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RESEARCH PAPER

Characterization of Morphological Traits (Growth, Flowering and Corm Yield) in different Gladiolus Cultivars

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ABSTRACT

A study on morphological characteristics of 27 (*Gladiolus* spp.) varieties under open field conditions at the Horticulture Research Farm, Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi. The experiment was laid out in a Randomized Block Design with five replications. The study revealed significant variability among cultivars. In growth parameters, Red Beauty had the highest number of sprouts per hill, Dhanvantari attained maximum plant height and Mohini produced the longest leaf. Flowering traits also varied significantly, with Chandni showing the earliest spike emergence and last floret opening, while Red Beauty had the earliest 1st floret opening. Pink Friendship had the largest 1st floret diameter and Flevo Souvenir had the largest last floret. Snow Princess produced the maximum florets per spike, Priscilla had the longest flowering duration and Dhanvantari had the longest spike. In corm yield, Shubhangini had the highest cormels weight per hill, whereas, IIHR recorded the maximum corms per hill and American Beauty had the largest corm diameter. These findings highlight the genetic diversity among gladiolus cultivars, aiding in the selection of high-performing varieties for commercial cultivation and market potential.

HIGHLIGHTS

- Red Beauty recorded the highest number of sprouts per hill and earliest first floret opening.
- Dhanvantari exhibited maximum plant height and the longest spike length.
- Among the varieties, Pink Friendship had the largest diameter for the first floret, while Flevo Souvenir had the largest diameter for the last floret.

Keywords: Gladiolus, growth traits, flowering traits, cultivars and corm traits

Gladiolus (*Gladiolus grandiflora*) belongs to the family Iridaceae. Often hailed as the queen of bulbous flowers, it is commonly known as the sword lily or corn lily and is native to South Africa. There are about 260 species of gladiolus (Singh and Sisodia, 2017) worldwide, primarily distributed across western, southern and eastern Africa, with approximately 12 species originating from the Mediterranean region. Renowned for its economic significance, it is widely cultivated as a cut flower and for ornamental purposes. It holds a notable position in the global cut flower export market. The spikes of gladiolus are adorned with a multitude of florets, presenting an assortment of sizes and forms, with petals that can be either smooth or deeply crinkled and ruffled. This magnificent inflorescence, along with its diverse colour palette and impressive durability, makes it an excellent choice for vase decoration, bouquet crafting, and various floral compositions (Singh *et al*. 2025). As a cut flower, it offers significant export

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potential to European markets during the winter season, contributing to foreign exchange earnings. Therefore, adopting scientific cultivation practices is essential to produce high-quality blooms that meet export standards while ensuring an optimal yield of gladiolus corms. India's agro-climatic conditions are well-suited for gladiolus cultivation, with commercial production thriving in states like West Bengal, Himachal Pradesh, Sikkim, Karnataka, Uttar Pradesh, Tamil Nadu, Punjab and Delhi. In the eastern regions, including Tripura, Assam, Manipur, Meghalaya and Nagaland, gladiolus has emerged as a promising commercial crop. Furthermore, substantial cultivation areas are also found in Jammu and Kashmir, Andhra Pradesh and Gujarat (Kadam *et al*. 2014). Gladiolus exhibits a significant diversity in its varieties, with numerous new cultivars being introduced annually. Consequently, it is essential to evaluate these varieties to identify the most suitable ones for specific regions (Kumar and Yadav 2005). Therefore, an experiment was carried out to study various morphological characters like growth, flowering and corm yield characteristics of various gladiolus varieties.

MATERIALS AND METHODS

The present experiment was conducted at the Horticulture Research Farm, Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, during the winter season of 2023–24. The research farm is geographically situated at 25° 02′ North latitude and 83° 03′ East longitude, with an elevation of 128.93 meters above sea level. The experimental site is characterized by a subtropical climate, with hot summers, moderate winters and a distinct monsoon period. The soil of the experimental field is alluvial in nature, well-drained and moderately fertile, with a pH ranging between 6.5 and 7.5. Healthy, disease-free corms of 27 gladiolus varieties were procured from the Department of Horticulture and used for planting. The varieties included 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. The corms were graded based on size and weight, ensuring uniformity in planting material. The experiment was laid out in a Randomized Block Design (RBD) with five replications. The corms were planted at a spacing of 30 cm between rows and 20 cm between plants, maintaining a uniform depth of 5 cm to 7 cm. 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.

