

PERFORMANCE OF DIFFERENT VARIETIES OF GLADIOLUS UNDER PRAYAGRAJAGRO-CLIMATIC CONDITIONS

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ABSTRACT

An experiment was carried out in the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, from November, 2023 to March, 2024. The experiment was conducted in Randomized Block Design (RBD) with fifteen varieties, replicated thrice. It was reported that it is concluded that among the different varieties of gladiolus variety V₆ (Pusa Suhagin) performed significantly better in plant height (90.69 cm), number of leaves (10), leaf area index (0.22), spike length (113.6 cm), more number of spikes per plant (2.83), more number of florets per spike (16), however less number of days taken for first sprouting recorded in V₁₅ (Snow Board, 7 days) and Vase life higher in variety V₉ (Arka Pratham, 11.66 days).

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Keywords: Variety Gladiolus, Pusa Suhagin, Arka Pratham, Flowering, Growth

1. INTRODUCTION

Flowers are one of the most beautiful gifts that nature has given to man. Their delightful smell makes people happy and joyful. The joy and peace of flowers are beneficial to the soul. Flowers are used for a number of additional purposes, including garlands, bouquets and interior décor in an old and religious culture like India, where they are deeply associated with nearly all social occasions and celebrations. In addition, cultivating attractive plants and flowers is crucial for sustaining the ecological balance and reducing pollution in the environment.

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Gladiolus is a flower of glamour and perfection which is known as the queen of bulbous flowers due to its flower spikes with florets of massive form, brilliant colors, attractive shapes, varying size and excellent shelf life. The modern varieties are botanically known as *Gladiolus grandiflorus* belonging to the family Iridaceae. Gladiolus is grown as flower bed in gardens and used in floral arrangements for interior decoration as well as making high quality bouquets (Bose et al., 2003).

Gladiolus is rated fourth in worldwide trade, third in India's cut flower output and sixth in loose flower production (Nath et al., 2020). Gladiolus flower cultivation generates six times the profit of rice production. Gladiolus cut flowers are produced by different countries such as USA, Holland, Italy, France, Poland, Bulgaria, Brazil, Australia and also Israel. Apart from this in Europe, for over 100 years Gladiolus has been popular, whereas it has been introduced recently in India. India has suitable agro-climatic conditions for gladiolus cultivation; it is commercially cultivated in Himachal Pradesh, Sikkim, Karnataka, Uttar Pradesh, West Bengal, Tamil Nadu, Punjab and Delhi. In the eastern states like Tripura, Assam, Manipur, Meghalaya and Nagaland, this flower has established itself as a commercial proposition. There is a sizeable area under gladiolus in Jammu-Kashmir, Andhra Pradesh and Gujarat also (Flower council of Holland, 2008).

During the last two decades the commercial production of gladiolus spikes has become a

very popular flowering plant in India. The cultivation of gladiolus has the potential to change the economic scenario of farmers especially under Northern Indian plains, Uttar Pradesh, Tamil Nadu and Pondicherry. It is also necessary to examine the efficiency of different varieties and varieties available in the market. So, all these cultivars need to be tested for their performance, colors and color combinations, floral characteristics like spike length, more number and better size of floret, increase vase life etc.

Considering the present status, it is necessary to improve both quantitative and qualitative features in order to capitalize on internal and exotic demand. Climate and soil conditions have a significant impact on plant nutrition, development and subsequent survival while growing the gladiolus crop. Different climatic conditions have a significant impact on the growth and yield performance of Gladiolus. Commercial cultivation of gladiolus is becoming more popular, with large-scale production practiced mostly during the winter season. This experiment was conducted to evaluate the performance of different varieties of gladiolus.

1. Materials and Methods

The field experiment entitled Performance of different varieties of gladiolus under Prayagraj agroclimatic conditions was carried out at the Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Naini, Prayagraj, during November, 2023 to March, 2024. The experimental field is situated on the left side of Prayagraj - Rewa Road, near the river Yamuna, and approximately 7 km from Prayagraj city.

