

Estimation of variability among morphological traits of *Chenopodium album*

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Abstract: The prescribed study was carried out to find the diversity of *Chenopodium album* under different locations and variability for various studied traits of *Chenopodium album*. It was found from results that the location 5 serve as highly suitable location for growing, developing and reproducing of *Chenopodium album* as compared other under studied locations. Plant height, dry plant weight, fresh plant weight, inflorescence dry and fresh weights, leaf length and leaf area showed strong inter correlation with each other. The strong positive correlation indicated that the traits were higher associated with each other and influence overall plant growth and development under variable environmental conditions. Regression analysis was performed to access the contribution of various traits towards fresh plant weight. It was found from results that there was a positive and significant contribution of dry plant weight, inflorescence dry weight, leaf width, leaf length and plant moisture contents. It was concluded from our study that the *Chenopodium album* plants showed higher survival adaptability under different environmental conditions, which helps to keep smooth growth and reproduction.

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Introduction

Chenopodium album belongs to Chenopodiaceae family grown in the lands of agriculture and usually grown in garden's and passing round all over South East Asia, also present in some areas around Bombay, Kashmir, Sikkim and all over Pakistan [1,2]. *Chenopodium album* is elsewhere considered as weed plant. *Chenopodium album* is commonly named as fat-hen, melde, lamb's quarters, whit goosefoota and sometime also called pigweed. Know by local as Bathua in Pakistan and India. *Chenopodium album* is extensively grown in Pakistan and north India as vegetable and consumed as a food crop [3,4]. *Chenopodium* is annual plant, flowering from July to October flowers are hermaphrodite (have both male and female organs) and seeds gets ripen from august to October, pollinated by wind. *Chenopodium* can grow in very acidic to very alkaline soils. The height of *Chenopodium album* varies from 0.3 to 3 m high and green, reddish in colour inodorous and stem often striped. Leaves are very variable in size and shape reaching in cultivated plants some times 15 cm long. *Chenopodium* belongs to genus *Chenopodium*. Leaves and seeds of members of this genus are more or less edible. Saponins are usually present in very small quantities in this genus to do any harm. Although less toxic, saponins are poorly retained by the body and most goes straight through without creating any problem [5].

The plant has some medicinal properties and that's the reason it has it application in

pharmaceuticals industries. The plant has aphrodisiac, diuretic, laxative and anthelmintic actions. The laxative property is use in enlargement of spleen treatment [6,7]. And aqueous extracted from leaves is given orally against jaundice. Used as diuretic for thirst quenching agent and nutritive, emollient for chest and throat [8,9]. These medicinal properties are present in both leaves and seeds. The seeds were chewed for treatment of urinary problems and were consider as useful for reliving the discharge of semen through urine. Juices of stem and root are applied to freckles, sunburn and in the treatment of bloody dysentery respectively [2,10].

Materials and methods

The presence study was conducted in the Centre of Excellence in Molecular Biology, University of the Punjab Lahore. The plant samples were collected form 5 different locations (1 = fields of CEMB, 2 = road sides of CEMB, 3 = lawns of CEMB, 4 = canal road, 5 = canal bank) of filed in three replication. The data was recorded for plant height, leaf length, leaf width, leaf area, fresh plant weight, dry plant weight, fresh inflorescence weight, dry inflorescence weight and moisture contents. The moisture contents for plant and inflorescence were recorded by following formulae:

Inflorescence moisture contents percentage = (fresh inflorescence weight- dry inflorescence weight /fresh inflorescence weight) ×100

Plant moisture contents percentage = (fresh plant weight- dry plant weight /fresh plant weight) ×100

The data was statistically analyzed for analysis of variance [11] to access the significance of differences

Results and discussions

It was found from results given in table 1 that there was a significant difference among the locations and traits under studies for *Chenopodium album*. The lower coefficient of variance (Table 1) recorded for all studied traits indicated that there was a significant consistency among the results which showed higher reliability for the results of studied traits. The results from table 2 indicated that higher fresh plant weight (154.34g) and dry plant weight (67.43g) were recorded under location 5 while lowest fresh plant weight (67.43g) and dry plant weight (48.32g) was found under location 3. Similarly higher fresh inflorescence weight (12.56g) and dry inflorescence weight (4.3g) were recorded for location 5 while lowest was fresh inflorescence weight (4.52g) and dry inflorescence weight (2.01g) was recorded under location 1. Higher

leaf length (6.2cm) and plant height (183.87cm) were recorded under location 5 while lowest leaf length (3.2cm) and plant height (77.32cm) were recorded under location 1. Higher plant moisture contents (73.71%) were recorded for location 1 while lowest 13.71% under location 3. Higher leaf width (3.6cm) and leaf area (16.25cm²) were recorded under location 2 while lowest leaf width (2.2cm) and leaf area (7.57cm²) were recorded under location 1. The higher fresh plant weight, dry plant weight, fresh inflorescence weight, leaf length, plant height and dry inflorescence weight under location 5 indicated that the environmental soil conditions were very suitable for higher growth and development of *Chenopodium album* which also helps to withstand the plants under harsh environmental conditions [5,12,13]. The higher leaf area indicated that the photosynthetic rate was higher and helps to improve plant biomass, growth and development under stressful environmental conditions [14,15].

