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MULTIVARIATE ANALYSIS FOR MORPHOLOGICAL TRAITS OF *PARTHENIUM HIRSUTISM*

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Abstract *Parthenium hirsutism is a weed that typically grows along roadsides, ditch banks, range areas, and pastures when the soil is damp. It is a quickly expanding weed those challenges crop plants for water, mineral nutrients, and light and serves as an insect hideout. Parthenium hirsutism morphological characteristics were assessed using the required study's four separate locations. According to the findings, less-studied regions had relatively larger plant fresh weight and moisture levels. Fresh weight, dry weight, moisture contents, and plant height showed a positive and substantial association. It was expected through regression analysis that plants dry weight and moisture contents were key factors in increasing the weight of a fresh plant. According to a recent study, the Parthenium hirsutism plant population may be declining minimizing crop plant output losses and lessening rivalry between Parthenium hirsutism and plant crops.*

Keywords: *Parthenium hirsutism; biodiversity; correlation; regression; morphology features*

Introduction

Parthenium hirsutism L. (Asteraceae) has global significance native to Central America but identifies in Australia in 1955 (Khan & Fahad, 2020). It recognizes as harmful and leading to restrictions and efforts to control and eradicate its presence as a noxious plant in 1975 introduced into Australia in two ways, one by the US military bases north of Brisbane in (1942-45) and the other by contamination of pasture seed from the USA into the grazing country in 1960 (Courchamp et al., 2003). An annual herb plant called a parthenium possesses both upright and deeply penetrating tap roots. Rosette of leaves in young plants develops close to the soil surface (Kaur et al., 2014). As it grows many branches develop and attain a height of about 2m. Parthenium grows throughout the year but mostly in the rainy season. After germination flowering stage starts about six to eight weeks (Gnanavel & Natarajan, 2013). Parthenium is primarily found in wet and dry season conditions in tropical and subtropical regions. In a case study that involved seven distinct patients with parthenium-related allergies, parthenium poses a number of health risks. (Kololgi et al (1997) (Shrestha et al., 2019). The environmentally hazardous chemical phytotoxin can be used to control these weeds. fungus that produce a variety of bioactive extracellular hazardous chemicals are used to control the other technique (Hasanuzzaman et al., 2020). Such harmful microorganism metabolites as phosphinothricin (glufosinate), bialaphos, and hydantocidin, which are commercially available, are used in weed control Pandey, 1999, 2000.

The first weed in Nepal appeared in 1967, posing a threat to the environment and to agriculture. The most commonly afflicted crops are mustard (Brassica campestris L.), sugarcane (Saccharum spp.), and maize (*Zea mays* L.) (Bajwa et al., 2019). The government of Nepal develops management plan for Parthenium with two invasive alien plant species by 2010 (Shrestha et al., 2015).

Materials and methods

Research on the various morphological characteristics of Parthenium hirsutism was conducted at the Institute of Agriculture Science University of the Punjab in Lahore, Pakistan. This data was selected from 3 locations with 3 weeds at one location with 9 total plants from an area of $1m^2$. The height, leaf area (leaf length x leaf width) root length is taken with scale

Fresh inflorescence weight calculated over an electric balance, dry plant weight after drying in an oven, total plant moisture percentage estimated using the moisture method [(fresh plant weight) - (dry plant weight/fresh plant weight) x100]. Applying variance statistical analysis to calculated data. To get different result sample were collected from a 200 m distance from one location to another and stored in separate bags to prevent mixing samples after carefully drying without losing their parts.

Results and discussions

After applying statistics to growing places under Parthenium hirsutism-related environmental circumstances, all values are arranged in the table as shown. The average fresh weight (73.793 7.8114 g), plant height (35.322 7.513 m), leaf area (50.478 17.380 cm^2), fresh inflorescence weight (0.035 0.008g), dry weight (11.181 2.9394 g), and moisture contents/percentage (73.793 7.8114%) were all confirmed to be accurate measurements.

The higher fresh weight indicated that this weed plant can survive under different harsh environmental conditions (Nxele et al., 2017). Higher leaves in the area help to carry out more photosynthesis. This weed competes with the main crop for water, minerals, and nutritional requirement for need to survival but mostly meet by making its food as it is found everywhere like in grasses wheat, maize, and sugarcane that is why it affects the crop badly (Turner et al., 2011).

