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MULTIVARIATE STUDY *OF LILIUM LANCIFOLIUM* WEED UNDER DIFFERENT FIELD CONDITIONS

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Abstract *Lilium lancifolium*, a weed, *is not typically found "around" a specific crop. Still, it is well known for its capacity to adapt to various habitats and compete for scarce resources like water, minerals, and nutrients. To tackle the declining agricultural output caused by this competition, a deliberate study was conducted to examine the characteristics of L .lancifolium in three distinct habitats. The findings revealed a significant relationship between characteristics like height, dry weight, fresh weight, leaf area, leaf length, leaf breadth, and root length. It was interesting to discover that the width of its leaves influenced a plant's height. Additionally, it was shown that location two provided a favorable atmosphere for the ferocious growth and development of L .lancifolium plants. It is highly advised to eradicate or manage L. lancifolium populations to successfully reduce crop output losses brought on by this plant. This study highlights the significance of population management measures.*

Keywords: *Lilium lancifolium,* habitats, fresh weight, leaf area, *population management*

Introduction

Lily (*Lilium spp*), is a member of the *Lilium* genus (Huo et al., 2022). The bulbous perennials in the genus Lilium were grown for their enormously beautiful, frequently scented flowers. Due to their stunning beauty, lilies, which have many corolla shapes and colors, were welcomed worldwide. The family Liliaceae includes the genus *Lilium*, which has about 110–115 species found primarily in East Asia, Europe, and North America in the temperate and frigid parts of the Northern Hemisphere. The various species have four common floral shapes: trumpet, bowl, recurved, and funnel (Kumar et al., 2021). In this study, new populations of a critically endangered Himalayan herb, *Lilium polyphyllum D.* Don ex Royle, have been reported from Chamba, Himachal Pradesh, India for the first time. Karyotypic, palynological, and serological studies under the light microscope (LM) and scanning electron microscope (SEM) have been carried out on specimens from these populations to add more knowledge to the current species database. Presently studied individuals depicted a diploid (2x) chromosome count of 2n = 24, confirming the previous Kashmir Himalaya reports. Mitotic study showed a karyotype formula of 2n = 2x = 2m + 2sm + 4st + 16t, that is, 2 metacentric +2 submetacentric +4 acrocentric +16 telocentric chromosomes. LM and SEM observations revealed that the pollen grains were monosulcate, heteropolar, elliptical in polar view, and oblate with reticulate ornamentation. Tiger lily is a triploid plant with a massive genome that measures 32.8 pg by 47.9 pg (Sun et al., 2021). From spring until October, various lilies bloom, giving rise to the terms early, mid, and late season (Moore & Lauenroth, 2017). Its diverse habitat includes everything from prairies, meadows, coniferous woods, clearings, and wayside vegetation to coastal scrub. The Columbian lily grows as high as 9,800 feet in lower, drier elevations. The plant blooms for a long time, from early May to early August. The monsoon season and spring, specifically July and August, are the best times for lily blossoming. They need soil that retains moisture and is well-drained. Asiatic, Martagon, Candidum, American, *Longiflorum*, Trumpet and Aurelian, Oriental, and Other are the 8 categories of hybrids, and there is also a classification for all true species (Kwon et al., 2010). Depending on the type, lilies can be used as cut flowers, in rock gardens, forest gardens, or even containers. Tiger lily, on the other hand, is also regarded as a nutritious food and listed as one of the medicinal plants by the Chinese Ministry of Health (Sun et al., 2022) because it contains a variety of nutrients and bioactive substances, including phenolic glycosides, pectin, steroidal saponins, alkaloids, and different types of vitamins.

According to molecular research, lilies first appeared in Eurasia roughly 68 million years ago. Despite their same genetic makeup, Lilium species have developed with noticeable phenotypic variety, which has significant evolutionary relevance. Endlicher (1836) was the first botanist to categorize the entire genus, and he did so by dividing it into five groups based on physical traits: *Amblirion*, *Martagon*, *Pseudolirium*, *Eulirion*, and *Cardiocrinum*. The most definitive division of the genus was suggested by Comber (1949), who divided naturally growing lilies into seven divisions and nine subsections based on 13 morphological traits and two germination types. *Martagon Rchb., Pseudolirium Endl., Liriotypus Asch. and Graeb., Archelirion Baker, Sinomartagon Comber, Leucolirion Wilson*, and *Daurolirion* Comber were the seven parts, in that order (Gao et al., 2015). Several techniques have been used to assess the level of genetic diversity, including DNA markers, isozymes, morphological traits, pollen morphology, chromosome traits, and others (Xu et al., 2016). They multiply via seeds and bulbs, which can sprout while still attached to the plant. Digging up the bulbs and carefully collecting all of the clumps is the most efficient technique to eliminate the lilies. All bulbs would need to be dug up, likely 6 to 8 inches below the surface.

