Studies on Floristic Composition of Chickpea Weeds in District Karak, Pakistan

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(Received 15 Febrary 2006; returned 11 July 2006; accepted 26 August 2006)

ABSTRACT

Chickpea (*Cicer arietinum*) is the most important crop sustaining the economy of district Karak, Pakistan. Weeds cause enormous losses to the quantity as well as quality of the crop. A survey was launched during February 2004, to record the phytosociological status of chickpea farms. A total of 21 chickpea growers from seven villages in district Karak, Pakistan, were randomly selected. At each farm, the density of weeds was determined using standard quadrate method. The density data were subjected to analysis to compute Relative density (%), Frequency (%), Relative frequency (%) and Importance value. *Asphodelus tenuifolius* emerged as the predominant species in the district. The highest importance value of *A. tenuifolius* weed was recorded (88.6) in Hada followed by Wachobaqas (65.2) and Bogara (64.8). Whereas, the highest (38.6) importance value of *Medicago denticulata* was observed in Lakki Ghundaki and Ahmad Wala (32.8). *Medicago-Cynodon-Asphodelus* community was recognized at Ahmad Wala, *Medicago-Fumaria- Asphodelus* was prevalent in Ambiri Kala, and *Medicago-Asphodelus-Cynodon* existed at Lakki Ghundaki and *Asphodelus-Cynodon-Euphorbia* commenced at Wachobagas. At Bagara, Hada and

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Sarkhawa the communities predominant were *Ashphodelus-Cynodon-Euphorbia, Asphodelus-Cynodon* and *Asphodelus-Medicago-Cynodon. Asphodelus, Medicago,* and *Cynodon* in the decreasing order were the major weeds in chickpea farms of Karak. Further studies are suggested to confirm the findings and launch an effective management program.

Key words: Gram relative weed density frequency Importance value *Asphodelus Medicago*

چکیده

نخود ایرانی مهمترین محصول اقتصادی در منطقه کاراک پاکستان می‌باشد. علف‌های‌هرز خسارت کمی و کیفی زیادی به این گیاه زراعی وارد می‌کنند. در بهمن ۱۳۸۲، برای تعیین وضعیت جامعه رویشی مزارع نخود، این منطقه مورد بازدید قرار گرفت. برای این منظور ۲۱ کشاورز نخودکار از هفت روستای کاراک پاکستان بطور تصادفی انتخاب شدند. در هر مزرعه، با استفاده از کادر استاندارد، فراوانی علف‌های‌هرز تعیین شدند. برای ارزیابی تراکم و انبوهی و درجه اهمیت علف‌های‌هرز، داده‌ها کامپیوتری آنالیز شدند. نتایج نشان داد که در این منطقه گونه *Asphodelus tenuifolius* چیره‌ترین علف‌هرز بود. بالاترین نمره اقتصادی این علف‌هرز ۸۸/۶ در هادا، ۶۵/۲ در واچوباگاس و ۶۴/۸ در بوگارا ارزیابی شد. در حالی‌که برای *Medicago denticulata*، بیشترین نمره اقتصادی (۳۸/۶) در لاکی‌فونداکی و (۳۲/۸) در احمدوالا ثبت شد. در احمدوالا جامعه *Medicago-Cynodon-Asphodelus* پوشش گیاهی چیره شناخته شد، در آمبیریکالا *Medicago-Fumaria-Asphodelus*، در لاکی‌فونداکی *Medicago-Asphodelus-Cynodon* و در واچوباگاس *Asphodelus-Cynodon-Euphorbia* از فراوانی بیشتری برخوردار بودند. در باکارا، هادا و سرخاوا به ترتیب *Ashphodelus-Cynodon-Euphorbia*، *Asphodelus-Cynodon* و *Asphodelus-Medicago-Cynodon* جامعه گیاهی چیره بودند. مهمترین علف‌های‌هرز منطقه کاراک، به ترتیب اهمیت *Asphodelus*، *Medicago* و *Cynodon* شناخته شدند.

کلمات کلیدی: نخود، جامعه رویشی، پاکستان، *Asphodelus tenuifolius*، *Medicago denticulata* ، *Fumaria* ، *Cynodon*، *Euphorbia*.

