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DIVERSITY OF WEED FLORA IN ONION FIELDS OF PUNJAB, PAKISTAN

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ABSTRACT

Weeds are serious management threat for onion (Allium cepa) production but very little information is available on their distribution frequency in various agro ecological zones of Pakistan. A project was designed to investigate distribution frequency of weeds of onion in Lahore, Kasur and Shiekhupra districts of Punjab, Pakistan. This study was designed in order to categorize the weeds and their relationship with crop production and protection. A detailed survey was carried out on autumn crop during the months of December-March 2013-2016. The information for weed distribution and its associated factors for crop production technology and effect of weed frequency and its impact on plant stand quality and yield were observed. On an average of 163 fields from more than 50 locations representing different sowing methods and location types were visited in each year. Field survey was classified on the basis of location type (rural, suburban and urban), method of sowing ridge, border, and intercrop. A total 33 weeds belonging to 16 angiosperm families were noted in onion fields that included Amaranthus hybridus, Amaranthus retroflexus,Anagallis arvensis, Atricaria chamomilla, Avena sterilis, Capsella bursapastoris, Carduus nutans, Chenopodium album, Chenopodium murale, Convolvulus arvensis, Cyperus rotundus, Digitaria sanguinalis, Euphorbia prostarta, Fumaria indica, Galium aparine, Lactuca serriola, Lolium temulentum, Malva sylvestris, Medicago polymorpha, Polygonum aviculare, Papaver rhoeas, Parthenium hysterophorus, Poa annua, Rumex dentatus, Setaria verticillata, Silybum marianum, Sinapis arvensis, Solanum nigrum, Sonchus asper, Sonchus oleraceus, Sorghum halepense, Stelleria media, Vicia sativa and Xantium strumarium. The highest weed invasion was in suburban areas where onion was grown on commercial or house hold consumption basis while lowest weeds frequency was in urban areas where small kitchen gardening was done. In kitchen gardening intercropping is also helpful to decrease the weeds invasion. The weeds C. album L., C. rotundus L., S. nigrum L., M. polymorpha L. showed 100% prevalence, while E. prostarta L. were in least frequency of 18%. This revision highlighted the requisite to grip weeds in order to grasp higher onion yields. It was

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observed among other families i.e. Fabaceae and Euphorbiaceae disturb the bulb size, number of leaves and plant height. Plant health quality was affected even at 18-20% distribution frequency describing the collective performance of weeds on agronomic traits of onion crop. Poaceae and Papaveraceae family weeds proved more harmful for onion plant stand, yield quality and all of the test parameters.

Key words: *Chenopodium album,* onion, Pakistan, production, *Xanthium stumarium*, Weed count.

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INTRODUCTION

Onion (*Allium cepa*) is a bulbous crop belonging to the Alliaceae family. Onion is a condiment consumed in raw, cooked and processed form as well. It is calculated that about 55 million tons per annum of onion are produced all over the world. China and India added just about half of world onion production (PHEB, 2006). Pakistan shares 2.25% and is included in top ten onion producer countries. Onion crop is mostly grown in all the districts of the Punjab Pakistan, covering areas of 35.1 thousand hectares of irrigated and non-irrigated, with total production of 293.8 thousands tones, respectively (MINFAL, 2011).

Obnoxious plants are the major alarming threat in onion. Weed strives with onions for sun, mineral, liquid, phyllosphere and also with host plants of some destructive pathogens and insects. Some researchers reported that onion plants are weak contenders (Carlson and Kirby, 2005; Ghosheh, 2004; Qasem, 2006; Smith *et al*., 2008). Appropriate methods for managing the weeds would help grower to manage the crop by available farm gate resources. Various factors e.g. current weed families, crop selection, growing stage of crop, labor expenditures and availability (Bell and Boutwell, 2001).

Distribution frequency of weeds in the environment and its relation with crop and soil factors is a complex phenomenon. Weeds are frequently adjusted to unpredictable atmospheric and loam situation. These are dispersed everywhere and no produce is free of weeds. Weeds are either grasses that might be of family Poaceae or Cyperacea. These may be either from monocot and dicot families of angiosperms. The weed flora diverges not only from zone, season but also from field subjected to several elements (Sosa *et al.,* 2017).