RESULTS AND DISCUSSION

Growth parameters

Data was collected on vegetative, floral and corm traits in various cultivars. The variance analysis indicated notable differences among the varieties for most characteristics, highlighting considerable potential for improvement *via* selection. The no. of sprouts/hill (Table 1) was found maximum in cultivar Red Beauty (3.56), followed by Pusa Shubham (2.71), Pusa Kiran (2.62) and Plum Tart (2.49) whereas, the minimum no. of sprouts/hill was found in cultivar American Beauty (1.07). The length of longest leaf at 90 DAP was found maximum in cultivar Mohini (58.83 cm) followed by Pusa Swarnima (57.88 cm), Pusa Manmohak (57.74 cm) and Dhanvantari (55.91 cm) whereas, the minimum length of longest leaf was found in cultivar Arka Arti (39.09 cm). The plant height at 90 DAP was found in maximum in cultivar Dhanvantari (73.46 cm) followed by Gulal (72.56 cm), Pusa Swarnima (70.66 cm) and Mohini (70.52 cm), whereas, the minimum plant height was found in cultivar Arka Darshan (53.22 cm). The differences in plant height among the various varieties could be attributed to genotypic variations in the expression of plant height, as well as the differing effects of genotype-environment interactions influencing this trait. Such height differences among varieties have also been observed in studies by Kamble *et al*. (2004), Singh *et al*. (2017) and Sumi *et al*. (2021).

Flowering parameters

The earliest opening of the 1st floret (Table 1) was recorded in Red Beauty (84.42 days), followed by

Pusa Kiran (84.51 days) and Chandni (84.58 days), while Arka Darshan exhibited the most delayed opening of 1st floret (105.58 days). The earliest opening of last floret was noted in Red Beauty (95.08 days), followed by Pusa Kiran (95.91 days) and Chandni (96.20 days), whereas, Arka Darshan had the most delayed opening (113.05 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).

Arka Darshan also reported for the longest duration in case of withering (Table 2) of the 1st floret (107.18 days), significantly differing from other varieties, followed by Tiger Flame (102.70 days), Flevo Souvenir (101.44 days) and Pusa Swarnima (100.33 days). In contrast, Chandni exhibited the earliest withering (85.86 days). Similarly, Arka Darshan had the most delayed withering of the last floret (114.95 days), significantly differing from Flevo Souvenir (111.37 days), Tiger Flame (109.79 days) and Pusa Swarnima (107.96 days), while the earliest was observed in Pusa Kiran (96.06 days). Regarding floret diameter, Pink Friendship recorded the largest 1st floret (11.23 cm), which was found at par with Flevo Souvenir (11.17 cm), IIHR (11.04 cm) and Tiger Flame (10.45 cm), while Arka Aarti had the smallest (7.63 cm). For the last floret, Flevo Souvenir and IIHR exhibited the maximum diameter (9.83 cm), followed by Tiger Flame (9.67 cm) and Yellow Star (9.63 cm), whereas, Arka Aarti had the smallest diameter (7.17 cm). Variations in floret diameter may be attributed to genetic and environmental factors (Kadam *et al*. 2014), with similar observations reported by Dilta *et al*. (2004) on gladiolus.

