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ORIGINAL RESEARCH ARTICLE

Genetic variability in *Cirsium arvense* under different environmental conditions

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ABSTRACT: Weeds are the plants that grow at all of the unwanted places. The plant population of weeds have to be controlled to reduce competition among crop plants and weeds. The prescribed study was conducted to evaluate *Cirsium arvense* growth under different locations/environmental conditions. The results showed that there was a positive and significant correlation among fresh weight, dry weight, plant height, fresh inflorescence weight, moisture contents and leaf area which shows similar findings from stepwise linear regression. GGE biplot showed location 4 as most favourable place for smooth growth and development of *Cirsium arvense*. It was suggested that the plant population of *Cirsium arvense* should be controlled through manual, chemical strategies while the use of transgenic crop plants (resistant to glyphosate) may be an advantage to control weeds.

Keywords: *Cirsium arvense*, genetic variability, weed, correlation, regression, GGE biplot

INTRODUCTION

Weeds are the plants that grow at unwanted place. It is also known as a pest plant. Common weeds are very resilient and fast growing that contends with cultivated crop. They are a source of diseases and pest. Superior method to control them is to prevent it from being established as its removal is time consuming. Weeds also provide shelter to several pests, disease, insect and pathogens and they may assist as substitute hosts for dispersal of disease and pest (Harrem et al., 2015; Mobeen et al., 2015; Qamar et al., 2015). *Cirsium arvense* is a species of Cirsium, indigenous across Europe and Northern Asia (Friedli and Bacher, 2001). Its height may go up to 30-100 cm and it is a perennial herb., It forms substantial clonal colonies from an underground root system, that give rise to many straight stems each spring, getting the height of 1-1.2 m tall (Donald, 1990). Its extract is used for manufacturing of antibiotic, antioxidants and drugs, used as medicinal plant. The flowers are purple-pink, with all the florets having diameter of 10-22mm and of similar form. The flowers are not repeatedly so; some plants bear hermaphrodite flowers but mainly dioecious. *Cirsium arvense* is judged as weed yet in its native areas, for example in the United Kingdome under the Weeds Act 1959 it is assigned as an “injurious weed” (Kay, 1985).

MATERIALS AND METHODS

The present study was conducted at Centre of Excellence in Molecular Biology, University of the Punjab Lahore Pakistan. Data on different morphological traits of *Cirsium arvense* was recorded. Data was recorded for 36 individuals collected from each population in triplicate from four different locations (environmental conditions). From each location, 9 plants were randomly selected. Data for plant height, leaf area (leaf length × leaf width), fresh plant weight, dry plant

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weight, fresh inflorescence weight, through the use of electric balance, total plant moisture percentage [(fresh plant weight) – (dry plant weight/fresh plant weight)× 100], were recorded and subjected to analysis of variance (Steel, 1997)(Steel et al., 1997). To avoid duplicate sampling of the same genome, each individual sample from a population was collected randomly from locations at least 100 m from each other. The samples were placed in zip lock bags. The samples were left drying to note the dry weight of the samples.

RESULTS AND DISCUSSIONS

It was revealed from results (Table 1) that significant differences were recorded for growing locations (environmental conditions) of *Cirsium arvense*. It was found that average fresh weight of plants was recorded as 46.954±3.235g, plant height (76.155± 1.085cm), leaf area (22.548±0.708cm^2), fresh inflorescence weight (0.035±0.008g), dry weight (4.995±0.336g) and moisture contents/percentage (89.359±0.211%). Higher fresh weight and moisture contents of *Cirsium arvense* plants indicated that there is higher survival ability under harsh environmental conditions. Higher leaf area revealed that the plants have higher ability for photosynthesis due to which the accumulation of organic compounds may be higher in *Cirsium arvense* plants that caused increasing in plant biomass. *Cirsium arvense* compete with crop plants for water, minerals and nutrients due to which the production and productivity of crop plants is highly affected. The removal of *Cirsium arvense* plants from filed of crop plants is necessary to reduce yield losses (Anwer et al., 2015; Friedli and Bacher, 2001; Ziska et al., 2004).

