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Allomorphic Study of *Gazania linearis* Collected from Gilgit, Pakistan

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Abstract: Morphometric and Allometric Analysis of the Ornamental Species *Gazania linearis* belonging to the family Asteraceae, Sampled in May 2024 from the Main Campus of Karakoram International University, Gilgit. Measurements and analyses of many morphological characteristics, including lengths and widths of sepals, petals, stamen, carpel, and leaves, are the main body of the study. To enhance the effectiveness of the outcome, simple, multiple, and regression analysis were also performed using the area of leaf as a dependent variable and length, width, and their combinations as independent variables. These studies are very essential for the conservation plan because they clearly elucidate how the environmental factors and morphological variations interact with one another. Where the cases of morphometry and allometry are concerned, which study the association between the size, shape, anatomy, and behavior of species, knowledge about plant growth pattern is important. It explains how the size and development of *Gazania linearis* gathered from various sites on the KIU main campus in Gilgit are related to each other. This study attempted to shed some light upon just how varied sections of the plant contribute towards the total growth and development of the plant through the examination of several growth indicators. The results show that the growth dynamics of *Gazania linearis* emphasize a strong relationship between leaves, the height, the width, and the floral region.

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Morphometric, Allometric, *Gazania linearis*, Flora, Ornamental, Gene Expression, Gilgit.

1. Introduction:

Allomorphy refers to allometric and morphometric study of any species or a population. Allometry, or the growth patterns, has been an essential biological element explaining morphological variation in organisms. Within this paper, we analyze the allometric and morphometric characteristics of *Gazania linearis* (figure 3), an interesting ornamental species grown in different regions (Wynd et al., 2021).

An allometric analysis can unveil important information regarding the developmental processes, growth patterns, as well as modularity present in the examined system (Sardi et al., 2007). Hallgrímsson et al. (2019) discussed that allometric variation reveal intricate genetic and developmental factors. Allometry has been proven to be a highly polygenic trait (Hallgrímsson et al., 2019). *Gazania linearis*, a perennial flowering plant of South Africa (Figure 1), has become recently a great matter of attention for its peculiar traits and possibilities in horticulture, ecology, and biotechnology applications. Being a part of the Asteraceae family, *Gazania linearis* boasts bright flowers (Elliott, B., 2019).

The graph (Figure 2) illustrates the experiences of observers with respect to various parts of the plant (leaves, flowers, and fruits) throughout the year. This suggests a seasonal variation in the visibility or experience of these plant parts. It blooms during the spring (March to May). Also has high frequency of flower sightings during this period but also continues to flower in the summer (June to August). During this period, leaves and fruit can also be observed frequently. During the autumn (September to November), people can see only leaves and fruit as flowers decline. In winter (December to February) fewer flowers and fruits can be seen with more leaves.

Allometric scaling in the understanding of complex interactions between plant

Figure 1 showing global distribution of Gazania linearis. Map accessed from https://identify.plantnet.org/k-world-flora/species/Gazania%20linearis%20(Thunb.)%20Druce/data

morphology and environmental factors towards a comprehensive understanding of the life cycle of the plant and its potential for horticultural and ecological significance (Taylor et al., 2021).

leaves, height, width, and floral region that illustrate the growth dynamics of *Gazania linearis* (Bookstein, 1991; Rohlf & Marcus, 1993)

