

Assessment of variation and interrelationship among plant growth and development traits in *Chenopodium album*

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Abstract: *Chenopodium album* is an important weed plant that grows in maize, cotton and wheat fields. It caused harmful effects on plant growth and development of crop plant which reduced crop yield. Present study was conducted in the Centre of Excellence in Molecular Biology, University of the Punjab Lahore during February 2016 to access the variation among growth and development traits under three different locations and inter relationship of studied traits of *Chenopodium album*. It was found from mean performance and GGEbiplot that the growth and development of *Chenopodium album* was higher under locations 1 and 3. Significant and strong correlation was found among most of the studied traits which indicated the higher ability of *Chenopodium album* to withstand in harsh and stress environmental conditions. The fresh plant weight, leaf length leaf width, leaf area, total fresh and dry plant weight were found strongly inter-correlated with each other. It was suggested that the removal of *Chenopodium album* should be carried out to reduce harmful effects on growth and development of crop plants. The use of pre-emergence herbicides, induced mutations for herbicide resistance and transgenic crop plants would be an advantage to combat weeds in crop field.

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Keywords: *Chenopodium album*, weeds, correlation, GGEbiplot, crop plant field, yield, stress environment

Introduction

Chenopodium album Linn (family: Chenopodiaceae) is a major weed in most of the crop plant species like maize, cotton, sugarcane, wheat and sorghum [1-4]. Plant seeds of *Chenopodium album* have larger amount of protein, vitamin, calcium, phosphores & potassium. Leaves have larger amount of soluble oxalate that interact with calcium & induced hypocalcemia [2]. The leaves are anti-scorbutic. The juice used on burn injuries as a treatment. It is mostly grow in all over South East Asia. It is found in areas around Mumbai, Kashmir, Sikkim and throughout Pakistan [5]. *C. album* is commonly called 'white goose foot', whereas in Pakistan's local language, it is called 'Bathua', which is a vegetable and consumed as a food product [6]. In agricultural fields, most of the weedy *Chenopodium* species are referred to as common lamb's quarters (*Chenopodium album* L.). Recently, it was reported that common lambs quarters, one of the worst weeds in the world [7], was difficult to control with the available herbicides in corn and soybean fields in the North Central states [8, 9]. The important constituents present in the plant that contribute to its nutritional value and pharmacological effects include, flavanols [10], carotene [11], vitamins A and C [12], minerals including potash salts [13], and amides [14]. The plant has laxative properties, it is also used in hepatic

disorder and conditions due to enlarged spleen [6, 13]. It is used as diuretic, febrifuge, emollient for throat and chest, nutritive and thirst quenching agent [15]. Methanolic extract of the plant has shown to produce significant anthelmintic activity [16]. The seed extract of *C. album* has been reported to produce significant spermicidal activity [17, 18]. The plant extract has also been identified to contain free radical scavenging activity and might have some use in cancer treatment [19]. The large plant population of weeds caused reduction in yield and productivity of crop plants. The removal of weeds from crop field is most important to reduce yield losses. There are various ways to control weeds through manual removal, use of plant extracts [4], induced mutation [20], use of transgenic crop plants [21-23]. Present study was carried out to access the variation among growth and development traits under three different locations and inter relationship of studied traits of *Chenopodium album*.

Material & Method

The present study was conducted in the Centre of Excellence in Molecular Biology, University of the Punjab Lahore during February 2016. The data was recorded for *Chenopodium album* plants in the area of 1m². This area of 1m² was selected randomly from three different locations with the help of scale. Three plants were selected randomly from that area. After

that the height of plants, length and width of leaf, leaf area were recorded. For number of flowers per plant, plucked all the flowers from these plants and were counted. Weight was recorded for fresh and dry plants and flowers with the help of weight balance

separately, after that dried these plants and flowers in sun light separately which are covered with paper envelop. The data was recorded and statistically analyzed for analysis of variance [24].

