



Assessment of Gladiolus Varieties Based on Growth, Flowering and Corm Characters

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Gladiolus (*Gladiolus grandiflora*) renowned for its vibrant spike and commercial value, is widely cultivated for the cut flower industry. This study evaluated the growth, flowering and corm parameters of 27 gladiolus varieties under field conditions at Horticultural Research Farm, Banaras Hindu University, Varanasi during November 2023. The experiment followed a Randomized Block Design with five replications. The findings revealed significant varietal differences in growth attributes, with Pusa Manmohak recorded the maximum number of leaves per hill, while American Beauty exhibited the broadest leaf. Arka Darshan had the maximum scape width, whereas, Pusa Shubham showed the least. Flowering traits displayed notable differences; Pusa Kiran exhibited the earliest 3rd floret opening, while Arka Darshan had the most delayed. Variety Flevo Souvenir recorded the largest 3rd floret diameter, whereas, Arka Aarti had the smallest. Snow Princess had

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the highest number of open florets and Shubhangini demonstrated the longest internodal length. Corm characteristics varied considerably, with Shubhangini producing the highest number of cormels per hill and Pusa Sunayana attaining the maximum corm weight per hill. These results highlight the phenotypic variability among gladiolus cultivars, providing valuable insights for breeders and commercial growers to select superior varieties for cut flower production.

Keywords: *Gladiolus*; growth; flowering and corm parameters; cut flower production.

1. INTRODUCTION

Gladiolus (*Gladiolus grandiflora*) often revered as the "Queen" of bulbous flowers, belongs to the Iridaceae family and is one of the most popular ornamental flowering plants worldwide. The genus name *Gladiolus* is derived from the Latin word *Gladius*, meaning 'sword,' which aptly describes its long, slender, sword-like foliage. Commonly known as "Sword Lily" or "Corn Flag," gladiolus is highly valued for its striking florets, making it a staple in gardens, landscaping, floral designs and the global cut flower trade. This herbaceous perennial is propagated primarily through corms and cormlets, which ensure rapid multiplication and easy cultivation. It produces tall, erect spikes adorned with large, vibrant florets, available in an extensive range of colours, including red, pink, orange, yellow, white, purple and bi-coloured variants. This broad spectrum of floral diversity, combined with its varying spike lengths, makes gladiolus an ideal choice for herbaceous borders, bedding displays, rock gardens, potted cultivation and commercial floriculture. The ability to thrive in different agro-climatic conditions further enhances its appeal, enabling successful cultivation in temperate, subtropical and tropical regions. Evaluation is a vital first step in crop improvement, helping to assess a crop's adaptability to local conditions. Limited work has been done on gladiolus, despite growing demand for varieties with vibrant colours, uniform floret opening, more florets per spike, longer vase life and higher yields. Therefore, this study was conducted to evaluate the morphological performance of different gladiolus varieties.

2. MATERIALS AND METHODS

The study was conducted at the Horticulture Research Farm, Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi. The experimental site is situated at 25° 02' North latitude and 83° 03' East longitude, with an altitude of 128.93 meters above sea level. The research involved planting healthy, disease-free corms of 27 gladiolus

varieties, obtained from Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, including American Beauty, Arka Aarti, Arka Darshan, Chandni, Dhanvantari, Flevo Souvenir, Gulal, Hunting Song, IIHR, Lemon Beauty, Malaviya Kundan, Mohini, Pink Friendship, Plum Tart, Priscilla, Pusa Kiran, Pusa Manmohak, Pusa Shubham, Pusa Sunayana, Pusa Swarnima, Red Beauty, Regency, Shubhangini, Snow Princess, Tiger Flame, True Love and Yellow Star. Planting was carried out in November 2023 under open field conditions, maintaining a row spacing of 30 cm and plant spacing of 20 cm within rows. The experiment was laid out in a Randomized Block Design (RBD) with five replications, ensuring an even distribution of treatment effects and minimizing experimental errors. Observations were recorded on various growth, flowering and corm parameters. Data collection followed a systematic approach, ensuring accuracy and precision. The recorded data were subjected to statistical analysis using Analysis of Variance (ANOVA) to determine the significance of differences among varieties.

