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ORIGINAL RESEARCH ARTICLE

Genetic association among morphological traits of *Lepidium draba*

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ABSTRACT: *Lepidium draba* is a weed plant usually grown where the conditions are moist like road side, ditch banks, rang lands and pastures. It is a fast growing weed plant that competes with crop plants for water, mineral nutrients, light and plays as a hiding place for insects. The prescribed study was carried out to evaluate morphological traits of *Lepidium draba* under four different locations. It was found from results that plant fresh weight and moisture contents were relatively higher for under studied locations. There was a strong and significant correlation among fresh weight, dry weight, moisture contents and plant height. From regression analysis it was predicted that plant dry weight and moisture contents played an important role in improving fresh plant weight. GGE biplot showed location 4 as best environmental area for propagation of *Lepidium draba*. It was suggested from current study that the plant population of *Lepidium draba* to minimize yield losses in crop plants and reducing competition between *Lepidium draba* and crop plants.

Keywords: *Lepidium draba*, biodiversity, correlation, regression, GGE biplot

INTRODUCTION

Lepidium draba is a perennial rhizomatous and root-creeping weed belonging to the Cruciferae family. This weed is basically native to the Balkan Peninsula, Georgia, Armenia, Israel, Russia, Turkey, and southern Europe. Firstly, it was collected on east coast of North America in 1862 and is now found in most US states, most Canadian provinces, and Mexico (Gaskin et al., 2005; Mulligan and Frankton, 1962). On the North American continent, especially in the central and western United States, *L. draba* destroy the pastures, crops like alfalfa and grains, rangelands, and riparian areas (Cripps et al., 2006b; Gaskin et al., 2005). It is widespread in cultivated fields in Turkey and invades field crops as well as gardens and pastures. This species has little economic value and is toxic to cattle. L. draba quickly forms pure colonies that are resistant to invasion by other plant species and are surrounded by an inhibitory zone (BON et al., 2005; Qasem, 2004). Its deep, penetrating, hard, and extensive creeping roots make it difficult to eradicate (Qasem and Foy, 2001). *Lepidim draba* (white top) now growing very rapidly day by day. Its rapid growth is a very critical scenario for all agricultural countries. It decreases the bio diversity in different wild life habitats. Its extract is used for manufacturing of antibiotic, antioxidants and drugs, used as medicinal plant (Caesar et al., 2010). White is a rhizomatous perennial weed it belongs to the family crucferae and native to Turkey, Russia and Israel (Aksakal et al., 2010; Kaya et al., 2015). This weed is grown through dispersal of seeds and through roots as well. This is

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now found in temperate region of the World including Asia as well as in England. *L. draba* is major concern for Wheat, Oat and Alfalfa (Francis and Warwick, 2008). This weed usually grown where the conditions are moist like road side, ditch banks, rang lands and pastures. *L. draba* or hoary cress, was first came southwestern Asia. Introductions likely came due to the shipment contaminated alfalfa seed from Turkistan into North America over a period of 40-50 years. *L. draba* was first found in California in 1876. This aggressive perennial for is salinity tolerance, and grows up to 2 feet tall. Many small white flowers are produced, giving a white-topped appearance. Plants most aggressively, grow where extra water is available like swales, irrigated fields without frequent cultivation, and in riparian areas. Seeds establish new stands when transported by water, vehicles, farm machinery, or contaminated hay and crop seeds. Palatability of *L. draba* decreases as plants mature. The foliage becomes coarse and bitter, and nutritive value decreases (Francis and Warwick, 2008).