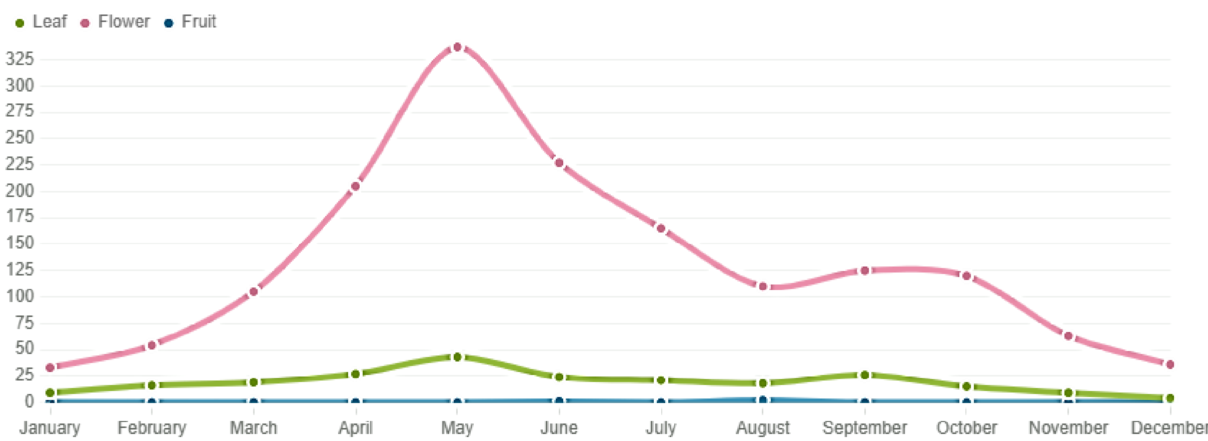


Figure 2 showing global experience of Gazania linearis. Map accessed from https://identify.plantnet.org/k-world-flora/species/Gazania%20linearis%20(Thunb.)%20Druce/data

Gazania linearis provides great landscape ornamentation at the main campus of Karakoram International University, Pakistan. A relation concerning the growth and size of *Gazania linearis* obtained from different areas of KIU's main campus in Gilgit was studied. The study has been conducted with the objective to clarify the extent of contributions made by different parts of the plant to the whole growth and development process through the investigation of a wide range of growth indicators. The results highlight the close relationship between

Gazania linearis, has showy daisy-like flowers, rosette growth pattern with linear to lanceolate leaves. The flower head attracts pollinators such as bees and butterflies, usually yellow or orange with dark central discs (Rohlf et al., 1993). Bookstein et al. (1991) investigated genetic variation within populations using molecular markers including RAPD, ISSR, and SSR. There is x = 9 chromosome number. Miller et al. (2016) studied karyotype and chromosome banding to explain chromosomal abnormalities and phylogenetic relationships within the genus Gazania.

their length (mm) and width (mm). Similarly, length (mm) and width (mm) were measured. Area (mm^2) was calculated using length and width (length x width = Area).

Figure 3 shows different phenological looks of *Gazania linearis* cultivated in the main campus of Karakoram International University, Gilgit, Pakistan. Photograph by Romana Batool

Several secondary metabolites found in the plant serve as defense factors. Of these flavonoids, terpenoids, phenolic acids, saponins and alkaloids have medicinal value. They are used as anti-cancer, antioxidants, antifungal, anti-inflammatory, antimicrobial and insecticidal (Jones et al., 2019; Smith & Clark, 2020; Williams et al. 2018; Brown et al., 2017; Taylor & Green, 2021; Clark et al., 2018).

2. Material and Methods

Sampling:

A total of 200 plants from 10 locations were identified from the entire main campus of the Karakoram International University. From each plant three leaves and three flowers were scaled. This makes a total sample size of 600 flowers and 600 leaves. Table 1 shows the GPS coordinates of the study area

Table 1 showing GPS coordinates and elevation (ft)

Location	Longitude (E)	Latitude (N)	Height (ft)
KIU CAMPUS	74.3111 E	35.9274 N	23,000 ft

and its elevation. Flower and leave's parts were pasted on the blotting papers and scaled properly (See figure 4).

