

Morphometric and Allometric study of *Campsis grandiflora* Species Collected from Mountainous Region of Gilgit, Pakistan

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Abstract: *Campsis grandiflora*, native to East Asia, is loved for its showy flowers and aggressive growth habit. It is adapted to varied adapho-climatic conditions. It is cultivated widely because of ornamental and medicinal choice. Study was carried out to investigate impact of independent variables i.e. slop, sunshine, humidity and elevation. Quantitative dependent variables were length, width and area of sepals, petals, stamens, pistils and leaves. Research revealed that mean sepal (total number in a flower = 05) length recorded was 15.50 mm (R^2 0.4008), width of 0.57 mm (R^2 = 0.4329) and area 4.12 mm² (R^2 = 0.4076). Mean petal (total number in a flower = 05) recorded was 30.24 mm (R^2 = 0.1703), width 12.20 mm (R^2 = 0.224), and area 263.03 mm² (R^2 = 0.4952). Stamens (total number in a flower = 4) with a mean length of 27.62 mm (R^2 = 0.072), width 0.47 mm (R^2 = 0.2259) and area 12.77 mm² (R^2 = 0.1818). Moreover, carpels with a mean width of 0.8 mm, length 49.8 mm (R^2 = 0.400) and area 13.80 mm² (R^2 = 0.407). The mean length of leaves was 33.56 mm (R^2 = 0.1046), width 18.06 mm (R^2 = 0.018) and area 713.75 mm² (R^2 = 0.0399). Current investigation concluded that *Campsis grandiflora* growing at slightly lower altitude bear brighter and vibrant colored flowers. Number of floral parts showed no variation across altitudes. Plant prefers higher sunshine, longer sunny days, slightly silty and lesser humidity for growth. Petals show highest vulnerability towards climatic conditions including altitude, soil type, average temperature, and water availability. Plant population in Danyore showed greater size and smaller in Khomer. Leaves data reveals a greater influence of climatic conditions. There is a direct correlation between slop, sunlight and temperature with the size of the leaves.

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Key words: Morphometry, Allometry, *Campsis grandiflora*, Ornamental, Chinese trumpet.

1. Introduction:

Campsis grandiflora has been utilized as an ornamental species because of their trumpet shape flowers (Jia et al.,2012).*Campsis grandiflora*, commonly known as the Chinese trumpet creeper or vine, is a vigorous grower, but not as vigorous as *Campsis radicans*, its deciduous creeper with cluster of deep and large, orange-red trumpet-shaped flowers in late summer and autumn, genus *Campsis* consists of only two species, *Campsis grandiflora* (Thunb.) distributed in East Asia and *Campsis radicans* (L.) Bureau found in North America (Wen and Jansen, 1995)

Campsis grandiflora can be propagated by layering, taking cuttings, or sowing seeds, annual pruning will keep control the spread of vine and create

a strong frame work of woody branches from which flower-bearing shoots will grow, they have very few aerial roots, so will need tying on to its support (Wilson, N., 2023). It can grow up to a height of 10 meters or above and spread for up to 4m. It is a native of East Asia and less hardy than its relative plant *Campsis radicans*, because of its disjunct distribution, its evolutionary history was studied, resulting that both species was estimated to be diversified at 24.4 million years ago (Wen and Jansen, 1995).

The chloroplast genome of *C. grandiflora* isolated in Korea is 154,293 bp long (GC ratio: 38.1%) and has four subregions: 84,121 bp of large single-copy (36.2%) and 18,521 bp of small single-copy (30.0%) regions are separated by 24,332 bp of inverted

repeat (42.9%) regions including 132 genes (87 protein-coding genes, eight rRNAs, and 37 tRNAs). One single-nucleotide polymorphism and five insertion and deletion (INDEL) regions (40-bp in total) were identified, indicating a low level of intraspecific variation in the chloroplast genome (Park and Xi, 2022).

It has been cultivated widely in world and found through northern areas of Pakistan due to its ornamental and medicinal importance. The flowers of *Campsis grandiflora* (Thunb.) K. Schum have long been used as herbal remedies in traditional Chinese medicine as an agent of activating blood circulation and removing blood stasis (in Chinese “Xing Xue Qu Yu”) for treatment of diseases caused by blood stagnation (Committee of Chinese Pharmacopoeia 2000).

