

Morphometric And Allometric Study of Zonal Geranium (*Pelargonium × Hortorum*) Species Collected from northern Pakistan

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Abstract: Geranium zonale (*Pelargonium × hortorum*), is an enormously cultivated ornamental and medicinal plant. Its ancestry stems in wild *Geranium africanum* found in Africa. Then, it moved to Europe and to the world in the 17th century. Its journey accumulated great morphometric variation. Now, hybridization has infused diversity across its geomorphological variegations. Study attempted to investigate climate induced variation on different parts of the plant body along altitudinal gradient. Very recently it has become part of the gardens in the northern part of Pakistan. By examining various floral and leaf traits, this research aims to elucidate the adaptive strategies employed by G. zonale in response to the unique environmental conditions prevailing in this high-altitude region. G. zonale species collected showed a great variation in coloration of flower. However, this does not show any preference of color towards altitudinal and temperature variegation. They can be found in white, pink, red and a mix of these colors. They uniquely bear 5 sepals, 9 petals, 6 stamens and 5 carpels in number. The mean area of sepals was 18.19 mm ($R^2 = 0.0006$) followed by petals with 117.51 mm ($R^2 = 0.003$), leaves 112.60 mm ($R^2 = 0.001$), stamens observed with 2.5 mm ($R^2 = 0.005$) and carpel showed nearly equal area to stamens i.e. 2.5 mm ($R^2 = 0.005$). Sepals showed negligible variation in their number and size. However, petals with no difference in number showed variation in their size. Petals and leaves showed greater response towards sunlight, temperature and altitude. An inverse relation with altitude and a direct relation with temperature and sunlight. Moreover, stamens and carpel showed no variation in their number and size. They showed the least response towards sunlight, slope, and temperature. They can be considered reliable characters in taxonomic dealings. [Samina B, Tika K, Nasreen, Misbah, Ghaznain A. **Morphometric and Allometric Study of Zonal Geranium (*Pelargonium × Hortorum*) Species Collected from northern Pakistan**. *Biomedicine and Nursing* 2024;10(4):1-4]. ISSN 2379-8211 (print); ISSN 2379-8203 (online). <http://www.nbmedicine.org>. 01. doi:[10.7537/marsbnj100424.01](https://doi.org/10.7537/marsbnj100424.01)

Key words: Morphometry, Allometry, Zonal geranium, Hybridization, Ornamental.

1. Introduction:

Zonal geranium (*Pelargonium hortorum*) is an ornamentally valued plant (figure 1). It's being popular for ease of cultivation, and its vibrant fast-growing flowers (Fehr, 2020). Species contain 22 chromosomes ($2n=22$). According to Branham et al.(1974), cytogenetic analyses of zonal geranium revealed the presence of structural chromosomal variations that may influence traits such as flower color and growth habits (Sigh et al.2020). Its cultivation dates to the 17th century from its wild ancestors in Africa (Langton, F. A., & Runger, W., 2019). Since then, it has been widely cultivated due to a range of ornamental, medicinal, and environmental conservation uses. It grows up to 30-50 cm in height. It also covers an area of 30-50 cm spread. The stem is erect and branched vary in color

from green to reddish-brown (Miller, D. M., 2002; Gardner and Lange, 2018). It produces small seeds within their capsules, but they are primarily propagated through cuttings. Zonal geraniums has fibrous roots. Flowers are formed in clusters (Hoyt, R., 2018).



Figure 1: Zonal geranium plant samples collected showing variation in color. (Photograph by Samina Batool).

The leaves are typically green rounded to kidney shaped. It is widely cultivated in garden beds,

borders, hanging baskets and pots. It is easy to cultivate and requires little effort to maintain. It tolerates a range of soil, water and climatic conditions. They bloom during early summer and last in autumn (Fehr, 2020; Ahmed et al., 2021).

Medicinally, it is used for minor skin infections. Its leaves carry antibacterial, antifungal and anti-inflammatory properties. Sometimes, its leaf aroma is used in aromatherapy for its soothing effect. Antioxidants extracted are used for reducing body stress (Verma, R. S., Padalia, R. C., & Chauhan, A., 2016). It also plays a very important role in biodiversity appreciation due to its bright, eye catching flowers attracting bees, butterflies and other pollinators (Smitley, D., Oneil, C., Hotchkiss, E., Runkle, E., & Studyvin, J., 2024).

Morphometric and allometric understanding of plants can provide insight into growth and development patterns, ecological processes and evolutionary relationships (Kumar et al., 2018).

2. Material and Methods

Samples were collected from three different major sites with different slop direction, temperature, water availability and altitudinal gradient. These sampling sites were Gilgit (Khomeer), Danyore (South facing) and Nagar (Sumayar, North facing) at varied altitudinal gradients (Table 1).

