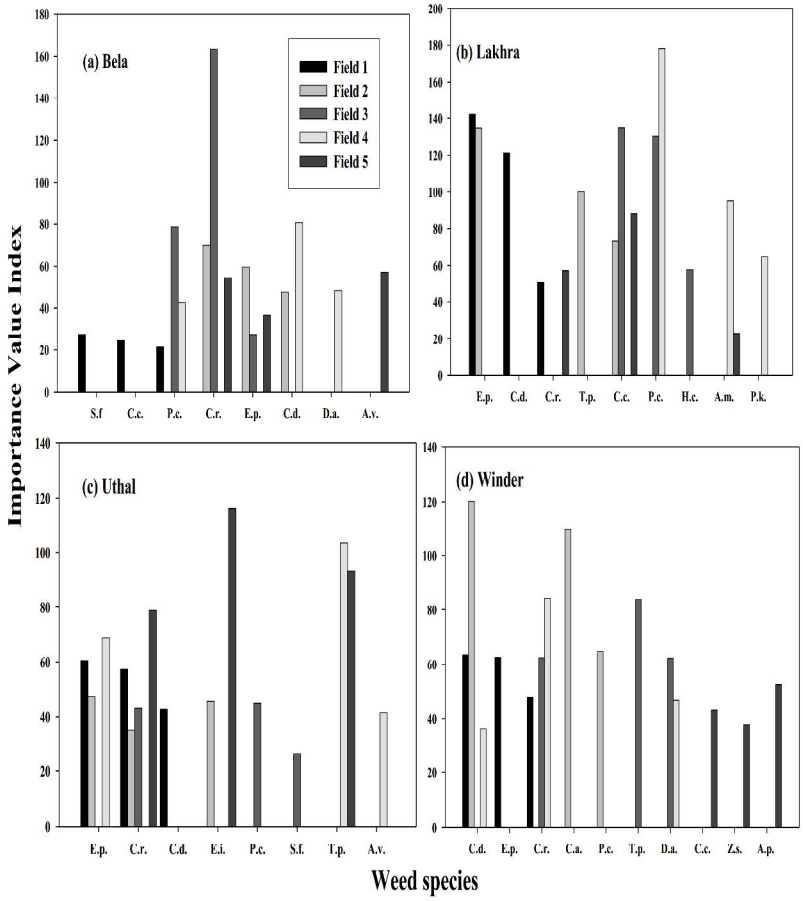

Figure 1. Dominant weeds in cotton fields of district Lasbela, Balochistan. (Abbreviations: A.m. *Alhagi maurorum*; A.p. *Abutilon pakistanicum,* A.v. *Amaranthus viridus,* C.a. *Convolvulus arvensis*, C.c. *Cressa cretica*, C.d. *Cynodon dactylon*, C.r. *Cyperus rotundus*, D.a. *Dactyloctenium aegyptium*, E.i. *Eleusine indica*, E.p. *Eclipta prostrata,* H.c. *Heliotropium curassavicum*, P.c. *Panicum capillare*, P.k. *Phragmites karka*, S.f. *Suaeda fruticosa*, T.p. *Trianthema portulacastrum*, Z.s. *Zygophyllum simplex*.)