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is a poor competitor to weeds because of slow growth rate and limited leaf area development at early stages of growth and establishment. Nevertheless, almost all values reflect the seriousness of the weed problem. Yield losses were observed to vary between 40 to 94% in the Indian subcontinent, depending on the level of weed infestation and weed species prevailing (ICARDA, 1985, Bhan & Kukula, 1987).

Chickpea is the principal pulse and provides a major source of proteins in the diet of the predominantly vegetarian population. It is traditionally cultivated in arid sandy areas of NWFP (Northwestern Frontier Province) but recently its production has declined as chickpea has been replaced by the rapid expansion of irrigated areas and the introduction of modern productive cultivars of wheat. Two main categories of chickpea are distinguished, based on seed characteristics: the 'Desi' types, having relatively small, angular seeds with rough, usually yellow to dark brown testa; and the 'Kabuli' types, which have large rounded and cream colored seeds. The Desi types, also known as Bengal grain, constitute about 85% of annual world production of chickpea and are confined entirely to the Indian sub-continent, Ethiopia, Mexico and Iran. The Kabuli types comprise only a minor area and production, but account entirely for the crops of Europe and the America, except Mexico. Other, locally important, categories are the 'Gulabi' (pea shaped) types of central India and green- seeded Desi types of central and northwestern India. In Pakistan, during 2003-4, chickpea was grown on an area of 982.3 thousands ha with a production of 611.1 thousand tons. During the year under reference, the area production in NWFP was 52.2 thousand ha and 19.7 thousand tons, respectively. Mean national yield during the year of report was 622 kg and in NWFP it amounted to 377 kg ha^{-1}. Punjab and Sindh with an area of 854.4 thousand and 61.7 thousand ha are the leaders in chickpea production in Pakistan (Anonymous,

2004). The area under chickpea in NWFP is not very high, yet the economy of the Southern Districts of NWFP largely depends on chickpea production. The economy of these Districts flourishes when chickpea flourishes, and economy declines when the chickpea production declines.

The chickpea yields realized in Pakistan are lower as compared to maximum potential of the cultivars. The gap could mainly be attributed to the weed competition in addition to other production constraints. Although chickpea is traditionally grown on residual soil moisture, weed competition poses major problem in many situations. Common weeds of chickpea in NWFP include wild onion (*Asphodelus tenuifolius* L.), common lambsquarters (*Chenopodium album* L.), meadow peavine (*Lathyrus aphaca* L.), edible wild pea (*L. sativus* L.), bermudagrass [*Cynodon dactylon* (L.) Pers.], common medic (*Medicago denaculata Willd.)*, fumitory [*Fumaria indica* (Hausskn.) Pugsley], field bindweed (*Convolvulus arvensis*L.), annual blue grass (*Poa annua* L.), and pimpernel (*Anagallis arvensis*l.) (Marwat, 1984). In commercial practice, the cultivation of preceding rainy-season fallows not only helps to capture and conserve moisture but also reduces weed infestations. On black soils of the wetter areas of central India, "haveli" cultivation (the practice of containing water by bunding in the rainy season) serves similar purposes. In Dera Ismail Khan, the chickpea is either grown on the residual moisture in the rice based cropping system or under the rod-kohi system. Inter-row cultivation by tractor or animal-drawn implements is common, facilitated in North Africa by sowing the crop in very wide rows. Potential yield losses in chickpea due to weeds range between 22-100% (Saxena and Yadav, 1976). Weed growth was significantly reduced by the use of herbicides and resulted in increased yield of 50% against the control (Stork, 1998). Singh (1998) and Sukhadia *et al* (1999) pointed out that weeds reduced productivity in chickpea up to 36.8% and 41-44%, respectively.

Recognizing the importance of identification, survey was formulated to highlight the flora of Karak District.