Parameters studies:

From each flowers different parts including sepals, petals, stamens and carpels were measured for

Figure 4 showing measurement work. Photograph by Romana Batool

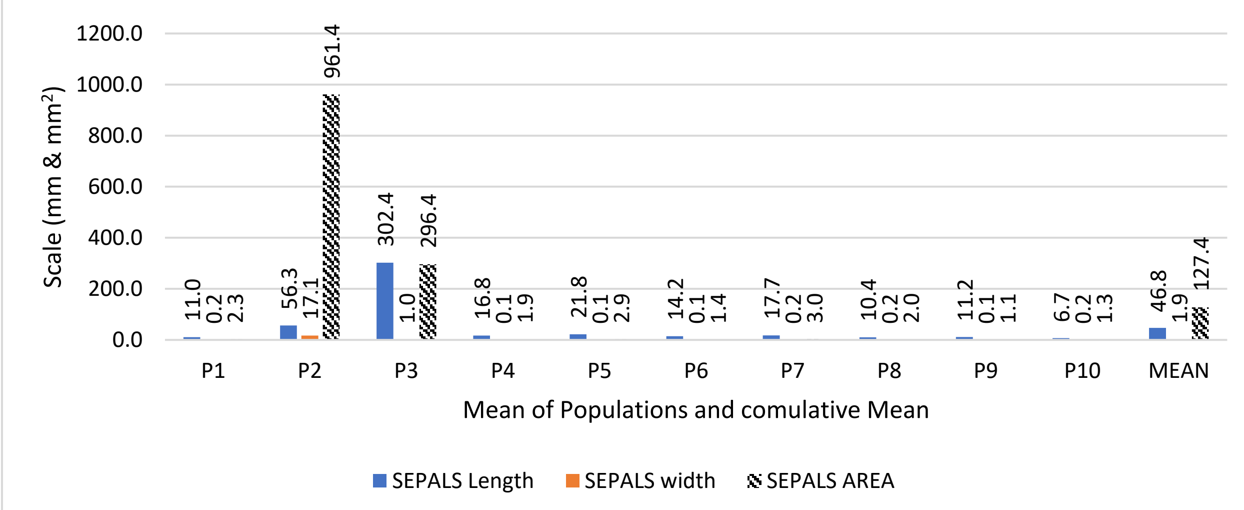
Data processing and analysis

Data measured was digitized in MS Excel (365). Digitized data was processed using MS Excel and SPSS v.16. Descriptive and inferential analysis was run using different but relevant tests to find the mean, mean deviances, ANOVA, MANOVA, T-test and correlational analysis.

3. Results and Conclusions:

Concentrating measuring of sepals, petals, stamen, carpel, and leaves for length (mm), width (mm), and area was calculated. **Sepals:** It proves that there are 10 sepals. The mean length of sepals observed was 46.85 (R^2 = 0.1351) followed by width of 1.93 (R^2 = 4.1784). The mean area calculated was 4.30 mm^2 (R^2 = 0.2398). The range between maximum and minimum is proved for both the length and the width, as illustrated in figure 5.

Figure 5 showing mean and comulative mean of length, width and area of sepals



Petals: In a similar trend, the flower of each test sample has 10 petals. The length of the average of the recorded petal was 177.6562514 mm (R^2 = 0.047). 7.01144 was the average width (R^2=0.009) (see in figure 6). The number of sepals is ten and the calculated average area was 76.4307205 (R^2 = 0.0901).

Stamens: Five stamens are present in each of the flowering plants. The count is constant with no variation. Average measured length of the stamen is 15.57216 mm. Measured average width is 0.2612356 mm. A mean area of 4.30267649 mm^2 is measured (see