In Pakistan, farmers employ various techniques to manage the *L. lancifolium* weed. They utilize manual weeding, hoeing, and pulling methods to address small weed infestations, although these approaches demand substantial labor (Khan et al., 2021). Typically, manual practices are combined with other strategies on farms. Conversely, mechanical weed control involves using harrows, cultivators, and rotary tillers to uproot and bury weeds (Bana et al., 2022). While this method is more suitable for larger agricultural operations, it must be executed carefully to prevent soil compaction and crop damage. Chemical weed control is another strategy Pakistani farmers adopt, herbicides like paraquat and 2,4-D specifically for managing *L. lancifolium {Haider, 2023 #1043}*.

Material and Methods

Location of Collection of Samples

The plant samples required for the experimental research were collected from the Faculty of Agricultural Sciences fields.

Collection of Samples

Three locations were allotted for the collection of samples. Ten plants from each site were collected. After taking initial measurements and readings, the plants were carefully put onto a newspaper for drying in sunlight for 2 days.

Parameters

The parameters studied and recorded are initial plant weight, final plants weight (after drying), plant length, leaf length, leaf area, leaf width, root length, number of inflorescence, initial weight of inflorescence and final weight (after drying).

Methods

The methods used to measure the parameters including a measuring tape/ruler for length and width and an electronic balance for measuring weight.

Statistics

Statistical analysis is a potent tool for data exploration, testing hypotheses, and model construction in biometry. It offers an organized framework for measuring and analyzing biological systems' patterns, connections, and variations. Researchers can use statistical techniques to identify underlying trends, establish causal linkages, and make predictions based on available data. ANOVA, correlation analysis, and regression are the statistical techniques used in this study (Nielsen, 2001). We can systematically evaluate data, find patterns, and reach solid findings using ANOVA, correlation, and regression, promoting evidence-based decision-making (Cole & Grizzle, 1966).

ANOVA

ANOVA efficiently compares many groups or conditions to spot significant differences and assess the influence of independent variables. (Nielsen, 2001).

Correlation

With the help of correlation analysis, we can determine the degree and direction of an association between two or more variables (Prion & Haerling, 2014).

Regression

Regression analysis enables us to model and predict outcomes based on the relationships between variables, providing a clearer knowledge of the underlying mechanisms at work (McEvoy & Cascio, 1987).

Results and Discussion

The outcomes presented in (Table 1) demonstrate statistically significant differences between the studied locations for *L.lancifolium*. The average dry weight was recorded as (1.2889±0.0839cm), fresh weight (5.7422±0.1081cm), number of inflorescence (21.889±1.8053g), leaf area (2.0424±0.5441cm^2), leaf length (2.9111±2.911cm), leaf width (0.9222±0.2244cm), plant length (44.889±0.8872g), and root length (6.4778±0.1836%) for *L.lancifolium* plants gathered from the three distinct locations. The plant's fresh weight indicates the resilience of L. *lancifolium Lilium* lancifolium, which enables it to withstand various environmental circumstances. The moisture content % further justifies its resistance to hard, hot, and dry weather. Notably, the species' ability to endure dry conditions raises the possibility that it could present crop plants with difficult water, mineral, nutritional, and space constraints, affecting crop yield and productivity. These findings offer insightful information about the competitive and adaptive traits of *L. lancifolium* in various ecological contexts (Li et al., 2023). Tiger lilies, *L. lancifolium*, should be planted in sandy loam soil with a pH range of 6.0 to 7.0 and at least 6 hours in direct sunlight daily for optimum growth (Yang et al., 2021). While their eye-catching and colorful blossoms surely improve a garden's beauty and draw beneficial pollinators like bees and butterflies, it's important to be aware of their potential impact on nearby crops. These negative effects include competing for resources like water and nutrients, shading out smaller plants, having an allopathic effect that can stunt the growth of neighboring flora, and perhaps luring pests that might spread to nearby crops (Schroth, 1998).

Careful planning and administration are essential for successfully overcoming these possible drawbacks. While putting smaller crops in brighter regions can ease the concern about shadowing, strategically spacing the Tiger Lilies and surrounding crops can in decreasing competition for resources. It is possible to promote better coexistence by choosing companion plants resistant to lily allelopathy. The use of appropriate watering methods and mulching strategies not only helps with resource allocation, but also improves the health of the soil (Sahrawat et al., 2010). The risk of pest transmission can be reduced by integrating pest management techniques, such as introducing beneficial insects or applying biological controls. It ensures prompt intervention and upkeep of a peaceful garden to check for illnesses and pests regularly. By taking these steps, gardeners can create a balanced ecosystem where the beauty of Tiger Lilies can be enjoyed alongside thriving neighboring crops.