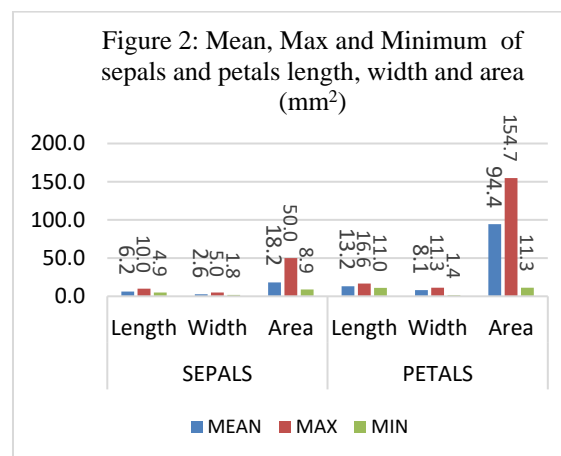
Table 1: Geographical and altitudinal description of sampling sites and their details (MASL=Mean above Sea Level)

Locations (Sample Sites)	Longitude	Latitude	Height (MASL)
Nagar (Sumayar)	74.6547 E	36.3022 N	7237ft
Gilgit (Khomeer)	74.3080 E	35.9202 N	6561 ft
Danyore (Muhammad Abad)	74.3881 E	35.9197 N	4929 ft

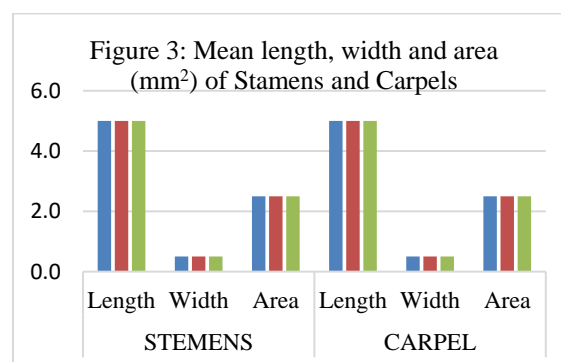
3. Results and Discussion

Careful measurement of leaves, sepals, petals, stamens and carpel for length (mm), width (mm), area (mm²) was made. It revealed that there are 5 sepals. The mean length of sepals recorded was 6.22 mm ($R^2 = 0.002$), followed by width of 2.55 mm ($R^2 = 0.005$) and the mean area calculated was 18.19 mm ($R^2 = 0.0006$). The range between maximum and minimum for the length and width was 10.0 - 4.9 mm followed by 5.0 - 1.8 mm respectively (Figure 2). There is no variation in the

number of sepals across the altitudinal gradient. It showed little impact of change in slop, water availability, temperature and altitude.



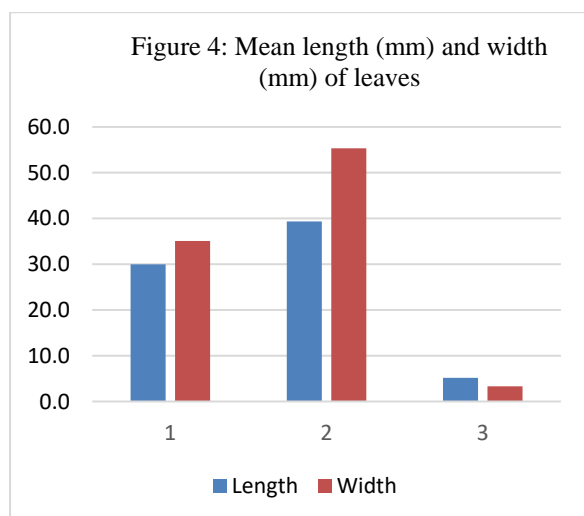
Similarly, there are 9 petals recorded in all samples. Mean length of petals recorded was 13.057 mm ($R^2 = 0.003$). The mean width was 8.08 mm ($R^2 = 0.521$). The mean area calculated was 117.51 mm ($R^2 = 0.003$). The maximum and minimum range for the length and width recorded were 16.6 – 11.0 mm and 11.3 – 1.4 mm respectively (Figure 2). Petal parameters are responsive towards climatic conditions and easily influenced. Petals prefer longer sunlight, slightly more water and higher temperatures for better and healthy projection. Petals in Danyore samples were recorded with greater size and small in Nagar.



There are six (#6) stamens in each flower. This number is fixed and show no variation. The mean length of the stamen recorded was 5.0 mm with a width of 0.5 mm. the mean area recorded was 2.5 mm. The mean length, width and area were similar to all samples collected from different altitudes.