Figure 6 showing Mean and comulative mean of leangth, width and area of petals

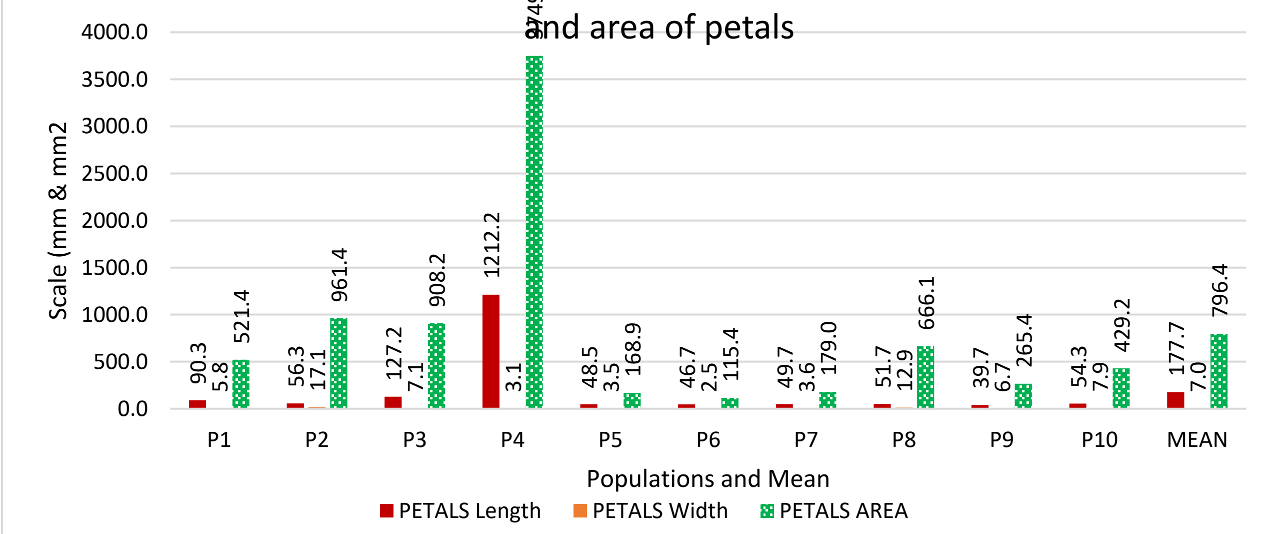
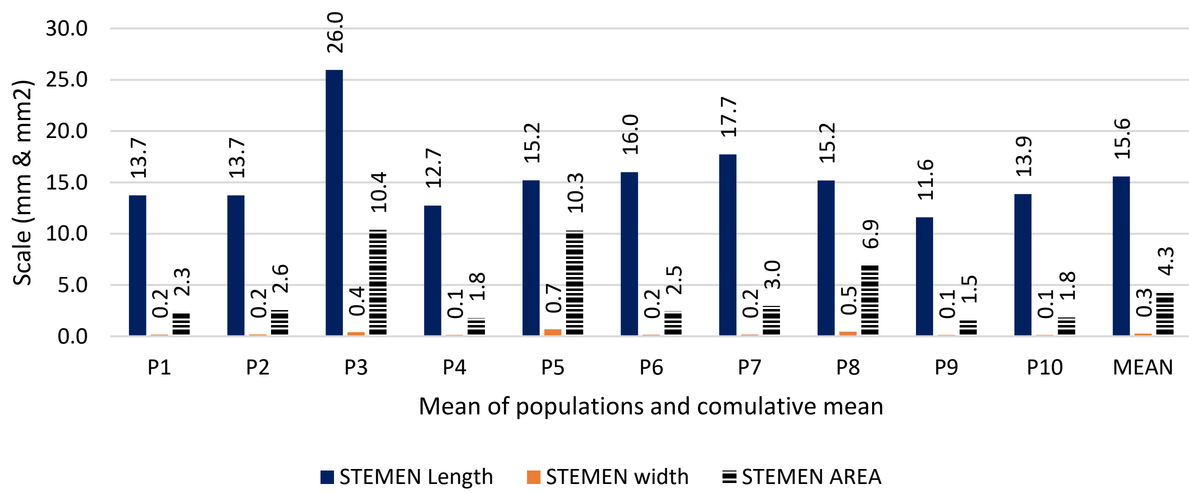


figure 7). Like all samples taken at the same elevation, mean area, width and length were similar.

