Biodiversity and correlation studies among various traits of *Digeria arvensis, Cyperus rotundus, Digitaria adescendense and Sorghum halepense*

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Abstract: The prescribed study was carried out to access the weeds for plant population and plant moisture percentage. Data of *Digeria arvensis, Cyperus rotundus, Digitaria adescendense and Sorghum halepense* from three places of four locations *viz*., Centre of Excellence in Molecular Biology, University of the Punjab Lahore, Institute of Agricultural Sciences (IAGS), University of the Punjab Lahore, Hanjerwal colony near Centre of Excellence in Molecular Biology, University of the Punjab Lahore and Road side area of Ferozepur Road Kasur. It was found that higher plant population was recorded for *Cyperus rotundus*, higher moisture percentage in the plant body and inflorescence was recorded for *Digeria arvensis*. The weed plants population per square meter was significantly correlated with all studied traits. Fresh inflorescence weight was strongly and significantly correlated with dry plant weight, dry inflorescence weight, total plant moisture percentage and inflorescence moisture percentage. The strong and significant correlation of total plant moisture percentage and inflorescence moisture percentage with other traits indicated that there is important association among the weeds with respect to all locations. It was suggested that the weed controlling measuring practices should be carried out to minimize the yield losing effects of weeds. The herbicide resistant crop varieties should be developed to control weeds.
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1. Introduction

The term weeds referred as any plant that grows at unwanted place. Taxonomically, the term "weed" has no botanical significance due to the fact that a plant which is a weed in at one place may be not a weed when growing in a situation where it is in fact wanted. Weeds are big issue in crop cultivation because it causes reduction in crop yield: Weeds starts to compete with our precious crop for water, nutrients and light (David 1998). As they are hardy and have vigorous growth habit, they outgrow the crops soon & consume large amounts of water and nutrient that cause heavy losses in yield. It may increase the cost of cultivation. Quality of the field produce also reduced. Weeds also give shelter to various insect pests & disease pathogens and they may serve as alternate hosts for spread of pest and disease (Qamar *et al*., 2015). Besides all these facts they also hinder the beautification of lawns and recreational parks. Weed seeds can be spread in a number of ways i.e. wind, water, animals, poor quality grass seed and garden and lawn equipments. Almost all weed seeds remain dormant even for years and initiates their germination when they met favorable conditions for germination (Janick 1979; Townsend 1985; Robert and Chanthy, 2009).

1.1. *Digeria arvensis*

Digeria arvensis, also known as cotton weed and Kunjaru is an annual herb that belongs to family Amaranthaceae. It grows abundantly in Subtropical Asia and eastern tropical Africa. It is commonly found in waste areas. It grows upto 70 cm tall, and have simple or may be branched stem, which is subglabrous in shape but ridged in structure. Leaves of this weed are alternate and simple, their petiole grows upto 5 cm in length, they are blade like in shape and are linear to ovate, their base is narrow, have acuminated apex. In inflorescence they contain a long-peduncle (may be up to 14 cm in length), have spike-like bracteate raceme that appears on axils and grows up to 30 cm long. Each of them unites to form a sub-sessile partially looked inflorescence which has a central fertile flower with 2 lateral sterile flowers.

Their hairless, white to pink color flowers are borne on slender spike-like racemes that can 30 cm large (Seshadri and Nambia 2003).

1.2. *Cyperus rotundus*

Cyperus rotundus (derived from Greek words, kyperos and rotundus is from Latin, meaning "round"), the most protruding weed, commonly also known as Java grass, nut grass, purple nut sedge, red nut sedge and Khmer Kravanh chruk and "worst weed", is perennial plant which belongs to sedge (family Cyperaceae). It is native of Africa, Southern and Central Europe and Southern Asia and damage crops by their allelopathic effect. It have intensive root system which provides it support to grow vigorously and thus it can reach upto height of 140cm. Leaves of Cyperus sprouts in the rank of 3 from the base of plant and grows about 5-20cm long having triangular cross section stem. Flower is bisexual having 3 stamens and 3 stigma carpel, also contain 3-8 unequal rays of flower head (Santos *et al*., 1998). Fruit is also 3-angled achene. Young plant initially exhibits fleshy rhizome as root system which usually forms the chain of 25mm dimension. Some rhizomes may grow upward in the soil which then forms a bulb like structure from which the new growth occurs. Other rhizomes grow horizontally or under the soil, that forms dark reddish-brown tuber or chains of tubers. It prefers dry conditions but can also grow in wet areas (Travlos *et al*., 2009; Shabana *et al*., 2010; Elahi *et al*., 2011a).