MATERIALS AND METHODS

District Karak is one of the principal chickpea growing districts of Pakistan. Almost whole district is rain-fed. Chickpea and wheat are the main crops in winter, which sorghum [*Sorghum bicolor* (L.) Moench] and pearl millet [*Pennisetum glaucum* (L.) R. Br. Syn.] are the major crops in summer. Northern half of the district is hilly with more rainfall, while the southern half is sandy with a scanty rainfall. Chickpea is the principal crop of the sandy belt of the district. Seven-gram growing locations were randomly selected from the chickpea growing area of district Karak. All the selected locations were rain-fed and mostly sandy in nature. No herbicide has ever been used at these sites throughout the growing season of crop. 7-8 weeks after sowing of chickpea, weed density m^{-2} was taken and from the same data, Relative density (%), Frequency (%), Relative Frequency (%) and Importance value of weed species was computed. At each of the selected sites, three gram fields were selected randomly and were surveyed following the methodology of Thomas (1985), McCully *et al*. (1991) and Thomas (1991) with slight modifications. Five $1x1m^2$ quadrates were randomly placed along an inverted horizontal pattern in each field. The distance between each quadrate depended upon the size and shape of the field and any obstructions that may have been present in the fields. The larger was the field, the greater was the distance between quadrates. During the course of studies, the data were recorded on the following parameters as adopted from Hussain (1989) and Hussain *et al*. (2004):

1. Relative density (%) = $\frac{\text{Mean field density value of individual species}}{\text{Sum of all species}} \times 100$
2. Frequency (%) = $\frac{\text{Number of quadrates in which a species occurred}}{\text{Total number of quadrates}} \times 100$

3. Relative frequency (%) = $\frac{\text{Frequency value of a single species}}{\text{Total frequency}} \times 100$

4. Importance value = $\frac{\text{Relative density + Relative frequency}}{2}$

RESULTS AND DISCUSSION

Weed populations are dynamic; constantly changing in response to sowing/planting period, planting techniques and planting geometry as well as changing across the agro-ecological regions. Moreover, weed populations (density and diversity) also depend on the agronomic techniques employed in the production of a crop. So surveys were carried out under the same growing season to understand the dynamics of weed communities.

Density m^{-2}

A perusal of data in Table 1 exhibit the variable density of weeds across the different locations studied. The total density varied between 13.4 in Sara khawa to 25.2 m^{-2} at Ahmadwala, Karak. The variability was also recorded among the relative number of the species recorded in the study area. *A. tenuifolius* was the most abundant weed at 3 out 5 locations. Similarly *M. denticulata* was the predominant species at 2 out of 5 sites (Table 1). The mean of the vegetation revealed almost 100% more infestation as compared to the second species in the array (Table 1). *P. annua* a moisture loving species was only found at Lakki Ghunddaki at a density of 0.2 plants m^{-2}. *Euphorbia helioscopia* L. and *A. arvensis* also had a meager density (Table 1).

Table 1. Mean density of various weed species (m^{-2}) across seven locations in district Karak, during 2003-04.

Weed species	Ahmad Wala	Ambiri Kala	Lakki Ghundaki	Wacho-Baqas	Bogara	Hada	Sara Khawa	Means
Asphodelus tenuifolius	2.7	3.3	2.9	16.1	13.6	16.3	1.6	**8.07**
Medicago denticulata	11.9	4.5	13.4	0.0	0.3	0.0	3.1	**4.74**
Cynodon dactylon	3.8	3.8	3.1	2.5	1.6	0.06	1.4	**2.32**
Fumaria indica	3.8	3.5	1.8	0.0	0.06	0.0	5.1	**2.03**
Vicia sativa	0.7	1.5	0.0	0.0	0.0	0.0	0.0	**0.31**
Convolvulus arvensis	0.6	2.4	1.3	0.2	1.0	0.0	1.5	**1.0**
Euphorbia helioscopia	1.7	3.5	0.0	0.0	0.0	0.0	0.0	**0.74**
Anagallis arvensis	0.0	0.0	0.3	0.0	0.0	0.0	0.0	**0.04**
Chenopodium album	0.0	0.0	0.0	0.0	0.0	0.0	0.3	**0.04**
Poa annua	0.0	0.0	0.2	0.0	0.0	0.0	0.0	**0.02**
Total	**25.2**	**22.5**	**23.0**	**18.8**	**16.6**	**16.4**	**13.0**	