In struggling with weeds the photosynthetic rate and bulb size of onion plants are significantly reduced. Growth of the plant is suppressed, leaves production was reduced and few leaves are formed. The leaves are smaller, with low chlorophyll and die more quickly when weeds are removed at crop emerging stage, and about half the applied nitrogen and a third of the potassium is taken up by the weeds.

Weed investigations are valuable for defining the incidence and importance of weed families in agronomical schemes and cultivation systems (Khan and Marwat, 2006; Armengot *et al.,* 2016). Fuller *et al.* (2017) argued on the role of landscape type, and plant domestication on weeds dispersal and distribution types. The dispersal mechanisms enables to establishing of consequences for research and additional facilities. So far there is scarcity of information on weeds distribution on onion crop is various cropping zones and cultivation types. Several factors can affect the overall growth and development of weeds (Kashmir *et al.,* 2016). Therefore a systematic study was conducted in onion growing district of Punjab, Pakistan to focus the dissemination of different weed species in onion field

MATERIALS AND METHODS

Determination and identification of weed species

A detailed survey of different onion growing fields in district Lahore, Pakistan was conducted in the onion growing seasons i.e. from December 2013 to March 2016. More than fifty localities in the district of Lahore were selected i.e. Jallo, Harbanspura, Gujjarpura, Taqqipur, Chappa, Bhama, Phulanwala, Attokayawan, Sootar Mill, Daroghawala, Jalwana, Tulaspura, Nathoke, Jhuggiandars, Manawan, Rehmanpura, Shah Shaheedi, Bata pur, Wahga, Basti Ameen Pura, Basti Haddayat-u-Allah, Mohanwala, Khaliq Abad, Waraallah dad, Barki, Hadyara Lane, Therra, Halloki, Lakhan Shrief, Bahno Chak, Raampura, Diyal, Manna, Bhassien, Ali Razaabad, Ashraf Abad, Barkatpura, Raheem Abad, Minhala, Chandair, kharak, Arazitalwara, Nawanpind, gujjran, narwar, Bhami, Paddy, Marl mari, Lallo, Killajewansingh, Wara Mohlay Wasian Thaypura, Baradari, San kay, Karan kay, Shaikhupura, Mureedkay, Ferozwala, Chonia etc. For study of weed distribution in each field, one m^2 quadrate was placed three times randomly, while all weed species in quadrates were added up and their proportion coverage was identified. Facts concerning Absolute frequency, Relative frequency, Absolute density, Relative density and Prevalence of weeds were documented by relating the following formulae (Riaz *et al*., 2007)

$$\text{Absolute Frequency (\%)} = \frac{\text{Number of quadrates in which a species occurs x 100}}{\text{Total number of quadrates}}$$

$$\text{Relative Frequency (\%)} = \frac{\text{Absolute frequency of a species x 100}}{\text{Total absolute frequency}}$$

$$\text{Absolute density} = \frac{\text{Total number of individuals of all species in a quadrate}}{\text{Total number of quadrates thrown}}$$

$$\text{Relative density (\%)} = \frac{\text{Absolute density of individual species x 100}}{\text{Total absolute density of all species}}$$

$$\text{Prevalence (\%)} = \frac{\text{Total number of sites in which a species occurs x 100}}{\text{Total number of visited sites}}$$