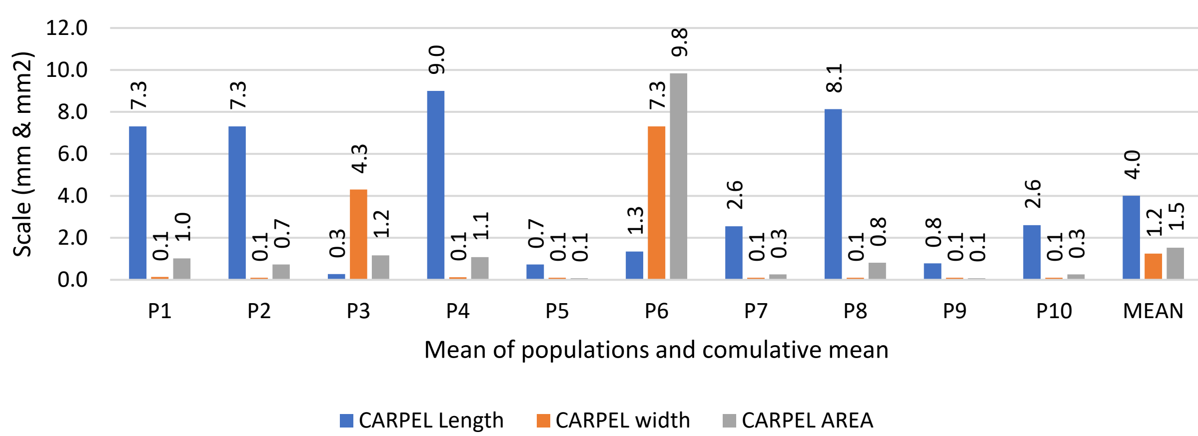
Leaves: The mean length of leaves recorded 110.014546 mm (R^2 = 0.2848) followed by mean width 08 mm (R^2 = 0.018). Similarly, their mean area recorded was 1343.728 mm^2 (R^2 = 0.0065) (see figure 9). Climate effects on the leaf were the highest. The size of the leaf has a direct proportion with slop, sunlight, and temperature.

Figure 7 showing Mean and comulative mean of leangth, width and area of stamens



Carpels : Regardless of whether it is the region or biological zone, all flowers are five carpels. The carpels also proved always to be of different value when compared to stamen, showing a mean length of 4.00470069 mm and a width of 1. 24728 mm^2. The recorded mean area was 1.53 mm (see figure 8).