The longest flowering duration was recorded in Priscilla (12.72 days) (Table 2), which was found at par with Flevo Souvenir (12.37 days), Regency (12.13 days), Shubhangini (11.95 days) and Pusa Kiran (11.92 days), while Malaviya Kundan exhibited the shortest duration of flowering (9.37 days). Variety Yellow Star noticed for the maximum 1st floret length (11.54 cm), which was found at par with Hunting Song (11.34 cm) and Red Beauty (10.91 cm), while Shubhangini exhibited the minimum length of 1st floret (8.59 cm). Similarly, Yellow Star had the longest last floret (10.63 cm), which was found at par with Pusa Sunayana (10.52 cm) and Chandni (10.02 cm), whereas, Pusa Kiran recorded the short floret length (8.11 cm). Maximum number of florets/spike was observed in Snow Princess (15.05), whereas, statistically at par with Pink Friendship (15.02), Pusa Sunayana (13.84), Pusa Manmohak (13.76), while, Plum Tart recorded the lowest number of florets/spike (9.61)). The differences in number of florets per spike is due to different combination of genetics, surrounding environmental factors and prevailing climatic conditions. These results align with the findings of (Bhat *et al*. 2017), (Sisodia *et al*. 2018) and (Rashmi *et al*. 2016) on different gladiolus varieties.

Dhanvantari recorded the longest spike length (98.51 cm) (Table 2), significantly surpassing all other varieties, followed by American Beauty (94.77 cm), Pusa Swarnima (93.76 cm) and Shubhangini (92.16 cm). In contrast, Pink Friendship exhibited the shortest spike length (75.49 cm). Findings regarding varietal differences in spike length, suggesting that the variation in spike length could be attributed to both genetic and environmental factors. These findings are in agreement with previous studies by Naresh *et al*. (2015) and Azimi (2020) on gladiolus.

Regarding days to colour show (Table 1), Chandni exhibited the earliest in showing colour stage (81.68 days), followed by Pusa Kiran (82.10 days) and Red Beauty (82.83 days), while Arka Darshan recorded the longest duration (103.12 days). The earliest spike emergence was observed in Chandni (75.19 days) (Table 1), followed by American Beauty (77.81 days), Snow Princess (80.31 days), Yellow Star (80.61 days) and Plum Tart (80.75 days), whereas, Arka Darshan recorded the maximum days to spike emergence (96.72 days). Spike emergence may largely depend on the plant's internal food reserves, which are influenced by the growth rate and the subsequent accumulation of sufficient carbohydrates necessary for spike initiation. These results align with the findings of Momin *et al*. (2015) and Kaur and Bajpay (2019) in different gladiolus varieties.

Corm parameters

The weight of cormels/hill (Table 2) was found maximum in cultivar Shubhangini (7.64 g) followed by cvs. Regency (5.65 g), Hunting Song (5.48 g) and Pusa Sunayana (3.75 g) whereas, the minimum weight of cormels/hill was found in cultivars Arka

Table 1: Performance of various gladiolus cultivars on growth and flowering parameters

Cultivars	No. of sprouts/ hill	Plant height (cm) at 90 DAP	Length of longest leaf (cm) at 90 DAP	Days to spike emergence	Days to colour show	Days to opening of floret	
						1st floret	Last floret
American Beauty	1.07	65.91	51.54	77.81	84.54	87.44	97.63
Arka Aarti	1.71	54.40	39.09	88.69	96.68	98.96	107.82
Arka Darshan	1.53	53.22	40.10	96.72	103.12	105.58	113.05
Chandni	1.78	60.02	44.04	75.19	81.68	84.58	96.20
Dhanvantari	1.6	73.46	55.91	88.42	83.90	85.81	95.94
Flevo Souvenir	1.23	63.42	46.57	87.97	97.83	99.79	109.93
Gulal	1.51	72.56	54.51	85.37	91.70	93.99	105.54
Hunting Song	2.02	65.26	53.83	82.54	88.64	91.10	101.34
IIHR	2.16	56.52	43.89	82.87	91.80	92.38	101.39
Lemon Beauty	2.44	64.44	51.81	84.09	91.35	93.31	102.36
Malaviya Kundan	2.11	65.46	50.67	82.75	87.98	89.40	98.02
Mohini	1.93	70.52	58.83	84.52	90.97	92.21	101.87
Pink Friendship	1.44	58.74	47.91	83.51	91.47	93.92	103.45
Plum Tart	2.49	64.58	53.65	80.75	87.74	90.16	99.31
Priscilla	1.47	66.82	53.36	84.52	90.76	92.53	101.84
Pusa Kiran	2.62	62.80	47.49	85.14	82.10	84.51	95.91
Pusa Manmohak	1.49	67.92	57.74	87.94	93.83	94.62	103.77
Pusa Shubham	2.71	57.70	39.29	86.88	93.19	95.32	103.96
Pusa Sunayana	2.27	66.60	52.83	80.56	86.13	88.74	99.33
Pusa Swarnima	1.71	70.66	57.88	89.53	97.55	98.46	106.58
Red Beauty	3.56	66.34	51.20	85.10	82.83	84.42	95.08
Regency	1.42	63.78	51.41	84.74	91.56	92.81	102.87
Shubhangini	1.44	56.54	50.33	80.73	89.44	91.79	101.56
Snow Princess	1.20	57.884	49.85	80.31	86.69	88.12	97.43
Tiger Flame	1.71	64.62	43.53	94.04	100.40	101.83	108.80
True Love	1.22	65.22	43.69	84.85	93.22	95.04	103.51
Yellow Star	1.56	64.51	49.39	80.61	87.22	89.63	98.27
C.D. at 5%	0.46	2.03	2.28	2.52	1.89	0.81	0.65