Table 1. Variance Analysis for morphological traits of *Parthenium hirsutism*

SOV	Height	Leaf Width	Leaf Length	Leaf Area	Root Length	Total Dry Weight	Total Moisture
Location	261.6*	3.56333*	10.0033*	784.33*	9.0678*	16.1886*	155.928*
Grand means	35.322	4.0667	10.500	50.478	11.678	11.181	73.793
CV	36.84	33.79	25.81	59.64	29.57	45.53	18.33
Standard Error	7.5133	0.7934	1.5649	17.380	1.9937	2.9394	7.8114
Error	677.39	7.5533	1.5649	3624.6	47.6978	103.680	732.21

*= Significant at a 5% probability level

Correlation analysis was conducted to examine the interconnection between various morphological traits of Parthenium hirsutism (Mandal et al.). It was found from the results (Table 2) that InDryWeig and root length, In moisture with root length and leave width and inflorescence weight and root length and total dry weight are correlation. Positive and Significant correlation play main role in creating plant varieties and hybrid seed with high quality yield (Reddy et al., 2003). On the other hand, a negative correlation is often employed to address traits that need reduction to enhance overall plant productivity.

Table 2. Correlation among morphological traits of *Parthenium hirsutism*

	Height	Inflorescence Dry Weight	Inflorescence Moisture	Inflorescence Weight	Leaf Area	Leaf Length	Leaf Width	Root Length	Total Dry Weight
Inflorescence Dry Weight	0.488*								
Inflorescence Moisture	0.3635*	0.2297							
InWeight	0.5954*	0.941*	0.4769*						
Leave Area	0.9058*	0.7391*	0.2774	0.794*					
Leaf Leng	0.9446*	0.5161*	0.2864	0.578*	0.9356*				
Leaf Width	0.7528*	0.6178*	-0.0053	0.5702*	0.7794*	0.7105*			
Root Length	0.0027	-0.2764	-0.0509	-0.2034	0.0447	0.14	0.0684		
Total Dry Weight	0.0477	0.8291*	-0.0674	0.7194*	0.4118*	0.1278	0.2527	-0.3695	
Total Moisture	0.5267*	0.1764	0.9295*	0.4091*	0.3543*	0.4147*	0.2446	0.0425	-0.248

*=Significant at 5% probability level.

The link between the response variable and the contributing variables was investigated using regression analysis (Lee, 2022). The results indicated that all the traits exhibited a positive correlation with fresh weight (Table 3Dry weight had the greatest impact (9.45) on the contributing attributes, followed by moisture content/percentage (4.95), fresh inflorescence weight (2.07), leaf area (0.045), and

plant height (0.025). The predictive regression equation was formulated as follows:

Fresh Weight (FW) = -39.09 + 0.025 * Plant Height (PH) + 0.045 * Leaf Area (LA) + 2.07 * Fresh Inflorescence Weight (FIW) + 9.45 * Dry Weight (DW) + 4.95 * Moisture Content (MC).

Table 3. Stepwise multiple linear regression for the fresh weight of *Parthenium hirsutism*

Traits	Coefficients	Standard Error	t Stat	Partial R2	Lower 95%	Upper 95%
Plant height	0.025	0.031	-0.98	38.48	-0.08	0.046
Leave area	0.045	0.045	1.035	35.2	-0.05	0.178
Fresh Inflorescence Weight	2.07	4.16	0.506	21.35	-7.35	12.94
Dry Weight	9.45	0.07	18.90	4.50	9.60	8.90
Moisture Content	4.95	0.14	15.415	2.90	5.90	3.89

Intercept = -39.09, standard error = 0.0633, Multiple R2 = 96.18%, R2 = 95.65%, Adjust R2 = 95.42%

Conclusions

According to the results of the current study, *Parthenium hirsutism* fresh plant weight was significantly correlated with their dry weight and moisture percentages. The ideal environment for *Parthenium hirsutism* growth and development is site 3. Therefore, it was recommended that *Parthenium hirsutism* growth and development be regulated using appropriate approaches to lower crop output losses.

Declaration

Conflict of interest

The researchers affirm that there were no financial or commercial ties that might be seen as a potential conflict of interest throughout the research's execution.

Data Availability statement

All data generated or analyzed during the study have been included in the manuscript.

Ethics approval and consent to participate

These aspects are not applicable in this research.

Consent for publication

Not applicable

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