Figure 8 showing Mean and comulative mean of leangth, width and area of Carpels



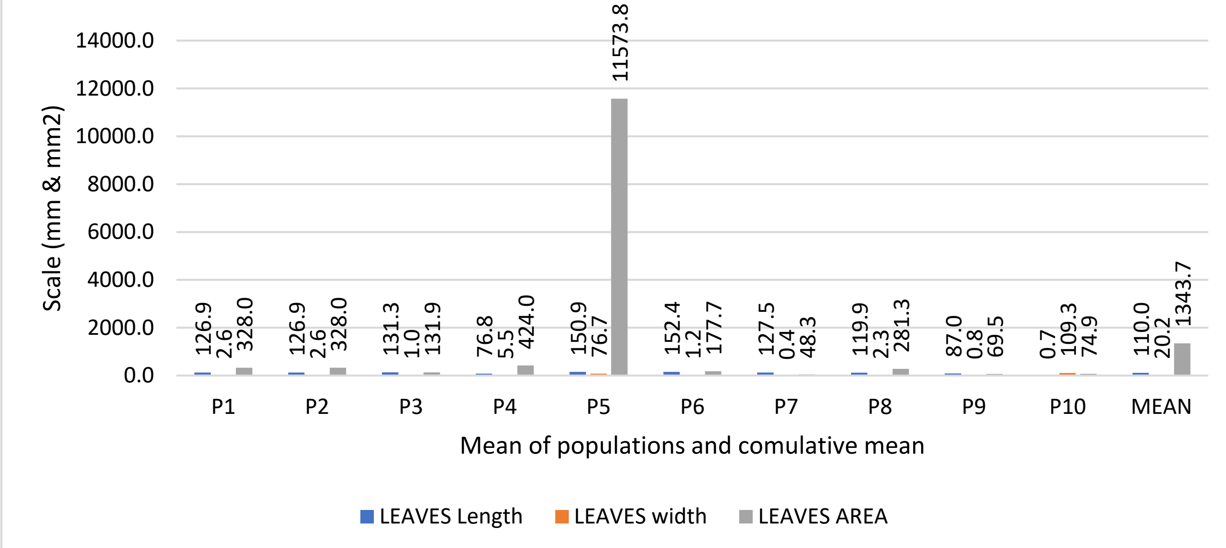


Figure 9 showing Mean and comulative mean of leangth, width and area of Leaves

Figure 10 showed the comparative analysis of different parameters (see figure 10).

In fact, morphometric studies reveal vulnerable insights into the phenotypic diversity and adaptability of *Gazania linearis*. Understanding its ecological tactics and the nature of evolutionary adaptations along those avenues of investigation that outline strongly significant environmental influences on its morphological features can lead to more results.

Morphometric analyses of *Gazania linearis* collected from KIU of District Gilgit, Gilgit Baltistan, Pakistan, yield a detailed source of information for understanding all its different sides, like its

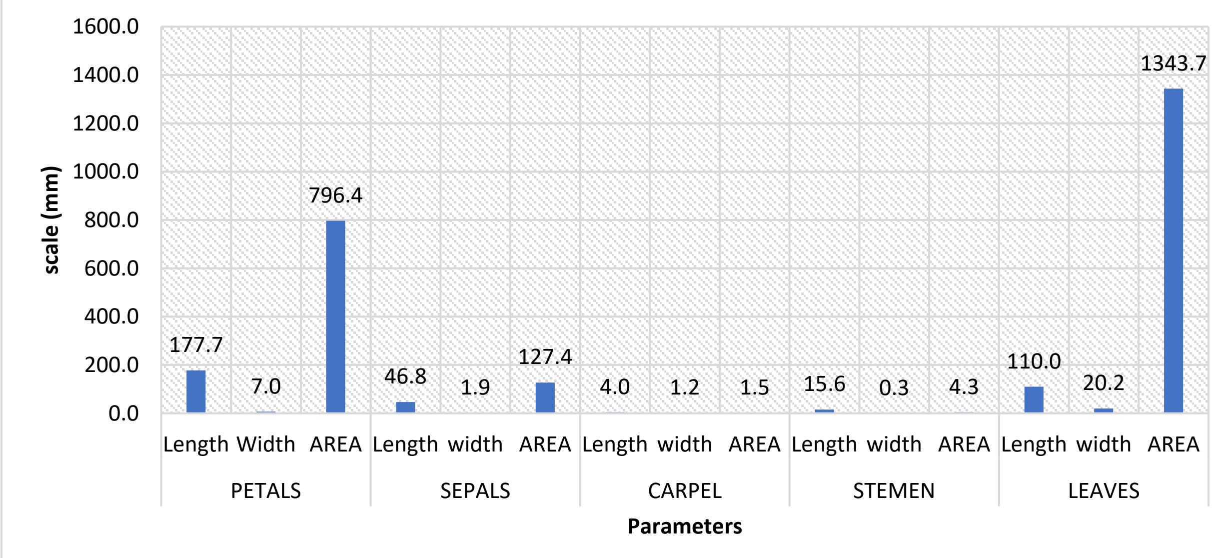


Figure 10 Showing comparative mean length, width and area of parameters

morphometric and allometric analyses that are indispensable for the cytogenetics and for dealing with its relationship with the particular area.

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Authors competing interests

There are no conflicting interests, according to the authors.

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