1.3. *Digitaria adescendense*

Digitaria adescendense being an annual grass is damaging to our crops as have advantage to grow even on less fertile lands and their drought resistance makes them possible to stand in almost every type of soil which extends its own root system by weakens the root system of surrounding plants. It has thin and narrow radiating branches at the top of stem which are usually 9 in number. A pair of spikelet is present on the terminal portion of each branch. The color of their inflorescence is reddish to purple. The table below shows how much water *Digitaria adescendense* consumes (Heatwole 1981).

1.4. *Sorghum halepense*

Sorghum halepense, a perennial plant, commonly known as Johnson grass belongs to Poaceae family is the native of Mediterranean regions but due to drought tolerace grows almost all over the world except Antarctica and archipelagos. It grows upto 50-200cm tall due to strong support of its creeping rhizome. It has pre-eminently white color midrib in leaf blade. The spikelets are sessile and appear in the form of pair which is 4.5-5.5 mm long that when grows, gives falling down look. The table below shows how much water *Sorghum halepense* consumes (Martin and Cox 1984; Holm *et al*., 1997; Elahi *et al*., 2011b).

2. Materials and Methods

The present study was conducted at Centre of Excellence in Molecular Biology, University of the Punjab Lahore, Pakistan during March 2015. The of *Digeria arvensis, Cyperus rotundus, Digitaria adescendense and Sorghum halepense* weeds was collected from 4 different locations *viz*. Centre of Excellence in Molecular Biology, University of the Punjab Lahore, Institute of Agricultural Sciences (IAGS), University of the Punjab Lahore, Hanjerwal colony near Centre of Excellence in Molecular Biology, University of the Punjab Lahore and Road side area of Ferozepur Road Kasur. The data was recorded for fresh plant weight, fresh inflorescence weight, dry plant weight, dry inflorescence weight by using an electronic balance (OHAUS-GT4000, USA), total plant moisture percentage [(fresh plant weight – dry plant weight)/fresh plant weight*100], total inflorescence moisture percentage [(fresh inflorescence weight - dry inflorescence weight)/ fresh inflorescence weight*100] and number of plants per square meter area. The data was statistically analyzed by using analysis of variance technique (Steel *et al*., 1997).

3. Results and discussions

It was found from table 1 that significant differences among all studied traits of weeds. It was also indicated from results that significant weeds × location interaction were found for all traits. Significant interactions suggested that the weeds have significant correlation with their biodiversity at various locations of the world. The weeds can grow at all locations along with the competition of crop plants and environmental conditions. The relation of weeds with locations indicated that the weeds can easily grow under various environmental conditions. It was indicated from results that average dry plant weight of all four studied locations was recorded to be 5.03±0.071g while fresh plant weight was found as 13.446±0.129. The average dry inflorescence weight was found as 0.5266±0.0573g while fresh inflorescence weight was 3.53±0.0881. The average number of plants at all locations was 50.74±7.6171. The total moisture percentage in plant body was recorded as 71.541±0.7183% while inflorescence moisture percentage was found as 79.71±2.1802%. The higher moisture percentage in whole plant body suggested that the weeds used higher water. The higher water use percentage also suggested that the weeds may cause loss of water and nutrient contents

from soil that leads towards the loss of crop yield. The use of herbicides (glyphosate) to control weeds may cause the loss of crop plants, therefore the improvement of glyphosate resistance in crop plant is needed in order to reduce the loss of crop plant yield due to weeds (Elahi *et al*., 2011ab, Qamar *et al*., 2015).