RESULTS AND DISCUSSION

In present investigations, a total of thirty four families were recorded among which 16 were angiospermic, belonging to families e.g. Brassicaceae, Poaceae, Rimulaceae, Asteraceae, Convolvulaceae, Amaranthaceae, Cyperaceae, Chenopodiaceae, Papaveraceae, Rubiaceae, Malvaceae, Leguminosae*, Polygonaceae, Fabaceae,* Euphorbiaceae and Caryophyllaceae which contained one or more species each. Among all these, four species e.g. *C. album*, *C. rotundus, S. nigrum*, *M. polymorpha* were present in all surveyed fields with 100% prevalence while *P. hysterophorus* exhibited more than 90% prevalence (Table-1). The *P. hysterophorus* was repeatedly occurring species with 90% absolute frequency and with relative frequency of 4.83%. Chinopodiaceae family revealed the second highest absolute frequency of 80% and relative frequency of 4.71% respectively. So, *P. hysterophorus* is an aggressive weed. It is recorded that in future this destructive foreign weed may become one of the challenging weed due to its high multiplicative, fast growing frequency, toxic nature (Pugalendhi *et al.,* 2011). The conducive field condition for onion is to cultivate on ridges with suitable plant to plant distance. The weed *A. retroflexus* L. had 4.11% absolute frequency and 70% relative frequency that was found to be the most frequent occurring weed followed by *A. hybridus* L., *A. arvensis* L., *C. bursa-pastoris* L., *G. aparine* L., and *S. arvensis* L., with 60% AF and 3.52% RF each. Other frequently occurring species were C*. vensis* L., *M. parviflora* L., *C. arvencese* L. were also observed.

Table-1. Absolute frequency, Relative frequency, Absolute density, Relative density and Prevalence of weeds in onion field in district Lahore, Pakistan

S. No.	Weeds	Family	AF%	RF%	P%	AD	RD%
01	*Amaranthus hybridus*	Amaranthaceae.	60	3.52	78	0.6	3.43
02	*Amaranthusr etroflexus*	*Amaranthaceae*	70	4.11	80	0.7	4
03	*Anagallis arvensis*	Primulaceae	60	3.52	70	0.6	3.7
04	*Avena sterilis*	Poaceae.	80	4.71	80	0.8	4.5
05	*Capsella bursa-pastoris*	Brassicaceae	60	3.52	76	0.6	3.42
06	*Carduus nutans*	Asteraceae.	80	4.71	82	0.8	4.6
07	*Chenopodium album*	Chenopodiaceae	100	5.29	96	0.9	5.2
08	*Chenopodium murale*	Chenopodiaceae	80	4.71	97	0.8	4.9
09	*Convolvulus arvensis*	Convolvulaceae	80	4.71	85	0.8	4.9
10	*Cyperus rotundus*	Cyperaceae.	100	4.11	82	1	5.8
11	*Digitaria sanguinalis*	Poaceae	50	2.81	83	0.5	2.9
12	*Fumaria indica*	Papaveraceae.	40	2.61	35	0.4	2.8
13	*Galium aparine*	Rubiaceae	60	3.52	65	0.6	3.6
14	*Lactuc aserriola*	Asteraceae.	30	1.76	35	0.3	1.86
15	*Lolium tameulentum*	Poaceae	50	2.94	40	0.5	3.1
16	*Malva sylvestris*	Malvaceae.	40	2.09	56	0.4	2.84
17	*Medicago polymorpha.*	Leguminosae	100	5.29	100	1	5.3
18	*Papaver rhoeas*	Papaveraceae	80	4.71	80	0.8	4.9
19	*Parthenium hysterophorus*	Asteraceae.	90	4.83	97	0.7	4.34
20	*Poa annua*	Poaceae	30	1.76	32	0.3	1.71
21	*Polygonu maviculare*	*Polygonaceae*.	30	1.76	37	0.3	1.71
22	*Rumex dentatus*	*Polygonaceae*.	30	1.76	35	0.3	1.72
23	*Setaria verticillata*	Poaceae:	20	1.17	32	0.2	1.34
24	*Silybum marianum*	Asteraceae	50	2.81	54	0.5	3.1
25	*Sinapis arvensis*	Asteraceae	60	3.52	65	0.6	3.7
26	*Solanum nigrum*	Brassicaceae	100	2.29	100	0.4	2.28
27	*Sonchus asperl*	Asteraceae.	30	1.76	30	0.3	1.86
28	*Sonchus oleraceus*	Asteraceae.	20	1.17	20	0.2	1.14

29	*Sorghum halepense.*	Poaceae	20	1.17	20	0.2	1.15
30	*Stelleria media*	*Caryophyllaceae*	30	1.96	30	0.3	1.86
31	*Vicia sativa*	Fabaceae	20	1.17	20	0.2	1.24
32	*Xantiumstrumarium*	Poaceae	20	1.17	20	0.2	1.24
33	*Euphorbia prostarta*	Euphorbiaceae	18	0.59	18	0.1	0.57