Table-2: Performance of various gladiolus cultivars on flowering and corm parameters

Cultivars	Days to withering of floret		Diameter of floret (cm)		Length of floret (cm)		No. of florets/ spike	Flowering duration (Days)	Spike length (cm)	Weight of cormels/ hill (g)	No. of corms/ hill	Diameter of corms (cm)
	1st floret	Last floret	1st floret	Last floret	1st floret	Last floret						
American Beauty	88.11	98.38	10.12	9.70	10.32	9.38	14.92	12.39	94.77	2.08	1.37	5.09
Arka Aarti	99.20	108.99	7.63	7.17	9.45	8.86	10.44	9.49	87.95	1.21	1.93	3.20
Arka Darshan	107.18	114.95	9.79	8.89	9.93	8.70	12.78	12.09	76.29	1.01	2.20	3.41
Chandni	85.86	99.14	8.88	8.87	10.23	10.02	11.77	11.77	82.90	2.57	1.92	4.02
Dhanvantari	86.92	99.94	8.92	9.01	9.20	8.54	11.40	11.54	98.51	3.14	2.06	4.30
Flevo Souvenir	101.44	111.37	11.17	9.83	10.80	9.49	13.48	12.37	81.70	2.91	1.88	3.19
Gulal	95.03	106.75	10.17	9.77	9.69	9.74	12.79	11.74	82.16	1.13	2.37	3.38
Hunting Song	92.93	104.92	9.61	8.82	11.34	9.98	11.82	11.82	83.17	5.48	2.17	3.90
IIHR	94.00	106.09	11.04	9.83	9.75	9.83	12.33	10.18	71.32	2.39	3.35	2.83

Lemon Beauty	94.60	104.63	9.07	8.74	9.83	8.64	13.16	9.96	81.11	1.18	2.37	3.69
Malaviya Kundan	90.96	102.94	10.15	8.90	10.08	9.14	12.18	9.37	75.63	1.01	2.01	2.36
Mohini	94.16	103.43	9.82	8.86	10.00	9.31	10.84	9.97	94.05	2.02	2.65	4.73
Pink Friendship	95.19	105.75	11.23	9.68	10.45	10.02	15.02	11.23	75.49	1.93	1.88	4.02
Plum Tart	92.25	103.49	9.76	9.07	8.89	8.62	9.61	11.71	79.36	1.01	2.77	3.00
Priscilla	94.32	105.24	9.92	8.88	9.92	9.25	12.72	12.72	83.18	2.75	2.55	2.79
Pusa Kiran	86.24	96.06	10.04	8.97	8.67	8.11	12.38	11.92	82.80	1.30	3.28	2.89
Pusa Manmohak	95.82	104.93	9.74	8.90	10.24	9.63	13.76	11.63	92.11	1.89	2.16	3.41
Pusa Shubham	97.10	104.95	10.28	8.96	10.28	9.44	10.29	10.29	75.99	1.64	2.31	3.71
Pusa Sunayana	90.22	101.14	9.76	8.81	12.12	10.52	13.84	11.64	85.75	3.75	2.31	4.19
Pusa Swarnima	100.33	107.96	10.18	9.19	10.18	9.51	12.93	10.57	93.76	2.85	2.75	3.76
Red Beauty	86.05	97.20	10.24	8.68	10.91	9.70	11.88	9.72	85.73	2.05	3.26	4.31
Regency	94.37	103.90	10.73	9.27	10.37	9.27	12.13	12.13	81.43	5.65	1.49	4.59
Shubhangini	93.30	102.80	10.13	9.30	8.59	8.11	13.18	11.95	92.16	7.64	3.00	3.16
Snow Princess	90.22	98.91	9.83	8.53	9.83	9.30	15.05	10.40	93.51	3.28	2.49	4.44
Tiger Flame	102.70	109.79	10.45	9.67	10.45	9.87	13.55	10.72	87.48	1.26	2.19	3.34
True Love	97.16	104.68	9.92	9.01	9.92	9.25	11.55	10.53	76.49	1.43	1.55	3.11
Yellow Star	91.37	100.27	10.51	9.63	11.54	10.63	12.86	11.62	84.22	2.06	2.70	3.65
C.D. at 5%	0.64	0.93	0.86	0.68	0.90	0.79	2.50	1.77	4.70	1.24	0.88	1.19