It was found from table 2 that higher number of plant per square meter of *Cyperus rotundus* were recorded at Hanjerwal (45.22), Institute of Agricultural Sciences University f the Punjab (120.87), CEMB (100.81) and Kasur (123.67) at all studied locations while lowest number of plants were found for *Sorghum halepense* Hanjerwal (10.98), Institute of Agricultural Sciences University f the Punjab (58.67), CEMB (35.56) and Kasur (9.87). The higher population of *Cyperus rotundus* at all locations indicated that the ability of *Cyperus rotundus* to compete with other weeds and crop plants is higher and may caused loss of crop yield plants. The results indicated that higher fresh plant weight and dry plant weight was found for *Sorghum halepense* at CEMB (34.838g, 15.977g), Hanjerwal (33.430g, 15.610g), Punjab University (32.853g, 15.207) and Kasur (33.070g, 15.440g) respectively. The lower fresh plant weight and dry plant weight was found for *Digitaria adscendense* at CEMB (4.920g, 1.400g), Hanjerwal (4.097g, 1.327g), Punjab University respectively. The results from table 2 indicated that *Cyperus rotundus* showed higher fresh inflorescence weight at CEMB (4.707g), Hanjerwal (4.447g), Punjab University (4.327g) and Kasur (5.00g) while lowest was found for *Digitaria adscendense* at CEMB (4.097g) and *Sorghum halepense* at Hanjerwal (1.273g), Punjab University (0.737g) and Kasur (1.143g). Higher dry inflorescence weight was found for *Digeria arvensis* at Hanjerwal (0.703g), Punjab University (0.767g) and Kasur (1.033g) while *Sorghum halepense* at CEMB (0.717g). The moisture percentage in the plant body and inflorescence was recorded for *Digeria arvensis* at CEMB (83.243%, 83.615%), Hanjerwal (85.487%, 83.893%), Punjab University (87.538%, 82.576%) and Kasur (85.845%, 77.857%) respectively. Lowest moisture percentage in the plant body and inflorescence was recorded *Sorghum halepense* at all locations. The higher moisture percentage in the weed body indicated that the ability of weeds to store and use water was higher. The absorption of nutrients from soil are also higher that caused the loss of availability of nutrients to the crop plants and effect the decrease in yield of crop plants. It was suggested that to control the losses of crop yield due to weeds should be improved through cultural and chemical control through the use of herbicide resistant crop varieties (Shabana *et al*., 2010; Ali *et al*., 2013; Ali *et al*., 2014ab).

It was found from table 3 that strong and significant correlation of dry plant weight was fresh plant weight, total plant moisture percentage, inflorescence moisture percentage, inflorescence fresh and dry weight and number of plant per square meter. The number of weed plants per square meter was significantly correlated with all studied traits. Fresh inflorescence weight was strongly and significantly correlated with dry plant weight, dry inflorescence weight, total plant moisture percentage and inflorescence moisture percentage. The strong and significant correlation of total plant moisture percentage and inflorescence moisture percentage with other traits indicated that there is important association among the weeds with respect to all locations. The yield losing effect of weeds on crop plants may have similar affects. The higher plant moisture percentage suggested that the weeds used much of soil water and nutrients that caused reduction in nutrients availability to crop plants. The increase in number of weed plant population caused competition with crop plants and reduced yield and quality of required field crop plants (Shabana *et al*., 2010; Ali *et al*., 2013; Ali *et al*., 2014ab). By controlling weeds the crop yield may be improved.

Table 1. ANOVA for various studied traits of weeds

Source	DF	Dry plant weight	Inflorescence Dry weight	Fresh plant weight	Inflorescence Fresh weight	No of plants	Total plant moisture percentage	Total inflorescence moisture percentage
Replications	2	0.4608	0.00165	0.4008	0.1052	0.1152	0.00135	0.00141
Weeds	3	403.284*	0.76003*	1463.92*	20.9601*	9721.67*	1518.54*	2776.11*
Location	3	0.15817*	0.04525*	1.28382*	0.2901*	2841*	1.12101*	7.76063*
Weeds×Location	9	0.0538*	0.03505*	0.17758*	0.08274*	618.889*	5.50332*	50.7013*
Error	15	2.53E-31	0.00001	1.21E-30	5.09E-32	1.77E-29	1.35E-29	2.00E-29
Grand Mean		5.03	0.5266	13.446	3.53	50.74	71.541	79.71
Standard Error		0.071	0.0573	0.129	0.0881	7.6171	0.7183	2.1802