Table 1. Analysis of variance for different traits of *Chenopodium album*

Source of Variation	Plant Height	Leaf Area	Fresh Plant weight	Fresh flower Weight	Dry Plant Weight	Dry flower Weight	No. of flowers	Total Plant fresh weight	Total plant dry weight	Leaf length	Leaf width
Replication	0.024	0.0124	4.028	0.0742	1.0424	0.0011	12.994	0.3091	0.0242	1.089	0.0982
Location	134.301*	8.406*	278.08*	8.192*	33.031*	2.343*	362.032*	34.145.*	204.368*	6.141*	5.029*
Error	16.021	1.914	23.42	0.6630	1.028	0.0022	0.00274	0.0041	4.011	0.044	0.283
Grand Mean	24.208	4.0631	53.382	1.156	14.764.	0.237	23.321	25.435	23.563	1.220	1.03
Standard Error	1.3016	0.0223	2.0823	0.0672	1.0243	0.0023	0.2834	0.0048	1.0021	0.1009	0.0025

Results and discussions

The results from table 1 indicated that significant differences were found for locations and all studied traits. The average plant height (24.208 ± 1.3016 inch), leaf area ($4.063 \pm 0.0223 \text{ cm}^2$), fresh plant weight ($53.382 \pm 2.0823 \text{ g}$), fresh flower weight ($1.156 \pm 0.0672 \text{ g}$), dry plant weight ($14.764 \pm 1.0243 \text{ g}$), dry flower weight ($0.237 \pm 0.0023 \text{ g}$), number of flowers per plant (23.321 ± 0.2834), total plant fresh weight ($25.435 \pm 0.0048 \text{ g}$), total plant dry weight ($23.563 \pm 1.0021 \text{ g}$), leaf length ($1.220 \pm 0.1009 \text{ cm}$) and leaf width ($1.03 \pm 0.0025 \text{ cm}$) were recorded for *Chenopodium album* under three different locations. The higher performance of weed plants at location 1 and 3 showed that the ability and survival rate of

weeds to was higher. The higher surviving weed plants showed tolerance against harsh environmental conditions, due to which the population of weed plant increased that may caused yield and productivity losses in crop plants [2, 25]. It was found from results given in table 2 that location 1 and 3 were most suitable locations for growth and development of *Chenopodium album* plants. The similar results were also conformed from figure 1 that locations 1 and 3 found best suited locations. Higher variation was recorded for PC1 (98.70%) while PC2 showed 1.3% variation. Principal component analysis provides an opportunity to select crop plant genotypes on the basis of large number of traits studied [26-29]. The control of weeds plants from field crop area is much important to reduce hazards to crop plants.

Table 2. Mean performance for different traits of *Chenopodium album*

Traits	Location 1	Location 2	Location 3
Plant height (inches)	24.67a	23.33b	23.33b
Leaf length (inches)	2.37a	1.73b	1.47c
Leaf width (inches)	1.87a	0.93c	0.83b
Leaf area (inches ²)	4.50a	1.63b	1.22c
Fresh plant weight (g)	59.97a	59.59b	38.46c
Dry plant weight (g)	15.24a	13.05b	8.26c
Fresh flower weight (g)	1.36b	1.07c	1.40a
Dry flower weight (g)	0.29b	0.22c	0.41a
Total fresh Plant weight (g)	26.02a	24.40bc	24.74b
Total dry Plant weight (g)	24.96a	23.55bc	23.74b
No. of flowers (m ²)	18.67b	18.67b	29.33a

It was found from table 3 that there was strong and significant correlation among plant height, leaf length, leaf width, total fresh and dry plant weight. Leaf length showed significant and strong correlation with plant height, leaf width, fresh plant weight, dry plant weight, total fresh and dry plant weight. The

traits fresh plant weight, leaf length leaf width, leaf area, total fresh and dry plant weight were significantly and strongly interrelated with each other. The results of our study was in accordance with many other researchers who also found significant and strong correlation among fresh plant weight, leaf