2.1 Geographical Location and Climate Condition

Geographically, Prayagraj is situated in the south-eastern part of Uttar Pradesh. It lies between 25° 47' North latitudes and 82° 21' East longitudes. The area of Prayagraj district comes under agro-climatic zone V (Upper Gangetic Plain region) and sub-zone of Central Plains. The climate ranges from dry sub-humid to semi-arid and the soil is alluvium calcareous sandy loam. The district experiences an average maximum temperature range between 43° - 47°C which may go as high as 48°C during peak summers (May-June). The minimum average temperature is 2-4°C, which may fall as low as 1°C during peak winter months (December-January). The average rainfall of the district is 960mm and the monsoon season is spread between July-September.

2.2 Experimental Details

The trail was laid out in a Randomized block design with fifteen varieties replicated thrice. Spacing 1 m x 1m. Fifteen different varieties used Priscilla, Joshika, Dhanvantari, Phule Neel Rekha, Souvik Biscuit, Pusa Suhagin, Chandni, Arka Amar, Arka Pratham, Smoky Lady, Arka Tilak, Panibica Beauty, Arka Naveen, Manhattan, Snow Board corm are procured from DFR, Pune College of Agriculture Campus, Narveer Tanaji Wadi, Shivajinagar, Pune, Maharashtra 411005.

2.2.1 Observation details

Number of days to sprouting, Plant height, Number of leaves per plant, Leaf area index, Number of branches per plant, Number of days for Spike emergence, Floret diameter(cm), Corm diameter (cm), Number of spikes per plant, Number of florets per spikes, Vase life.

2. RESULTS AND DISCUSSIONS

3.1 Vegetative Parameter

Days taken to first sprouting - Significantly, less number of days first sprouting (7 days) was recorded in the variety V15 (Snow Board), followed by variety V5 (Souvik Biscuit, 8.8 days) whereas, the variety that took more number of days for first sprouting V11 (Arka Tilak, 11days).

The differences in days to first sprouting in different cultivars of gladiolus due to genetic nature of cultivars. Similar report was also investigated in different varieties of tuberose by **Singh et al., (2013), Kumar et al. (2014).**

Plant height- 90 days after planting, significantly taller plants (90.69 cm) were recorded in V₄ (Pusa Suhagin) followed by V₁₂ (Arka Pratham, 87.8 cm) whereas shorter plants were recorded in V15 (Snow Board, 67.83 cm).

Plant height is a genetic character of every species and cultivar variation in plant height of different varieties may be attributed to the fact that this genetic character varied from variety to variety. Similar findings in variation in plant height were obtained by **Mohanty et al. (2011)** in rose and **Hussain and Khan (2004)** in variety of gladiolus.

Number of leaves- 90 days after planting, significantly more number of leaves (10) were recorded in V₆ (Pusa Suhagin) at par by V₁₁ (Arka Tilak, 9.8) and V₉ (Arka Pratham, 9.6) whereas less number of leaves were recorded in V15(Snow Board, 7.33).

Difference in number of leaves in different varieties might be due to the different genetic makeup of the varieties and their adaptability to the existing environmental conditions. The findings of the present investigation are in conformity with the reports of **Treder (2008)** in Oriental lily; **Lalmuanpui et al.(2021)** in gerbera; **Balan et al. (2020)** in tuberose; **Khan et al. (2020)** in Chrysanthemum.

Leaf area index- Significantly, more leaf area index (0.22) was recorded in the variety V6 (Pusa Suhagin) at par by variety V5 (Souvik Biscuit, 0.20) and V2 (joshika,0.19) whereas, the less leaf area index recorded in V15 (Snow Board, 0.11).

Difference in leaf area index varieties might be due to the different genetic makeup of the varieties and their adaptability to the existing environmental conditions. The findings of the present investigation are in conformity with the reports of **Gupta et al. (2014)** in marigold; **Balan et al. (2020)** in gladiolus; **Singh et al. (2015)** in Chrysanthemum.