*= Significant at 5% probability level

Table 2. Mean performance of weeds at various locations

No of plant					
Weeds/Locations	**CEMB**	**Hanjerwal**	**Punjab University**	**Kasur**	**Average**
Digeria arvensis	50.13b	20.22b	80.14b	65.36b	53.9625b
Cyperus rotundus	40.28c	15.17c	50.29c	34.55c	35.0725c
Digitaria adscendense	100.81a	45.22a	120.87a	123.67a	97.6425a
Sorghum halepense	35.56d	10.98d	8.67d	9.87d	16.27d
Average	56.695c	22.8975d	64.9925a	58.3625b	
Fresh plant weight (g)					
Weeds/Locations	**CEMB**	**Hanjerwal**	**Punjab University**	**Kasur**	**Average**
Digeria arvensis	9.807b	9.417b	8.773b	9.113b	9.278b
Cyperus rotundus	6.373c	6.150c	5.450c	6.410c	6.096c
Digitaria adscendense	4.920d	4.097d	4.373d	4.740d	4.533d
Sorghum halepense	34.253a	33.430a	32.853a	33.070a	33.402a
Average	13.838a	13.273c	12.863d	13.333bc	
Fresh inflorescence weight (g)					
Weeds/Locations	**CEMB**	**Hanjerwal**	**Punjab University**	**Kasur**	**Average**
Digeria arvensis	4.333ab	4.367ab	4.400ab	4.667b	4.442ab
Cyperus rotundus	4.707a	4.447a	4.327a	5.000a	4.620a
Digitaria adscendense	4.097abc	3.457b	3.487c	3.743c	3.696b
Sorghum halepense	1.317b	1.273c	0.737d	1.143d	1.118c
Average	3.613b	3.386c	3.238d	3.638a	
Dry plant weight (g)					
Weeds/Locations	**CEMB**	**Hanjerwal**	**Punjab University**	**Kasur**	**Average**
Digeria arvensis	1.643b	1.367bc	1.093c	1.290d	1.348c
Cyperus rotundus	1.363cd	1.340b	1.337bc	1.327c	1.342c
Digitaria adscendense	1.400c	1.327bcd	1.377b	1.447b	1.388b
Sorghum halepense	15.977a	15.610a	15.207a	15.440a	15.558a
Average	5.096a	4.911b	4.753d	4.876c	
Dry inflorescence weight (g)					
Weeds/Locations	**CEMB**	**Hanjerwal**	**Punjab University**	**Kasur**	**Average**
Digeria arvensis	0.710bc	0.703a	0.767a	1.033a	0.803a
Cyperus rotundus	0.713b	0.677b	0.557b	0.703b	0.663b
Digitaria adscendense	0.033d	0.027d	0.030d	0.273d	0.091d
Sorghum halepense	0.717a	0.620c	0.343c	0.410c	0.523c
Average	0.543a	0.507c	0.424d	0.605a	
Total plant moisture percentage %)					
Weeds/Locations	**CEMB**	**Hanjerwal**	**Punjab University**	**Kasur**	**Average**
Digeria arvensis	83.243a	85.487a	87.538a	85.845a	85.528a
Cyperus rotundus	78.609b	78.211b	75.474b	79.303b	77.899b
Digitaria adscendense	71.545c	67.616c	68.521c	69.480c	69.290c
Sorghum halepense	53.357d	53.305d	53.713d	53.311d	53.422d
Average	71.688b	71.155d	71.312c	71.985a	
Total inflorescence moisture percentage (%)					
Weeds/Locations	**CEMB**	**Hanjerwal**	**Punjab University**	**Kasur**	**Average**
Digeria arvensis	83.615c	83.893c	82.576c	77.857c	81.985c
Cyperus rotundus	84.844b	84.783b	87.134b	85.933b	85.674b
Digitaria adscendense	99.186a	99.229a	99.140a	92.698a	97.563a
Sorghum halepense	45.570d	51.309d	53.394d	64.140d	53.603d
Average	78.304c	79.803b	80.561a	80.157ab	

Table 3. Pooled correlation among various weed traits

Traits	Dry plant weight	Inflorescence Dry weight	Fresh plant weight	Inflorescence Fresh weight	No of plants/m^2	Total plant moisture percentage
Inflorescence Dry weight	-0.0072					
P<0.05	0.9688					
Fresh plant weight	0.9888*	-0.1261				
P<0.05	0.000	0.4918				
Inflorescence Fresh weight	0.9537*	0.2424*	0.9191*			
P<0.05	0.0000	0.1813	0.0000			
No of plants/m^2	0.5417*	*0.4069*	0.5839*	0.3958*		
P<0.05	0.0014	0.0208	0.0005	0.0249		
Total plant moisture percentage	0.8731*	0.4238*	0.7929*	0.9347*	0.2839*	
P<0.05	0.0000	0.0157	0.0000	0.0000	0.1153	
Total inflorescence moisture percentage	0.9096*	0.3935*	0.9463*	0.7815*	0.6333*	0.6281*
P<0.05	0.0000	0.0259	0.0000	0.0000	0.0001	0.0001

4. Conclusions

It was concluded that the weed controlling measuring practices should be carried out to minimize the yield losing effects of weeds. The herbicide resistant crop varieties should be developed to control weeds.

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