White top also contains poisoning element name glucosinolates. It is harmful and dangerous to grazing animals particularly for cattle when consume at large quantity. White top has low palatability and sheep can graze before flowering. Before flowering it contains high amount of proteins which is digestible for animals but when flowers emerges (post flowering stage) the protein level decreases and unable to fulfil the energy requirement of healthy livestock (Cripps et al., 2006a; Fumanal et al., 2004). This weed is very competeable to various nutrients with other plants and alarmingly decreases the yield of valuable crops it commonly emerges in alkaline soils. This perennial weed has multi branching network with rhizomes budding form nodes which later produce aerial shoots. Its stem is tough and above the ground. *L. draba* has erect to nearly procumbent stem (Francis and Warwick, 2008). Every shoot can produce up to 850 silicles each containing two seeds, almost three quarters of *L. draba* are below the ground surface which provides the good capacity of re-growth and also enable high competitive ability (McInnis et al., 1993). The competing ability of *L. draba* is well controlled and can increase by allelopathic glucosinolates which restrict the growth of other competitors (Cripps et al., 2006a). *L. draba* has primary root system and also few to thousand permanent lateral roots.

MATERIALS AND METHODS

Prescribed study was carried out at Centre of Excellence in Molecular Biology, University of the Punjab Lahore, Pakistan to access the biodiversity of *Lepidium draba* at different locations of Centre. Data was recorded from 4 different locations with 3 replications. Thirty six plants were collected from each population (for a total of 36 samples), with about 50 g fresh leaves for each sample. From each location, 9 plants were randomly selected, in the form of three replicates of *L. draba*. Data for plant height, leaf area (leaf length × leaf width), fresh plant weight, dry plant weight, dry inflorescence weight with 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 and Torrie, 1997). To avoid duplicate sampling of the same genome, each individual sample from a population was collected randomly from locations at least 50 m from each other. The samples were placed in zip lock bags. Then the sample were left for drying (sun drying) for three days then noted the dry weight of the sample.

RESULTS AND Discussions

It was persuaded form results (Table 1) that significant differences were reported among the location where from the data of *Lepidium draba* was recorded. It was found that average

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dry weight of plant was 3.9317±0.0122g while 14.408±1.0742g fresh weight under all studied locations. Inflorescence fresh weight (0.014±0.0001g), leaf area (22.847±3.0282), moisture contents (72.714±4.2487%) and plant height (45.593±1.2494cm) was recorded for *Lepidium draba* under all studied locations. Higher moisture contents indicated that the plant have ability to withstand with harsh environmental conditions. The higher leaf area and fresh weight indicated that the plant have ability to grow and develop vigorously and increase ability to survive under variable environments. The results showed that the lower coefficient of variation was recorded for all studied traits which indicated the higher reliability of the results (Ali et al., 2012; Anwer et al., 2015; Elahi et al., 2011).

Table 1. Analysis of variance for morphological traits of *Lepidium draba*

SOV	DW	FW	FIW	LA	MC	PH
Locations	0.528*	4.957*	0.3045*	5.944*	7.245*	12.1712*
Error	0.008	0.228	0.00042	0.1202	1.0928	0.2206
Grand Mean	3.9317	14.408	0.014	22.847	72.714	45.593
Standard Error	0.0122	1.0742	0.0001	3.0282	4.2487	1.2494
CV	2.35	3.32	4.72	1.52	1.64	1.03

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

It was found form results (Table 2) that significant and strong correlation was reported between plant height and fresh weight, dry weight and fresh weight, plant height and dry weight, leaf area and dry weight while significant and negative correlation was reported between leaf area, dry weight and moisture contents. Positive correlation indicated that the traits were highly associated with each other. The higher plant and fresh weight indicated that the plants have higher ability to store and absorb soil water and nutrients, so that the growth and development of plants may be higher under variable environmental conditions. The higher leaf area indicated that the plants have higher potential to make and use photosynthetic compounds. The moisture contents may also helped the *L. darba* plants to tolerate harsh conditions and may caused harmful effects on crop plants. The removal of *L. darba* from field of crop plants is essential to control the losses caused. Various researchers have reported *L. darba* as a harmful weed plant in crop plant fields that caused yield losses (Harrem et al., 2015; Zameer et al., 2015).