3. RESULTS AND DISCUSSION

3.1 Growth Parameters

The number of leaves per hill varied significantly (Table 1) among the gladiolus varieties studied. Pusa Manmohak recorded the maximum number of leaves per hill (12.95), exhibiting statistical superiority over all other varieties except Pink Friendship (12.13), True Love (12.11), Shubhangini (11.99), Yellow Star (11.75) and Pusa Swarnima (11.63), which were statistically at par. Conversely, the lowest leaf count per hill was observed in cv. American Beauty (8.63). The differences in the number of leaves per hill among the varieties may be attributed to variations in the amount of stored food reserves in the mother corms, as indicated by their size. Additionally, these differences could result from varying rates of vegetative growth among the genotypes, which are likely influenced by their genetic makeup and further affected by the

prevailing agro-climatic conditions. This variation have been documented by Swain et al. (2008), Susila (2013) and Momin et al. (2015) on different gladiolus varieties.

The experimental findings revealed significant variation in scape and leaf width (Table 1) among the gladiolus varieties. Arka Darshan recorded the maximum scape width (3.44 cm), exhibiting a statistically significant advantage over the varieties Chandni (3.32 cm), Dhanvantari (3.29 cm), Gulal (3.16 cm) and Mohini (3.05 cm). In contrast, the minimum scape width was noted in Pusa Shubham (1.09 cm). Similarly, American Beauty exhibited the maximum leaf width (3.63 cm), significantly surpassing the varieties Priscilla (3.45 cm), True Love (3.44 cm) and Snow Princess (3.30 cm). Conversely, the minimum leaf width was observed in IIHR (2.48 cm). This variation may be influenced by both the plant's genotype and certain known or unknown environmental factors. Plants generate food through the process of photosynthesis. Present findings have been in lent credence as reported by Kumar and Yadav, (2005) and Kumawat et al. (2018) on gladiolus.

3.2 Flowering Parameters

The earliest opening of the 3rd floret (Table 1) was recorded in cultivar Pusa Kiran (86.37 days), followed by Red Beauty (86.47 days) and Chandni (87.06 days), while Arka Darshan exhibited the most delayed opening (107.06 days). A similar trend was observed for the 5th floret, with Pusa Kiran (88.56 days), Red Beauty (88.67 days) and Chandni (89.33 days) being the earliest, whereas, Arka Darshan was the latest (108.74 days). The variation in days to floret opening among different cultivars may be attributed to differences in growth rates driven by their genetic makeup, leading to diverse phenotypic expressions. Comparable findings on flowering traits in gladiolus have also been reported by Mishra (1997) and Swain et al. (2008) on various varieties of gladiolus.

The longest duration of withering for 3rd floret (Table 2) was noted in Arka Darshan (108.30 days), significantly differing from Flevo Souvenir (103.81 days), Tiger Flame (103.80 days) and Pusa Swarnima (101.71 days), while the earliest was in Red Beauty (87.84 days). For the 5th floret, Arka Darshan again showed the most delayed withering (110.01 days), significantly differing from Flevo Souvenir (105.87 days), Tiger Flame (105.65 days) and Pusa Swarnima

(103.18 days), whereas the earliest was in Pusa Kiran (89.96 days). The largest 3rd floret diameter was recorded in Flevo Souvenir (10.44 cm), which was at par with Pink Friendship (10.15 cm), Tiger Flame (10.13 cm) and Regency (10.12 cm), while the smallest was in Arka Aarti (7.19 cm). A similar pattern was observed for the 5th floret, with Flevo Souvenir (10.34 cm) showing the maximum diameter, comparable to Pink Friendship (10.28 cm), Tiger Flame (9.97 cm) and Yellow Star (9.86 cm), whereas Arka Aarti had the minimum (6.89 cm). Differences in floret diameter may be attributed to genetic and environmental influences (Kadam et al., 2014). Comparable findings have been reported by Diltia et al. (2004) and Ram et al. (2005) on gladiolus.

The highest number of open florets (Table 2) was documented in cv. Snow Princess (13.05), followed closely by Pink Friendship (13.02), Gulal (12.79), Priscilla (12.72) and Tiger Flame (12.55), all statistically at par, while Yellow Star had the lowest (8.86). Pusa Sunayana exhibited the longest 3rd floret (12.02 cm), significantly exceeding Yellow Star (11.09 cm) and Hunting Song (10.52 cm), whereas, the shortest was observed in Shubhangini (8.33 cm). A similar trend was noted for the 5th floret, where Pusa Sunayana recorded the maximum length (11.61 cm), distinctly differing from other varieties, with Yellow Star (10.64 cm) and Hunting Song (10.49 cm) being comparable. In contrast, the shortest 5th floret was found in cv. Shubhangini (8.21 cm). The variation in floret length among the varieties may also be attributed to differences in their genetic makeup. Similar observations were reported by Pandey et al. (2012) and Singh et al. (2020) on different gladiolus varieties.