Relative density (%)

The data on relative density of weed species is shown in Table 2. The statistical analysis of the data revealed that the highest relative density of 97.6% was recorded in *A. tenuifolius* in Hada followed by 82.8% relative density of the same species in Wachobaqas and 81.4%, in Bogara, respectively. While the lowest relative density of *A. tenuifolius* (11.4%) was observed in Ahmad Wala. The next prevalent weed was *M. denticulta* and *C. dactylon* whose relative densities were higher as compared to other weeds recorded in the 7 sites (Table 2). *F. indica* emerged as the predominant species

in village Sara Khawa. Sporadic occurrence of *A. arvensis*, *C. album* and *P. annua* were recorded in the selected sites (Table 2).

Table 2. Relative density (%) of various weed species across seven locations in district Karak, during 2003-04.

Weed species	Ahmad Wala	Ambiri Kala	Lakki Ghundaki	Wacho-Baqas	Bogara	Hada	Sara Khawa
Asphodelus tenuifolius	11.4	14.0	20.5	82.8	81.4	97.6	20.9
Medicago denticulata	41.7	19.2	52.3	0.0	1.5	0.0	21.2
Cynodon dactylon	14.5	16.3	13.1	13.5	9.5	2.1	10.7
Fumaria indica	12.9	15.9	7.0	0.0	0.4	0.0	33.7
Vicia sativa	4.1	6.5	0.0	0.0	0.0	0.0	0.0
Convolvulus arvensis	2.7	11.1	5.0	3.2	6.7	0.0	12.5
Euphorbia helioscopia	13.5	16.3	0.0	0.0	0.0	0.0	0.0
Anagallis arvensis	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Chenopodium album	0.0	0.0	0.0	0.0	0.0	0.0	1.9
Poa annua	0.0	0.0	0.6	0.0	0.0	0.0	0.0

FREQUENCY (%)

The perusal of data in Table 3 revealed that most frequent weed species in the study area were A. *tenuifolius* and *M. denticulta* (Table 3). The Frequency of *A. tenuifolius* ranged from 60 in Sara Khawa to 100% in Wachobagas, Bogara and Hada villages exhibiting that 3 out of 7 sites possessed 100% Frequency for the *A. tenuifolius.* The data further manifested that 2 out of 7 selected sites had 100% Frequency of *M. denticulta* (Table 3). *C. dactylon*, *F. indica* and *C. arvensis* possessed intermediate frequency. *A. arvensis*, *C. album* and *P. annua* were recorded as the least frequent species across the selected sites (Table 3).

Table 3. Frequency (%) of various weed species across seven locations in District Karak, during 2003-04.

Weed species	Ahmad Wala	Ambiri Kala	Lakki Ghundaki	Wacho-Baqas	Bogara	Hada	Sara Khawa
Asphodelus tenuifolius	73.3	80.0	93.3	100.0	100.0	100.0	60.0
Medicago denticulata	100	80.0	100.0	0.0	3.3	0.0	26.6
Cynodon dactylon	66.6	66.6	66.6	50.0	60.0	3.3	36.6
Fumaria indica	56.6	80.0	53.3	0.0	0.0	0.0	66.6
Vicia sativa	13.3	30.0	0.0	0.0	0.0	0.0	0.0
Convolvulus arvensis	30.0	60.0	60.0	30.0	40.0	0.0	50.0
Euphorbia helioscopia	73.3	86.6	0.0	0.0	0.0	0.0	0.0
Anagallis arvensis	0.0	0.0	13.3	0.0	0.0	0.0	0.0
Chenopodium album	0.0	0.0	0.0	0.0	0.0	0.0	3.3
Poa annua	0.0	0.0	13.3	0.0	0.0	0.0	0.0

RELATIVE FREQUENCY (%)

The relative Frequency of weeds is a good statistic showing the prevalence of weed species in the study area. Among all weed species encountered in the study area, the highest relative frequency of *A. tenuifolius* to the tune of 79.7, 48.2, and 47.9% was recorded in Hada, Bogara and Wachobaqas, respectively (Table 4). A diverse relative frequency of all weeds was recorded in Ahmad Wala, Ambiri Kala and Lakki Ghundaki (Table 4). Village emerged as the most specific weed growth area where the chickpea crop was exclusively infested with *A. tenuifolius* and *C. dactylon.* The differential relative frequency across the selected sites warrants varying control measures for the different weed species.