Isolation of oleanolic acid, apigenin, cinnamic acid from the flowers of this plant were reported (Zhao et al., 2002). Chu et al. (2000) reported that the flower of this plant has showed inhibitory effects on dimethyl benzene-induced acute inflammation models and the proliferation of granuloma induced by agar. They tolerates a range of soil, water and other climatic conditions including altitude, temperature. According to Ouyang et al. (2022), temperature, precipitation, and altitude are the primary factors influencing *Campsis grandiflora*'s geographical distribution. Climate change is expected to increase the total area of suitable habitat and highly suitable habitat, while decreasing moderately and poorly suitable habitats. “Morphometric and Allometric understanding of plants can provide insight into growth and development patterns, ecological processes and evolutionary relationships.

2. Material and Methods

Research was carried out during the months of June-September 2024. Area falls between 35°52'49"N 74°28'05" (E1,452 m) and 35°54'55"N 74°19'30" (E1,475 m).

Three major sample sites were identified with varied slop, length of sunshine, moisture content and temperature i.e. North facing (Khomer, Gilgit), neutral (Danyore) and South facing (Oshikhandas). Geo-

elevational details of the sample sites have been given in the table 1 (below).

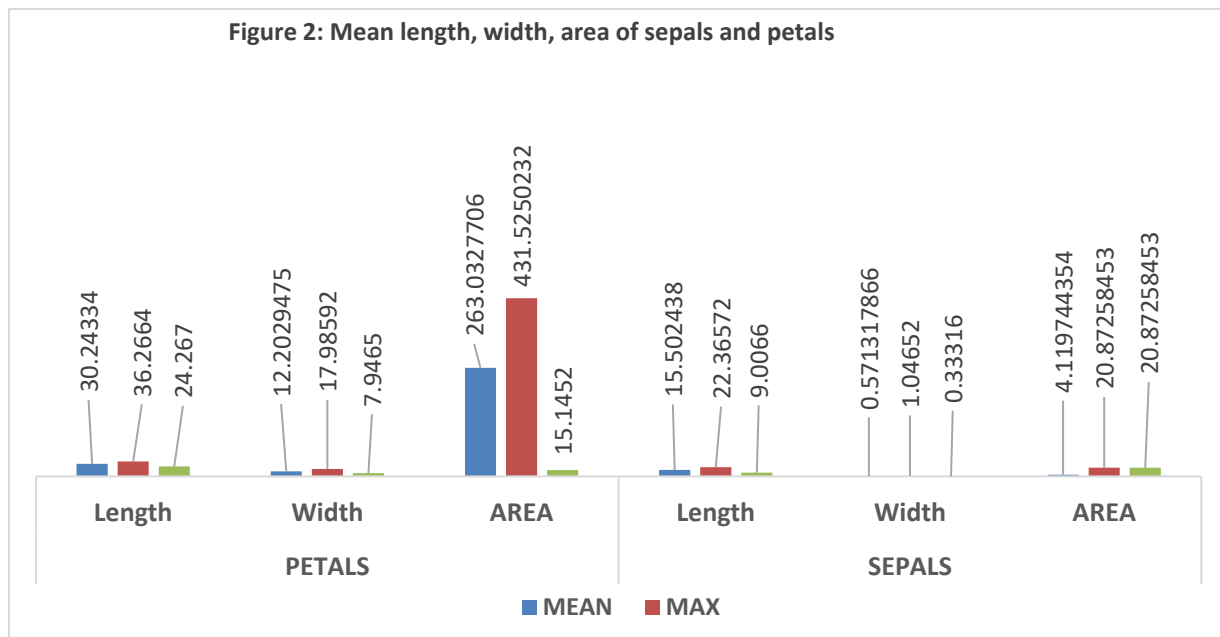
Flower samples (N = 100) were taken from each of three different major sites. Each site was different from each other in terms of independent variables considered for the research. Research area is one of the nine (11) administrative districts in the extreme north of Pakistan, called Gilgit-Baltistan (see map of the research site in the given figure 1 below).

Different independent variables taken into account were slop, temperature, moisture, and sunshine length. Whereas, dependent variables were leaf length, leaf width, leaf area, sepals length, sepals width, sepals areas, petals length, petals width and area, stamens length, width and area and carpels length, width and area.





Figure 1a: *Campsis grandiflora* samples collected showing variation in color intensity and other floral parts. (Photograph by Issar Karim).