Shubhangini exhibited the longest internodal length (15.48 cm) (Table 2), significantly surpassing Pusa Manmohak (14.37 cm), Hunting Song (13.40 cm) and Tiger Flame (12.51 cm), whereas, Regency recorded the shortest (9.08 cm). The longest rachis was observed in Snow Princess (64.32 cm), statistically superior to Dhanvantari (64.08 cm), Pusa Swarnima (62.13 cm) and Pusa Manmohak (61.47 cm), while Arka Darshan had the shortest (46.09 cm). The differences in rachis length could be linked to corm vigour, which is influenced by the genetic potential of the varieties. These results align with previous findings by Mushtaq et al. (2018) and Nalage et al. (2019) on gladiolus.

Table 1. Performance of gladiolus cultivars on growth and flowering parameters

Cultivars	No. of leaves/hill at 90 DAP	Width of longest leaf (cm) at 90 DAP	Scape width (cm) at 90 DAP	Days to opening of floret	
				3 rd floret	5 th floret
American Beauty	8.63	3.63	2.43	89.65	92.26
Arka Aarti	10.75	2.70	2.79	101.10	103.27
Arka Darshan	9.63	3.10	3.44	107.06	108.74
Chandni	10.97	2.56	3.32	87.06	89.33
Dhanvantari	11.53	2.92	3.29	88.12	90.14
Flevo Souvenir	10.04	2.92	2.81	102.39	104.39
Gulal	9.54	3.07	3.16	96.44	98.91
Hunting Song	10.98	2.96	2.29	93.64	95.40
IIHR	11.11	2.48	2.64	94.05	95.80
Lemon Beauty	9.33	2.77	2.90	95.15	96.44
Malaviya Kundan	9.44	2.98	2.58	91.45	93.45
Mohini	10.80	3.08	3.05	94.02	95.94
Pink Friendship	12.13	3.11	2.94	95.26	97.11
Plum Tart	10.58	3.08	2.13	92.07	93.59
Priscilla	11.01	3.45	2.07	94.29	95.85
Pusa Kiran	10.60	3.03	1.91	86.37	88.56
Pusa Manmohak	12.95	3.01	2.37	96.22	97.85
Pusa Shubham	9.30	2.85	1.90	97.18	98.67
Pusa Sunayana	11.53	3.10	2.15	90.64	92.72
Pusa Swarnima	11.63	3.30	2.61	99.70	101.66
Red Beauty	11.10	3.13	2.28	86.47	88.67
Regency	10.89	3.26	2.47	94.62	96.34
Shubhangini	11.99	3.28	2.72	93.57	95.35
Snow Princess	10.04	3.30	2.94	89.92	91.82
Tiger Flame	10.13	2.91	2.64	102.96	104.33
True Love	12.11	3.44	2.79	96.51	97.58
Yellow Star	11.75	3.27	2.86	91.69	93.29
C.D. at 5%	2.33	0.23	0.39	0.93	0.86