Each flower irrespective of its location and ecological zone, carry 5 carpels. Moreover, carpels all the time showed similarity to stamens in terms of their length, width and area i.e. 5.0 mm, 0.5 mm and 2.5 mm respectively (Figure 3).

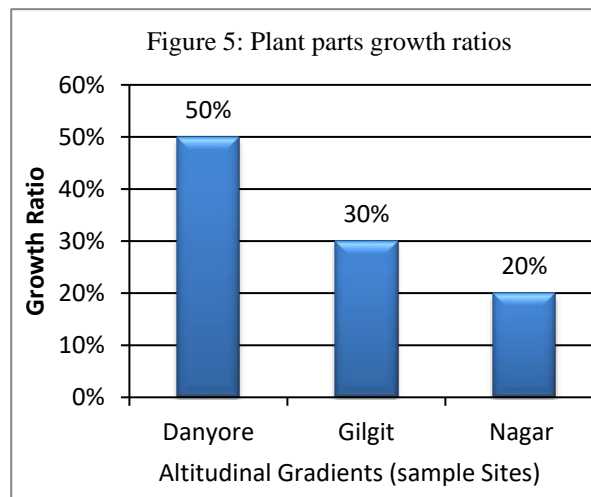
The mean length of leaves was 29.98 mm ($R^2 = 2.05$) followed by mean width 35.08 mm ($R^2 = 0.018$). Similarly, their mean area observed was 112.60 mm ($R^2 = 0.001$). Leaves showed a greater influence of climatic conditions. There is a direct correlation between slop, sunlight and temperature with the size of the leaves. As Danyore has lower altitude, higher temperature and longer sunlight showed larger leaf size as compared to Gilgit and Nagar.



From the growth perspective, figure 5 showed a higher level of growth in Danyore, where climatic conditions are best fit as the temperature, water availability and sunlight durations are good. Whereas Nagar showed poor growth ratios having shorter sunlight period flowed by temperature which is less as compared to other two major sampling sites.

Investigation revealed that principal reproductive parts show no variation not only in their number but also in their length, width and area. Therefore, these two features i.e. carpel and stamen can be taken into consideration when taxonomic

categorization is necessary. Whereas petals and leaves are vulnerable towards the climatic conditions and therefore they cannot be considered for taxonomic dealings.



For the nursery builders and farmers are recommended to cultivate Zonale geranium in good sunny, warm temperatures and well irrigated soils are preferred for its best growth.

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Author competing interests

Authors declare that there is no competing interest.

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References

1. Ahmed, A., Author, B., & Author, C. (2021). Title of the article. Title of the Journal, Volume(Issue), page numbers.
2. Aydin,Z.,Colak,A.H.,&Unver,H.Y.(2022).3D modelingandmorphometricanalysisofPelargoniumzonaleL.cultivars.ScientificaHorticulturae,297,114906.<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10764464/>
3. Chen,J.,Li,Y.,Li,C.,Yu,H.,&Guo,Z.(2020).Effectsoflightintensityandplantgrowthregulatorsongrowthandfloweringofzonalgeranium(PelargoniumzonaleL.).ScientificaHorticultura
4. Fehr, M (2020) .pelargonium hortorum .Missouri Botanical Garden .Retrieved from <http://www.missouribotanicalgarden>.
5. Hoyt, R. (2018). Minimum Temperatures for Geranium Plants. Gardening. Home and Garden. Week&. Accessed from <https://www.weekand.com/home-garden/article/minimum-temperatures-geranium-plants-18038444.php> on August 26, 2024.
6. Kumar R., et al. (2018).Allometric relationships in leaves of zonal geranium .journal of Botany, 2018-19.
7. Langton, F. A., & Runger, W. (2019). Pelargonium. In Handbook of Flowering (pp. 9-21). CRC Press.
8. Miller, D. M. (2002). The taxonomy of Pelargonium species and cultivars, their origins and growth in the wild. In Geranium and pelargonium (pp. 61-91). CRC Press.
9. Singh, B. et al (2020) .Morphometric analysis of zonal geranium leaves .journal of plant Biology ,63(0),153-162.
10. Smitley, D., Oneil, C., Hotchkiss, E., Runkle, E., & Studyvin, J. (2024). Evaluation of the most popular annual flowers sold in the United States and Europe indicates low visitation rates by pollinators and large variation among cultivars. Journal of Economic Entomology, 117(3), 1057-1070.
11. Verma, R. S., Padalia, R. C., & Chauhan, A. (2016). Rose-scented geranium (Pelargonium sp.) oils. In Essential oils in food preservation, flavor and safety (pp. 697-704). Academic Press.

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