(a) American Beauty

(b) Arka Aarti

(c) Arka Darshan

(d) Dhanvantari

(e) Flevo Souvenir

(f) Gulal

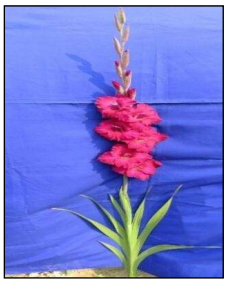
(g) Hunting Song

(h) IIHR

(i) Malaviya Kundan

(j) Mohini

(k) Pink Friendship



(l) Plum Tart

(m) Priscilla

(n) Pusa Kiran

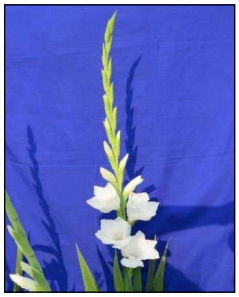
(o) Pusa Manmohak

(p) Pusa Shubham

(q) Pusa Swarnima

(r) Regency

(s) Shubhangini



(t) Snow Princess

(u) Tiger Flame

(v) True Love

(w) Yellow Star

Darshan, Malaviya Kundan and Plum Tart (1.01 g). The no. of corms/hill was found in maximum in cultivar IIHR (3.35), Pusa Kiran (3.28), Red Beauty (3.26) and Shubhangini (3.0) whereas, the minimum no. of corms/hill was found in cultivar American Beauty (1.37). The diameter of corm was found maximum in cultivar American Beauty (5.09 cm) followed by Mohini (4.73 cm), Regency (4.59 cm) and Snow Princess (4.44 cm) whereas, the minimum diameter of corm was found in cultivar Malaviya Kundan (3.36 cm). The genetic composition of each variety influences its response to varying soil and climatic conditions. Larger mother corms typically store more nutrients, which enhances plant growth, as noted by Swaroop *et al*. (2019). Similar findings have been reported by previous researchers (Kadam *et al.*, 2014 and Nalage *et al.* 2019).

CONCLUSION

The present study highlights the significant genetic variability among 27 gladiolus cultivars in terms of growth, flowering and corm yield traits. Red Beauty exhibited the highest number of sprouts per hill (3.56), while Dhanvantari attained the greatest plant height (73.46 cm). Mohini produced the longest leaves (58.83 cm) and IIHR recorded the maximum number of corms per hill (3.37). Among flowering traits, Chandni showed the earliest spike emergence (75.19 days), while Red Beauty exhibited the earliest first floret opening (84.42 days). The largest first floret diameter was recorded in Pink Friendship (11.23 cm), while Snow Princess produced the highest number of florets per spike (15.05). Dhanvantari had the longest spike length (98.51 cm), whereas Priscilla exhibited the longest flowering duration (12.72 days). These findings provide valuable insights for selecting superior gladiolus varieties for commercial cultivation and floricultural advancement.

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