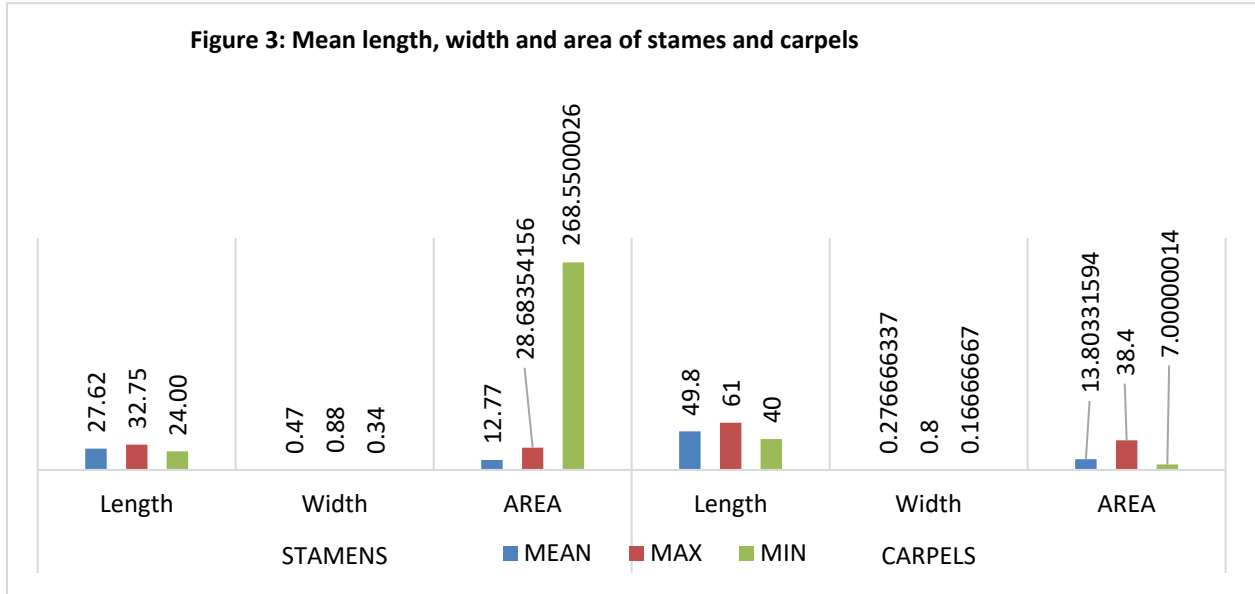


Figure 3 shows the mean length, width and area of stamens and carpels.

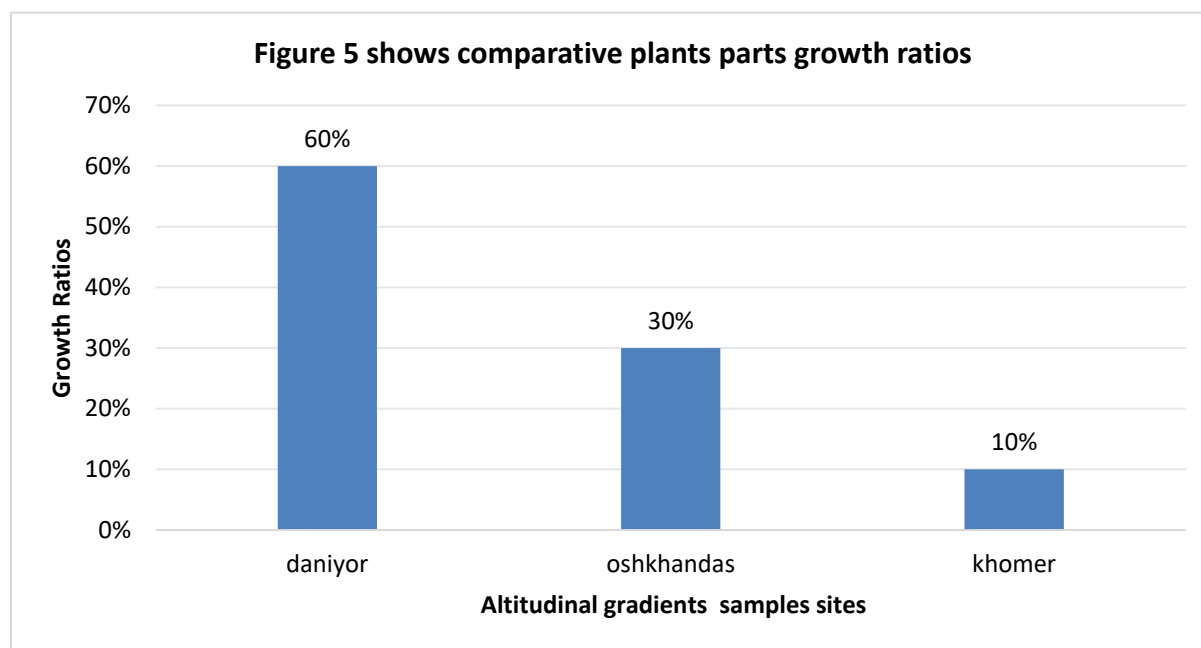


Figure 5 shows comparative growth ratios of plants at different location with varied conditions.