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

SOV	DW	FW	PMC	FIW	DIW	IMC	LA	LL	LW	PH
Replication	0.38	0.5	2.36	0.125	0.005	0.782	0.089	0.0428	0.0253	0.9
Locations	6512.0*	27493.1*	6122.34*	433.757*	42.448*	452.419*	107.597*	17.763*	1.031*	23564.4*
Error	4.90	12.1	14.16	0.408	0.0156	6.007	0.883	0.081	0.061	6.4
Grand Mean	44.419	99.678	53.835	7.083	2.144	72.986	12.627	5.210	3.287	136.13
Standard Error	0.4520	0.7110	0.7681	0.1304	0.0257	0.5003	0.1918	0.579	0.0506	0.5164
CV	1.76	1.23	2.47	3.19	2.08	1.19	2.63	1.92	2.66	0.66

*=Significant at 5% probability level, PH = Plant height, FW = Fresh weight, LL = Leaf length, LW = Leaf width, LA = Leaf area, FIW = Fresh inflorescence Weight, DW = Dry weight, PMC = Plant moisture contents, IMC = Inflorescence moisture contents, CV = coefficient of variation

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

Locations	FW	DW	PMC	IFW	IDW	IMC	LL	LW	LA	PH
1	62.32d	16.3e	73.71a	4.52e	2.01c	78.84ab	3.2c	2.2c	7.57d	77.32e
2	150.21b	66.34b	55.77c	12.00ab	3.21b	73.25c	6.1ab	3.6a	16.25a	170.54b
3	56.54e	48.32c	13.71d	9.10c	3b	67.03d	5.5b	3.3b	13.43b	145.67c
4	75.67c	23.67d	68.44b	5.81d	2.17c	79.01a	5.1b	3.5b	13.20b	105.34d
5	154.34a	67.43a	56.21c	12.56a	4.3a	65.76de	6.2a	3.2b	12.38c	183.87a

PH = Plant height, FW = Fresh weight, LL = Leaf length, LW = Leaf width, LA = Leaf area, FIW = Fresh inflorescence Weight, DW = Dry weight, PMC = Plant moisture contents, IMC = Inflorescence moisture contents

The results from correlation analysis studies (Table 3) indicated that there was a strong and significant correlation between plant height, dry plant weight, fresh plant weight, inflorescence dry and fresh weights, leaf length and leaf area. Fresh and dry plant weights were strong significantly and positively correlated with dry plant weight, fresh plant weight, inflorescence dry and fresh weights. The strong positive correlation indicated that the traits were higher associated with each other and influence overall plant growth and development under variable environmental conditions [16,17]. The strong

correlation among dry plant weight, fresh plant weight, inflorescence dry and fresh weights indicate that the plants have ability to withstand under harsh environmental conditions. Regression analysis was performed to access the contribution of various traits towards fresh plant weight. It was found from results (Table 4) that there was a positive and significant contribution of dry plant weight, inflorescence dry weight, leaf width, leaf length and plant moisture contents. The higher contribution of these traits towards fresh plant weight indicated that there was interrelationship among the traits which helps plants to

growth, develop and reproduce in large population under varying environmental conditions [18-20]. The

regression equation for studied traits was recorded as:

$$\text{Fresh plant weight (Y)} = -154.878 + 1.705(\text{DW}) + 1.437(\text{PMC}) - 0.313(\text{IFW}) + 10.223(\text{IDW}) + 0.220(\text{IMC}) + 11.198(\text{LL}) + 19.256(\text{LW}) - 2.600(\text{LA}) - 0.168(\text{PH})$$

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

Traits	PH	FW	DW	PMC	IFW	IDW	IMC	LL	LW
FW	0.795*								
DW	0.99*	0.821*							
PMC	-0.43	0.194	-0.399						
IFW	0.973*	0.746*	0.988*	-0.496					
IDW	0.963*	0.688*	0.967*	-0.553	0.979*				
IMC	-0.76*	-0.323	-0.739*	0.748*	-0.775*	-0.879*			
LL	0.919*	0.724*	0.869*	-0.353	0.822*	0.797*	-0.582*		
LW	-0.392	-0.349	-0.379	0.08	-0.368	-0.512	0.622*	-0.203	
LA	0.736*	0.561*	0.695*	-0.32	0.656*	0.565*	-0.298	0.898*	0.248

*=Significant at 5% probability level, PH = Plant height, FW = Fresh weight, LL = Leaf length, LW = Leaf width, LA = Leaf area, IFW = Fresh inflorescence Weight, DW = Dry weight, PMC = Plant moisture contents, IMC = Inflorescence moisture contents

Table 4. Stepwise regression analysis for fresh weight of *Chenopodium album*

	Coefficients	Standard Error	t Stat	Partial R ²	Lower 95%	Upper 95%
DW	1.705	0.203	8.400	0.020	1.183	2.227
PMC	1.437	0.067	21.545	0.030	1.266	1.609
IFW	-0.313	0.820	-0.382	0.718	-2.420	1.794
IDW	10.223	4.311	2.371	0.064	-0.860	21.306
IMC	0.220	0.371	0.591	0.580	-0.735	1.174
LL	11.198	4.340	2.580	0.049	0.042	22.354
LW	19.256	7.546	2.552	0.051	-0.142	38.653
LA	-2.600	1.783	-1.458	0.205	-7.184	1.985
PH	-0.168	0.124	-1.358	0.233	-0.487	0.150

PH = Plant height, FW = Fresh weight, LL = Leaf length, LW = Leaf width, LA = Leaf area, IFW = Fresh inflorescence Weight, DW = Dry weight, PMC = Plant moisture contents, IMC = Inflorescence moisture contents
Intercept = -154.878, R² = 99.34%, Adjust R² = 89.54%, Standard Error = 0.4325

Conclusions

It was concluded from our study that the *Chenopodium album* plants showed higher survival adaptability under different environmental conditions, which helps to keep smooth growth and reproduction.

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