Table 2. Correlation among morphological traits of *Lepidium draba*

Traits	FW	PH	LA	FIW	DW
PH	0.9616*				
LA	0.4459*	0.5989*			
FIW	-0.1886	-0.1458	0.0741		
DW	0.8912*	0.9507	0.6107*	-0.0115	
MC	-0.0197	-0.2202	-0.4619*	-0.3507	-0.4705*

*=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 performed to access the effect of independent variables (yield contributing traits) on dependent variable (like, yield). It helps to select genotypes of crop plants on the basis of relative contribution of yield related traits. In our study we have studied fresh plant weight as dependent variable. It was found that dry plant weight contributed higher then the other traits followed by moisture contents and fresh inflorescence weight while other traits negatively contributed in improving the fresh

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plant weight of *L. draba* (Table 3). The regression equation was predicted as, Y (fresh weight) = -37.001 - 0.036(PH) -0.008(LA) + 0.195(FIW) + 3.805(DW) + MC (0.526). Similar findings have been reported by various researchers, who have suggested that the plant population of *L. drabai* should be controlled through manual, chemical or through the use of transgenic crop plants to minimize yield losses of crop plants (Fumanal et al., 2004; Mobeen et al., 2015). GGE biplot (Figure 1) was constructed to evaluate the best location for propagation of *L. draba* under variable environmental conditions. It was found that the location 4 showed best and favourable place for *L. draba* to grow and develop.

Table 3. Stepwise multiple linear regression for fresh weight of *Lepidium draba*

Traits	Coefficients	Standard Error	t Stat	Partial R^2	Lower 95%	Upper 95%
PH	-0.036	0.037	-0.964	37.2	-0.128	0.056
LA	-0.008	0.012	-0.666	43.0	-0.037	0.021
FIW	0.195	0.540	0.361	8.31	-1.126	1.515
DW	3.805	0.187	20.333	7.10	3.348	4.263
MC	0.526	0.020	26.485	4.23	0.478	0.575

Intercept = -37.001, standard error = 0.0332, Multiple R^2 = 99.98%, R^2 = 99.96%, Adjust R^2 = 99.92%

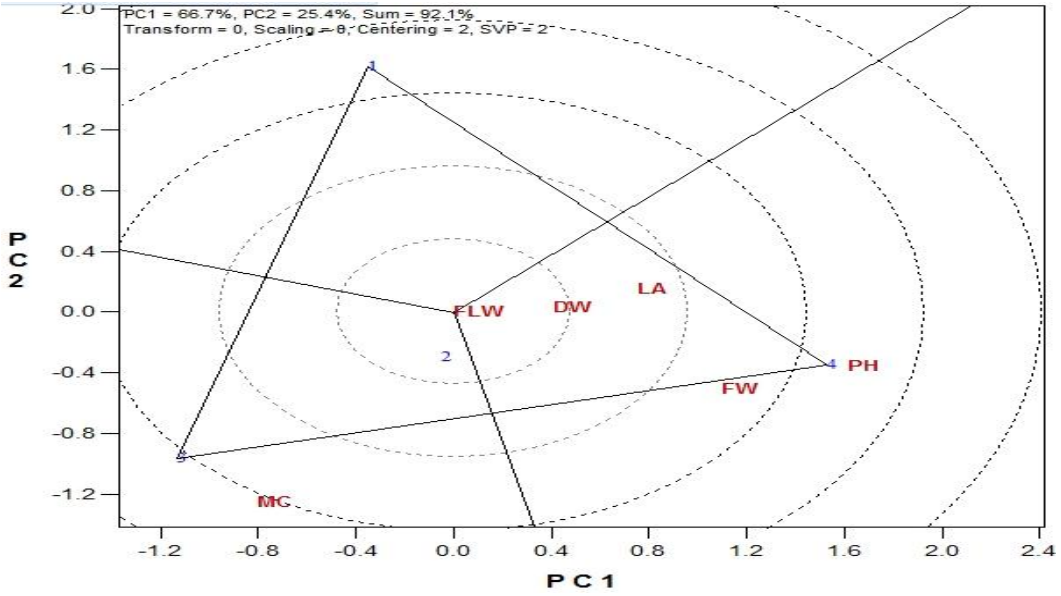

Figure 1. GGE biplot for morphological traits of *Lepidium draba* under 4 different locations

CONCLUSIONS

It was concluded form prescribed study that the plant population of *Lepidium draba* 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.

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