Table 1. Analysis of variance for morphological traits of *Cirsium arvense*

SOV	FW	PH	LA	FlW	DW	MC
Locations	0.893*	5.675*	0.455*	4.091*	6.025*	23.872*
Error	0.012	0.323	0.001	0.0142	0.9122	1.0634
Grand Mean	46.954	76.155	22.548	0.035	4.995	89.359
Standard Error	3.235	1.085	0.708	0.008	0.336	0.211
CV	6.889	1.425	3.140	7.792	6.718	0.236

*=Significant at 5% probability level, PH = Plant height, FW = Fresh weight, LA = Leaf area, FIW = Fresh inflorescence Weight, DW = Dry weight, MC = Moisture contents

Correlation analysis was performed to access the relationship among the morphological traits of *Cirsium arvense*. It was found from results (Table 2) that there was a positive and significant correlation among plant height, leaf area, fresh inflorescence weight, dry weight, moisture contents/percentage and fresh weight. Significant and positive correlation indicated that the fresh weight is highly affected by all studied morphological traits. Positive and significant correlation is usually favourable for a researcher to develop higher yielding crop plant varieties and hybrids. Negative correlation is usually used for traits which are to be reduced for improving plant productivity (Ali et al., 2012; Anjum and Bajwa, 2010).

Table 2. Correlation among morphological traits of *Cirsium arvense*

Traits	FW	PH	LA	FIW	DW
PH	0.4620*				
LA	0.3716*	0.6047*			
FIW	0.5019*	0.2068	-0.2044		
DW	0.9536*	0.4677*	0.4051*	0.3974*	

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MC	0.2482*	0.0362	-0.0825	0.3879*	-0.0542

*=Significant at 5% probability level, PH = Plant height, FW = Fresh weight, LA = Leaf area, FIW = Fresh inflorescence Weight, DW = Dry weight, MC = Moisture contents

Regression analysis was carried out to find out the dependence of response variable on contributing variables. It was found that all of the traits showed positive association for fresh weight (Table 3). The higher contributing trait was dry weight (9.329), moisture contents/percentage (4.602), fresh inflorescence weight (2.041), leaf area (0.049) and plant height (0.027). The regression equation was predicted as,

Y (FW) = -40.009 + 0.027(PH) + 0.049(LA) + 2.041(FIW) + DW (9.329) + 4.602(MC)

The positive contribution of each traits revealed that the decrease in any of the trait may cause the declining of growth and development of *Cirsium arvense* plants. GGE biplot was constructed to find out the location/environmental condition most favourable for smooth growth and development of *Cirsium arvense* (Fig. 1). It was found that PC1 showed 95.7% and PC2 (2.9%) for total variation among the studied traits. The location 4 (environmental condition) serves as highly suitable place for growing of *Cirsium arvense*. Various researchers have reported that the weeds should be controlled to minimize the yield losses in crop plants. The *Cirsium arvense* plants compete with crop plant for water, minerals nutrients, space and sun light (Aksakal et al., 2010; Harrem et al., 2015; Zameer et al., 2015).

Table 3. Stepwise multiple linear regression for fresh weight of *Cirsium arvense*

Traits	Coefficients	Standard Error	t Stat	Partial R^2	Lower 95%	Upper 95%
PH	0.027	0.029	-0.94	38.41	-0.097	0.043
LA	0.049	0.048	1.032	34.2	-0.067	0.166
FIW	2.041	4.006	0.509	21.29	-7.762	11.845
DW	9.329	0.09	103.383	4.32	9.108	9.55
MC	4.602	0.12	38.407	2.54	4.309	4.895

Intercept = -40.099, standard error = 0.0733, Multiple R^2 = 97.18%, R^2 = 98.65%, Adjust R^2 = 96.42%