Table 4. Relative frequency (%) of various weed species across seven locations in district Karak, during 2003-04.

Weed species	Ahmad Wala	Ambiri Kala	Lakki Ghundaki	Wacho-Baqas	Bogara	Hada	Sara Khawa
Asphodelus tenuifolius	17.7	16.5	23.3	47.9	48.2	79.7	43.8
Medicago denticulata	24.0	16.4	25.0	0.0	1.5	0.0	8.7
Cynodon dactylon	16.2	13.7	16.6	23.6	25.0	20.0	10.6
Fumaria indica	13.1	16.6	13.3	0.0	1.9	0.0	21.8
Vicia sativa	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Convolvulus arvensis	3.2	6.0	15.0	0.0	0.0	0.0	0.0
Euphorbia helioscopia	8.5	12.4	0.0	28.7	22.9	0.0	13.9
Anagallis arvensis	17.3	18.1	3.2	0.0	0.0	0.0	0.0
Chenopodium album	0.0	0.0	0.5	0.0	0.0	0.0	0.0
Poa annua	0.0	0.0	3.2	0.0	0.0	0.0	1.8

IMPORTANCE VALUE OF WEEDS

The Importance Value determination is a good indicator for the flora impeding the crop growth. The highest importance value of *A. tenuifolius* weed was recorded (88.6) in Hada followed by Wachobaqas (65.2) and Bogara (64.8). Highest (38.6) importance value of *M. denticulata* was observed in Lakki Ghundaki followed by the village Ahmad Wala (32.8). A judicious review of data enunciates that the Importance value of either *Asphodelus* or *Medicago* was higher among all prevailing weed species across the 7 surveyed locations (Table 5). The remaining weed species carried a relatively lower Importance value except *Fumaria indica* at village Sarakhawa possessing moderately higher value of 27.7 (Table 5). The Importance value of *C. dactylon* shows that across the locations it ranged between 10.6 in Sarakhawa to 18.5 in Wachobagas. Although, the Importance value of this weed

stayed intermediate across all the locations, but it is very clear that its growth was very consistent throughout the study area (Table 5). *C. dactylon* is a Poaceous C_4 plant listed as one of the worst weeds of the world. As it is perennial in nature, perennating through its stolons, hence its control is very difficult in chickpea. Further research is recommended to streamline the findings and the density/diversity trends across the years. Our findings are in great analogy with the work of Sultan and Nasir (2003) who observed different communities of weeds in gram fields of Chakwal at 8 different locations. The phytosociology in the gram fields they reported partially agrees with our findings.

Table 5. Importance Value of weed species across seven locations in district Karak, during 2003-04.

Weed species	Ahmad wala	Ambiri kala	Lakki-Ghunda-ki	Wacho-Baqas	Bogara	Hada	Sara Khawa	Average imp. value	Spp. ranking
Asphodelus tenuifolius	14.6	15.3	21.9	65.2	64.8	88.6	32.4	43.25	1
Medicago denticulata	32.8	17.8	38.6	0.0	1.5	0.0	15.0	15.1	2
Cynodon dactylon	15.3	15.0	14.8	18.5	17.2	11.0	10.6	14.62	3
Fumaria indica	13.0	16.2	10.2	0.0	1.2	0.0	27.7	9.75	4
Vicia sativa	2.1	3.2	0.0	0.0	0.0	0.0	0.0	0.75	8
Convolvulus arvensis	3.0	8.5	10.0	1.6	3.6	0.0	6.2	4.7	6
Euphorbia helioscopia	11.0	14.3	0.0	14.3	11.5	0.0	7.0	8.3	5
Anagallis arvensis	8.6	9.1	2.1	0.0	0.0	0.0	0.0	2.82	7
Chenopodium album	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.08	10
Poa annua	0.0	0.0	1.9	0.0	0.0	0.0	0.9	0.4	9

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