length leaf width, leaf area, total fresh and dry plant weight [25, 30, 31]. The strong and positive correlation of leaf area with plant weight traits indicated that the photosynthetic rate was higher that leads to improve plant fresh and dry biomass [32]. The higher plant biomass indicated that the weed plants have ability to survive under various harsh environmental conditions [33-35]. The weed plants get higher water, mineral salts and other essential organic nutrients form soil in higher amount which

caused greater and rapid weed plant growth. The nutrient availability is usually reduced to crop plants due to higher weed plant population. The higher weed plant population also caused drought stress on crop plants due to the uptake of water and minerals from soil [30]. The drought caused reduction in crop plant yield and productivity [36-38]. The removal of weeds from crop plant field must be carried out to control yield and economic losses in crop plants.

Table 3. Correlation among different traits of *Chenopodium album*

Traits	Plant height	Leaf length	Leaf width	Leaf Area	Fresh plant weight	Dry plant weight	Fresh flower weight	Dry flower weight	Total fresh plant weight	Total dry plant weight
Leaf length	0.958*									
Leaf width	0.996*	0.979*								
Leaf area	0.993*	0.984*	0.901*							
Fresh plant weight	0.513*	0.739*	0.587*	0.609*						
Dry plant weight	0.742*	0.904*	0.798*	0.814*	0.956*					
Fresh flower weight	0.384	0.101	0.301	0.275	-0.595*	-0.335				
Dry flower weight	-0.131	-0.411*	-0.217	-0.244	0.918*	-0.762*	0.865*			
Total fresh Plant weight	0.981*	0.883*	0.960*	0.952*	0.336	0.597*	0.556*	0.065		
Total dry Plant weight	0.992*	0.914*	0.977*	0.971*	0.403*	0.652*	0.496*	-0.006	0.997*	
No. of flowers	-0.500	-0.729*	-0.574*	-0.596*	-0.090	-0.952*	0.608*	0.924*	-0.322	-0.388

* = Significant at 5% probability level

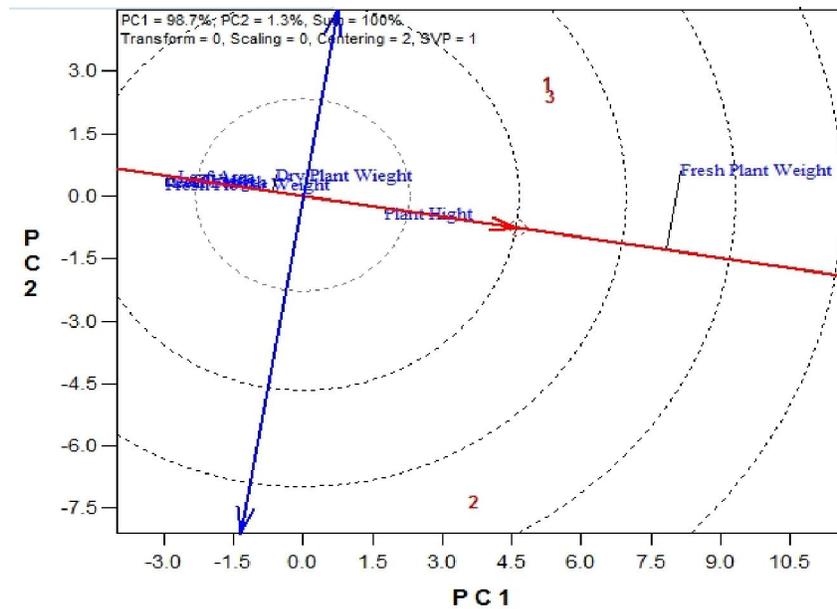


Figure 1. GGEBiplot showing the mean vs stability for different traits of *Chenopodium album* studied at three locations

Conclusions

It was found from study that the growth and development of *Chenopodium album* was higher under locations 1 and 3. Significant and strong correlation was found among most of the studied traits which indicated the higher ability of *Chenopodium album* to withstand in harsh and stress environmental conditions. It was suggested that the removal of

Chenopodium album should be carried out to reduce harmful effect on growth and development of crop plants.

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