Absolute frequency= AF, Relative frequency= RF, Prevalence = P, Absolute density =AD, Relative density = RD

Table-2. Effect of weed infestation on plant yield

S. No.	Family	Number of Members	Number of Leaves		Plant Height (cm)		Bulb Size(cm)	
			Max	Min	Max	Min	Max	Min
1	Amaranthaceae	02b	10a	05b	53.8a	46.2a	4.2	3.3
2	Primulaceae	01c	09b	03d	46.5c	35.8c	4.1	3.1
3	Poaceae.	07a	10b	04c	49.6c	40.2b	3.8	3.01
4	Brassicaceae	02b	08c	06a	50.1b	38.5c	4.0	3.04
5	Asteraceae.	07a	07d	06a	43.2d	35.6c	4.5	3.9
6	Chenopodiaceae	02c	07d	04c	40.8e	32.2d	5.0	4.08
7	Euphorbiaceae	01c	07d	03d	40.6e	30.1d	4.7	3.5
8	Caryophyllaceae	01c	07d	05b	41.9e	33.4c	4.8	3.2
9	Fabaceae	01c	05f	04c	48.2c	36.5c	4.6	3.05
10	Convolvulaceae	01c	05f	03d	50.9b	45.8b	3.2	2.06
11	Cyperaceae.	01c	06e	03d	50.6b	48.9a	4.3	2.04
12	Poaceae	07a	07d	04c	51.8b	46.5a	4.0	1.8
13	Malvaceae.	01c	10a	04c	53.0a	42.5b	4.9	1.3
14	Leguminosae	01c	09b	05b	49.5c	39.9c	4.3	2.3
15	Papaveraceae.	02b	08c	03d	41.5e	38.6c	5.2	1.98
16	Rubiaceae	01a	07d	03d	45.8d	31.5d	4.4	2.05

Values with different letters on top of bar show significant difference (P≤0.05) determined by Tukey's HSD method.

Some members of Amaranthaceae, Primulaceae, Brassicaceae and Asteraceae showed more than 70% prevalance and 3.52 absolute densities each. Absolute frequency of 50% and 40% were also observed in some members of Poaceae, Malvaceae and Asteraceae. The least frequently occurring species in the zone were *Euphorbia* L. with AF of 18% and the absolute density of 0.57, respectively. The existing study reveals that onion fields are infested with many challenging weed classes especially *C. album, C. rotundus, M. polymorpha and S. nigrum* are well known for their antagonistic impacts on crop development and yield. Generally, the yield of onion bulb is reduced by 40-65% due to weed invasion. As weeds decrease the productivity of onion crop, therefore weeds must be controlled in due time.

Effect of weeds on plant stand quality or yield has been understood in the older crop production history and in later studies it was pointed out that besides food, space and light competition many other factors play role. In present investigations it is confirmed that weeds affect plant stand quality and yield attributes of the onion plant (Table-2). Plant stand quality was measured for number of leaves, plant height (cm) and bulb size (cm). The families Primulaceae, Euphorbiaceae, Convolvulaceae, and Rubiaceae affected the number of leaves and onion plants in the closer vicinity of these weeds showed a minimum of three leaves as compared to the 10 leaves in case of onion plants in closer vicinity of Malvaceae family. Chenopodiaceae, Euphorbiaceae and Papaveraceae showed highest reduction in onion plant height and in these families it ranged 40 -41.5 cm as compared to highest plant height of 53.8 cm by Amaranthaceae. In case of the effect of weeds on bulb size, Convolvulaceae, Poaceae, Malvaceae, Leguminosae, Papaveraceae and Rubiaceae showed highest reduction trend on bulb size which ranged 1.3 to 2.06 cm bulb size and among these Malvaceae showed the least bulb size of 1.3 cm where as Poaceae and Papaveraceae were closer to this with 1.98 cm bulb size. While describing the collective performance, Poaceae and Papaveraceae family weeds proved more harmful for onion plant stand and yield quality and all of the test parameters.

There is an immediate requirement to take prompt intervention to create consciousness among the growers for accepting integrated weed management strategies to increase and maintain the quality and harvest of onion.

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