Table 1: Geo-elevational table showing sample sites and their key sample sites and their elevation.

Locations (Sample Sites)	Longitude	Latitude	Height (MASL)
Oshekhandas valley	35.8850 E	74.3371 N	4900ft
Gilgit (Khomer)	74.3080 E	35.9202 N	6561 ft
Danyore (Diding Dass)	74.3881 E	35.9197 N	4929 ft

3. Results and Discussion

After having a careful and precise measurement of sepals, petals, leaves, stamens and carpel for length (mm), width (mm), area (mm²) was made.

Sepals: Our findings reveals that there are a total of 5 sepals in each sample. The mean length of sepals recorded was 15.502438 mm (R^2 is 0.4008), followed by width of 0.5713179 mm (R^2 is 0.4329) and the mean area calculated was 4.119744354mm² (R^2 is 0.4076). The range between maximum and minimum

for the length and width was 22.36572-9.0066mm followed by 1.04652 – 0.33316 mm respectively (Figure 2). No variation in the number of sepals across the altitudinal gradient was observed in our findings. Each sample collected from different sites have 5 sepals. It shows little impact of change in slop, water availability, temperature altitude. and soil type (see in figure 2 here below).

Petals: There are 5 petals recorded in all samples collected from different sites. Mean length for petals was recorded 30.24334mm (R^2 is 0.1703). mean width was 12.2029475 mm and its ($R^2 = 0.224$).

The mean area calculated was 263.0327706 mm² its ($R^2 = 0.4952$). The maximum and minimum range for the length and width recorded were 36.2664 – 24.267mm and 17.98592 – 7.9465 mm respectively (Figure 2). Petal parameters were found to be responsive towards , climatic conditions i.e. altitude, soil type, average temperature, And water availability. campsis grand flora Petals prefer position with full and longer sunlight for healthy growth. Petals collected from Danyore samples were recorded with greater size and small in Khomer.

Figure 2 shows the mean length (mm), width (mm) and area (mm²) of sepals and petals.

Stamens: There are 4 stamens in each flower, each sample carried four stamens its fixed. The mean length of the stamen recorded was 27.62 mm its (R^2 is 0.072 with a width of 0.47 mm its (R^2 is 0.2259) . the mean area recorded was 12.77mm² its (R^2 is 0.1818) the range between maximum and minimum for the length and width was 32.75-24.00 mm and 0.88-0.34 mm Moreover, carpels showed a little similarly to stamens in terms of their width only i.e. 0.8 mm, 0.8 mm respectively (Figure 3),the mean length of carpel's recorded was 49.8mm its (R^2 is 0.400)with a width of 0.27666mm its (R^2 is 0.432),the mean area calculated was 13.8033 its R^2 is 0.407 (see in figure 3 here).

Leaves: The mean length of leaves was 33.5613 mm (R^2 is 0.1046) followed by mean width 18.058042 mm ($R^2 = 0.018$). Similarly, their mean area observed was 713.7587704mm² (R^2 is 0.0399) (see in figure 4). Leaves data reveals a greater influence of climatic conditions.

Figure 4 shows mean length, width and area of leaves

Growth Ratios: There is a direct correlation between slop, sunlight and temperature with the size of the leaves. As has lower altitude, higher temperature and longer sunlight showed larger leaf size as compared to Gilgit and Nagar (see figure 5).

From the growth perspective. figure 4 showing higher level of growth in Danyore, where climatic conditions are better as the temperature, water availability, soil type and sunlight durations are good. Whereas khomer showed poor growth ratios

having shorter sunlight period and temperature which is less as compared to other two sites.

Our Investigation reveals that all parts of samples collected from different sites showed no variation in their number but there was negligible variation in their length, width and area. Petals and leaves were observed to be more responsive towards sunlight and other climatic conditions, whereas sepals ,stamens and carpels also showed no variation in number, little difference in length width and area was observed in all parts .samples from lower altitude sites were found more vibrant and intense in color in comparison to those collected from higher altitude.

Farmers are recommended to cultivate campsis grandiflora in 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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