Table 1. Analysis of variance for morphological traits of *L. lancifolium*

SOV	Fresh weight	Dry weight	Plant Length	Leaf Length	Leaf Width	Leaf Area	Root Length	Inflorescence
Locations	13.0627	0.96444*	706.778	0.80444	0.40111	2.73822	0.30778	56.4444
Error	0.035	0.02111	2.361	0.30778	0.15111	0.88817	0.10111	9.7778
Grand Mean	5.7422	1.2889	44.889	2.9111	0.9222	2.0424	6.4778	21.889
CV	3.26	11.27	3.42	19.06	42.15	46.14	4.91	14.29
Standard Error	0.1081	0.0839	0.8872	0.3203	0.2244	0.5441	0.1836	1.8053

Table 2 shows the outcomes for *L .lancifolium* from a correlation analysis examining the relationship between different morphological qualities. The results showed substantial and positive relationships across all the analyzed traits. These results demonstrate the amazing ability of the plant to survive in arid and hot environments. The accumulation of organic compounds and its increased photosynthetic rate, both of which contribute to its strong growth and development, can be credited for this ability (Khan et al., 2020).

Table 2. Correlation among morphological traits of *L. lancifolium*

Attributes	Dry Weight	Fresh Weight	Plant Height	Leaf Area	Leaf Length	Leaf Width
Fresh Weight	0.9779*					
Plant Height	0.857*	0.9352*				
Leaf Area	0.9144*	0.9238*	0.772*			
Leaf Length	0.8118*	0.8202*	0.7039*	0.8755*		
Leaf Width	0.7663*	0.7771*	0.6195*	0.8853*	0.5565*	
Moisture %	0.4382*	0.6115*	0.7843*	0.501*	0.3686*	0.5004*
Root Length	0.986*	0.9482*	0.7883*	0.9281*	0.8272*	0.7895*

Regression analysis was used to determine the factors that have the greatest influence on plant height. The findings showed that the most important contributing element was leaf width (-0.397332936), which was then followed by leaf area (-0.07707705), dry weight (3.99345008), leaf length (-0.21567442), root length (-0.429935208), inflorescence (-0.244306902), and plant length (0.138632743). Conversely, it was determined that variables that negatively influenced plant height were moisture % (-0.46), root length (-7.65), and leaf area (-24.20) (Table 3). The following regression equation was developed to predict the relationship: Y (FW) is equal to -36.606 + 0.003 (PH), 0.04 (LA), 0.008 (FIW), 9.106 (DW), and 0.424 (MC) {Meeran, 2023 #1044}.

Table 3. Stepwise multiple linear regression for fresh weight of *L. lancifolium*

Traits	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Leaf width	-0.397332936	1.889940124	-0.210235727	0.868080953	-24.41129909	23.61663322
Leaf Area	-0.077077005	0.910430004	-0.084660001	0.946231982	-11.64518704	11.49103303
Dry weight	3.99345008	0.453782434	8.800362861	0.072031207	-1.772402434	9.759302594

Leaf length	-0.21567442	0.602121238	-0.35819102	0.781032577	-7.866350142	7.435001302
Root length	0.429935208	0.408337386	1.0528921	0.483601326	-4.758483224	5.618353641
Ino	0.244306902	0.068372855	3.573156378	0.173722807	-0.624452588	1.113066392
Plant length	0.138632743	0.027379118	5.063448034	0.124131098	-0.20925194	0.486517426

The Principal of Component Analysis (Figure 1) showed that PC1 predicted only 3% of the variation, while PC2 predicted 95.3 percent of the observed variation in all studied morphological traits, indicating that the majority of the observed differences among the studied traits can be attributed to this single component common factor, which is captured by this component. Additionally, position 3 was found to have the maximum productivity, which suggests that it is especially conducive to establishing and developing *L.lancifolium* plants. In light of these findings, it is advised to conduct plant population control measures, specifically at position 3. Doing this makes it possible to minimize potential yield losses in agricultural plants and guarantee that *L.lancifolium* grows in the best possible conditions (Clegg et al., 2009).

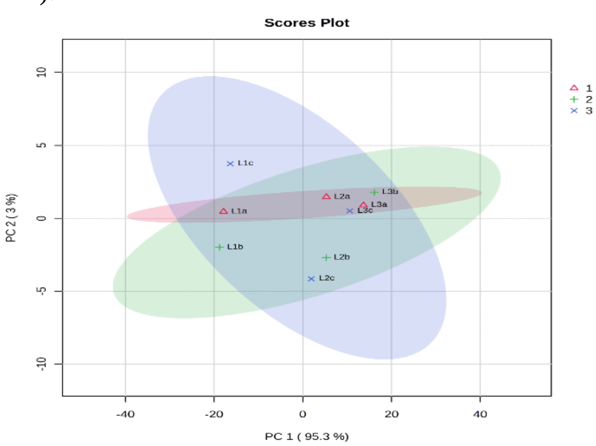

Figure 1: Scores Plot for Morphological Traits of L. lancifolium across Three Different Locations

Conclusions

According to the study's findings, site 3 was the most advantageous for the growth and development of *L. lancifolium*. Therefore, it was advised to use methods to limit *L. lancifolium* growth and development to reduce crop output losses.

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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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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