Table 2. Performance of gladiolus cultivars on flowering and corm parameters

Cultivars	Days to withering of floret		Diameter of floret (cm)		Length of floret (cm)		No. of open florets /spike	Rachis length (cm)	Internodal distance (cm)	No. of cormels/hill	Weight of corms/hill (g)
	3 rd floret	5 th floret	3 rd floret	5 th floret	3 rd floret	5 th floret					
American Beauty	90.80	93.06	10.04	9.80	10.44	10.10	12.92	58.49	11.97	10.47	39.54
Arka Aarti	101.84	105.10	7.19	6.89	8.90	9.04	9.44	52.28	11.37	6.51	20.86
Arka Darshan	108.30	110.01	9.39	9.22	9.32	9.34	11.78	46.09	12.45	9.88	19.57
Chandni	88.42	91.10	9.03	8.97	10.03	9.83	10.77	54.17	10.09	12.74	23.82
Dhanvantari	90.19	91.72	9.22	9.13	9.06	8.40	10.40	64.08	9.63	7.98	31.56
Flevo Souvenir	103.81	105.87	10.44	10.34	10.03	10.17	11.48	50.22	12.17	9.67	25.06
Gulal	97.72	100.09	9.97	9.68	9.57	9.68	12.79	58.59	12.25	4.72	21.25
Hunting Song	95.24	96.65	9.33	8.95	10.52	10.49	10.82	60.21	13.40	23.65	40.47
IIHR	96.24	97.01	10.22	9.85	9.34	9.85	12.33	52.04	11.61	11.79	22.12
Lemon Beauty	97.01	98.26	8.85	9.01	9.65	9.01	10.16	55.69	10.88	9.76	27.99
Malaviya Kundan	92.99	94.80	9.98	9.34	9.53	9.34	9.18	51.07	10.70	5.99	11.34
Mohini	95.99	96.82	9.86	8.92	9.81	9.40	10.84	59.92	12.88	11.98	33.39
Pink Friendship	97.29	98.70	10.15	10.28	10.38	10.28	13.02	50.11	11.86	9.70	26.47
Plum Tart	93.88	95.31	9.00	8.89	8.77	8.61	9.61	51.57	11.77	6.39	23.80
Priscilla	95.75	97.35	9.48	8.84	9.60	9.31	12.72	58.89	11.48	14.96	23.52
Pusa Kiran	88.03	89.96	9.64	9.19	8.55	8.46	10.38	52.25	11.52	10.24	29.43
Pusa Manmohak	97.59	98.94	9.21	8.78	9.79	9.81	11.76	61.47	14.37	12.07	25.75
Pusa Shubham	98.84	100.49	9.64	9.40	9.64	9.62	9.29	48.01	11.12	6.30	32.77
Pusa Sunayana	92.23	93.89	9.28	9.14	12.02	11.61	11.84	56.97	12.90	26.50	48.37
Pusa Swarnima	101.71	103.18	9.56	9.17	9.96	9.90	10.93	62.13	11.50	16.92	41.76
Red Beauty	87.84	90.06	9.29	9.25	10.05	9.82	9.88	54.61	11.11	13.48	30.66
Regency	95.98	97.88	10.12	9.65	10.12	9.65	10.13	49.29	9.08	21.59	32.00
Shubhangini	95.40	96.99	9.96	9.39	8.33	8.21	11.18	55.24	15.48	27.43	29.96
Snow Princess	90.93	93.05	9.30	8.91	9.35	9.20	13.05	64.32	12.10	20.99	32.66
Tiger Flame	103.80	105.65	10.13	9.97	10.13	9.97	12.55	56.17	12.51	11.66	21.86
True Love	98.06	99.07	9.74	9.17	9.89	9.35	9.55	47.98	12.20	6.79	27.76
Yellow Star	93.03	94.81	10.17	9.86	11.09	10.64	8.86	52.36	11.36	12.75	32.94
C.D. at 5%	0.76	0.89	0.75	0.76	0.75	0.67	1.69	3.08	2.28	2.24	10.53

3.3 Corm Parameters

The experimental findings revealed significant variation in the number of cormels per hill (Table 2) among the gladiolus varieties. Shubhangini produced the highest number of cormels per hill (27.43), which was statistically at par with Pusa Sunayana (26.50), Hunting Song (23.65), Regency (21.59) and Snow Princess (20.99), while maintaining a significant advantage over the remaining varieties. Conversely, the lowest number of cormels per hill was recorded in Gulal (4.72). Different varieties exhibit varying responses or interactions with specific soil and climatic conditions, largely due to their genetic makeup. These findings are in accordance with the results reported by Lepcha et al. (2007) on different gladiolus varieties.

The study revealed significant differences in corm weight per hill (Table 2) among the evaluated gladiolus varieties. Pusa Sunayana exhibited the highest corm weight per hill (48.37 g), significantly outperforming all other varieties. It was followed by Pusa Swarnima (41.76 g), Hunting Song (40.47 g) and American Beauty (39.54 g). In contrast, Malaviya Kundan recorded the lowest corm weight per hill (11.34 g). The greater amount of stored food in larger mother corms, which supported enhanced plant growth, could be associated with increased corm weight influenced by corm size. These findings are in accordance with the results reported by Kumar et al. (2018) on gladiolus.

4. CONCLUSION

The present study highlights the significant variability among gladiolus cultivars in terms of growth, flowering and corm characteristics, emphasizing their diverse ornamental and agronomic potential. Pusa Manmohak exhibited the highest number of leaves per hill, while American Beauty recorded the lowest. Arka Darshan had the widest scape, whereas Pusa Shubham had the narrowest. Among corm traits, Shubhangini produced the highest number of cormels per hill, while Pusa Sunayana had the maximum corm weight per hill. Flowering parameters also showed considerable variation, with Pusa Kiran being the earliest to reach floret opening and Flevo Souvenir recording the largest floret diameter. These findings provide useful insights for growers and stakeholders in selecting suitable cultivars for different agro-climatic conditions and market preferences. The observed variations in key traits underline the

importance of varietal selection for optimizing gladiolus production and quality.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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