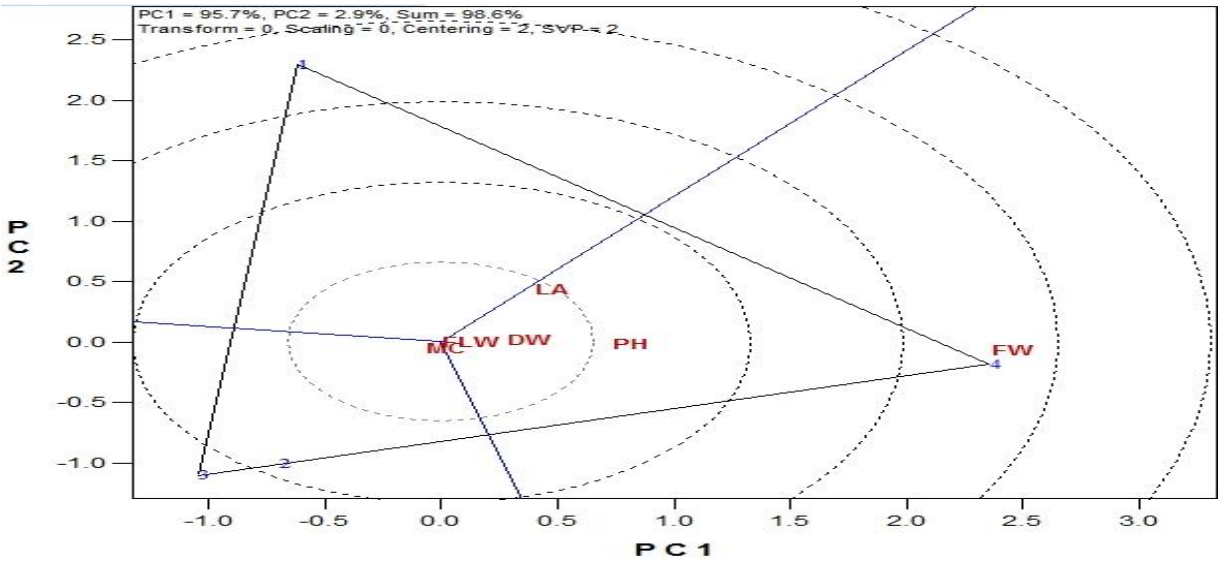

Figure 1. GGE biplot for morphological traits of *Cirsium arvense* under 4 different locations

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CONCLUSIONS

The results from prescribed study indicated that the significant association was recorded for fresh weight with all studied contributing traits. Therefore, the study concluded form prescribed study that the plant population of *Cirsium arvense* should be controlled to minimize the yield losses of crop plants.

CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

REFERENCES

Aksakal, O., Sunar, S., Kaya, Y., and Agar, G. (2010). Genetic diversity within and among Lepidium draba populations from Eastern Anatolia based on RAPD analysis. *Biochemical genetics* **48**, 603-611.

Ali, Q., Ahsan, M., Tahir, M. H. N., and Basra, S. M. A. (2012). Genetic evaluation of maize (Zea mays L.) accessions for growth related seedling traits. *International Journal for Agro Veterinary and Medical Sciences* **6**, 164-172.

Anjum, T., and Bajwa, R. (2010). Competition losses caused by Rumex dentatus L. and Chenopodium album L. in wheat (Triticum aestivum L.). *Philippine agricultural scientist* **93**, 365-368.

Anwer, S., Ali, Q., Ali, M., Khalid, H., Ahmad, A., Ali, A., Shafiq, M., Haider, M. S., Nasir, I. A., and Husnain, T. (2015). Assessment of association among various morphological traits of Euphorbia granulata, Euphorbia hirta, Fumaria indica and Parthenium hysterophorus. *Nature and Science* **13**, 47-51.

Donald, W. (1990). Management and control of Canada thistle (Cirsium arvense). *Reviews of weed Science* **5**, 193-249.

Friedli, J., and Bacher, S. (2001). Direct and indirect effects of a shoot-base boring weevil and plant competition on the performance of creeping thistle, Cirsium arvense. *Biological Control* **22**, 219-226.

Harrem, K., Qurban, A., Sadia, A., Mobeen, A., Ali, A., Arfan, A., Muhammad, S., Muhammad, S., Idrees, A., and Tayyab, H. (2015). Biodiversity and correlation studies among various traits of Digeria arvensis, Cyperus rotundus, Digitaria adescendense and Sorghum halepense. *NY Sci J* **8**, 37-42.

Kay, Q. (1985). Hermaphrodites and Subhermaphrodites in a Reputedly Dioecious Plant, Cirsium arvense (L.) Scop. *New Phytologist* **100**, 457-472.

Mobeen, A., Qurban, A., Sadia, A., Harrem, K., Ali, A., Arfan, A., Muhammad, S., Muhammad, S., Idrees, A., and Tayyab, H. (2015). Estimation of Correlation among various morphological traits of Coronopus didymus, Euphorbia helioscopia, Cyperus difformis and Aristida adscensionis. *NY Sci J* **8**, 47-51.

Qamar, Z., Aaliya, K., Nasir, I. A., Farooq, A. M., Tabassum, B., Qurban, A., Ali, A., Awan, M. F., Tariq, M., and Husnain, T. (2015). An overview of genetic transformation of glyphosate resistant gene in Zea mays. *Nat. Sci* **13**, 80-90.

Steel, R. G., Torrie James H Dicky, AD (1997). "Principles and procedures of statistics: a biometrical approach," McGraw-Hill, New York New York, USA.

Zameer, M., Munawar, S., Tabassum, B., Ali, Q., Shahid, N., Saadat, H. B., and Sana, S. (2015). Appraisal of various floral species biodiversity from Iskandarabad, Pakistan. *Life Sci J* **12**, 77-87.

Ziska, L. H., Faulkner, S., and Lydon, J. (2004). Changes in biomass and root: shoot ratio of field-grown Canada thistle (Cirsium arvense), a noxious, invasive weed, with elevated CO2: implications for control with glyphosate. *Weed Science* **52**, 584-588.

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