Table 1. Vegetative Parameters

Notation	Varieties	Days to germination	Plant height (cm)	Number of leaves	Leaf area index
V ₁	Priscilla	7.83	81.3	9.33	0.20
V ₂	Joshika	8	78.12	9	0.19
V ₃	Dhanvantari	8.33	78.43	9	0.14
V ₄	Phule Neel Rekha	7.16	80.93	9	0.16
V ₅	Souvik Biscuits	8.66	83.88	9	0.20
V ₆	Pusa Suhagin	8.33	90.69	10	0.22
V ₇	Chandani	8.5	83.43	8.33	0.13
V ₈	Arka Amar	8.26	84.63	8.34	0.12
V ₉	Arka Pratham	8.66	87.8	9.6	0.14
V ₁₀	Smoky Lady	8.23	84.29	8.66	0.15
V ₁₁	Arka Tilak	11	81.63	9.8	0.13
V ₁₂	Panibica Beauty	7.66	84.33	8	0.16
V ₁₃	Arka Naveen	7.76	81.99	9	0.17
V ₁₄	Manhattan	8.33	73.68	8.7	0.11
V ₁₅	Snow Board	7	67.83	7.33	0.11
	F-TEST	S	S	S	S
	SE(d)±	0.59	1.75	0.38	0.23
	C D _{0.05}	1.22	3.60	1.12	0.02
	C.V.	8.95	2.6	0.54	1.62

3.2 Floral Parameters

Number of days for Spike emergence - Significantly, less number of days for spike emergence (70.83 days) was recorded in the variety V6 (Pusa Suhagin), followed by variety V13 (Arka Naveen, 72.2 days) whereas, the variety that took more number of days for spike emergence V15 (snow Board, 90 days).

This variation among cultivars might be due to genetic traits and prevailing climatic condition. These findings are accordance with **Singh and Singh (2013)**, **Patil et al (2009)** and **Rachana et al (2013)**.

Number. of florets per spike-

Significantly, more number of floret per spike (16.6) was recorded in the variety V6 (Pusa Suhagin), followed by variety V9 (Arka Pratham, 15.6) whereas, the less number of spike recorded in V15 (snow Board, 10.66).

This variation in florets per spike may be due to genetic variability among the different cultivars of gladiolus and prevailing environmental conditions. Variation in number of florets among the varieties was also reported **Ramachandrudu and Thangam (2004)** and **Singh and Singh (2013)**.

Quality parameters

Spike length - Significantly, longer spike length (113.6 cm) was recorded in the variety V6 (Pusa Suhagin), followed by variety V13 (Arka Naveen, 111.3 cm) whereas, the shorter spike length recorded in V15 (snow Board, 74.66 cm).

The number of days taken from flower bud initiation to tight bud stage is an important character of rose cut flower, which indicates the early or late flowering habit of any of the cultivars. Both characters like bud stage and tight bud stage are helpful in the availability of flowers for a long among different cultivars. Variation for late or early flowering seems to be the genetically inherent character of different variety. Similar results have also been reported by **Harshvardhan (2009)**, **Nagaraja (1996)**, **Manjula (2005)** in gladiolus.

Floret diameter- Significantly, bigger floret diameter (12.33) was recorded in the variety V5 (Souvik Biscuit), at par by variety V9 (Arka Pratham, 12) and V13(Arka Naveen 11.9) whereas, the less number of spikes recorded in V15 (Snow Board, 10.66).

The differences in floret diameter varieties may be attributed to the fact that this genetic character varied from variety to variety. The variation in floret diameter might be due to the retarded growth of the plants, low temperature and low light intensity in winter as reported earlier by **Gill and Atwal (1976)**, **Gill et al (1988)** and **Terfa et al (2014)**.

Corm Diameter- Significantly, higher corm diameter (6.49 cm) was recorded in the variety V9 (Arka Pratham), followed by variety V3 (Dhanvantri, 5.33) whereas, the lesser corm diameter recorded in V15 (Snow Board, 2.63).

The differences in corm diameter varieties may be attributed to the fact that this genetic character varied from variety to variety. Similar findings of **Murugesan et al (1991)**, **Bhattacharjee (1993) et al** and **Sundram et al (1996)**.

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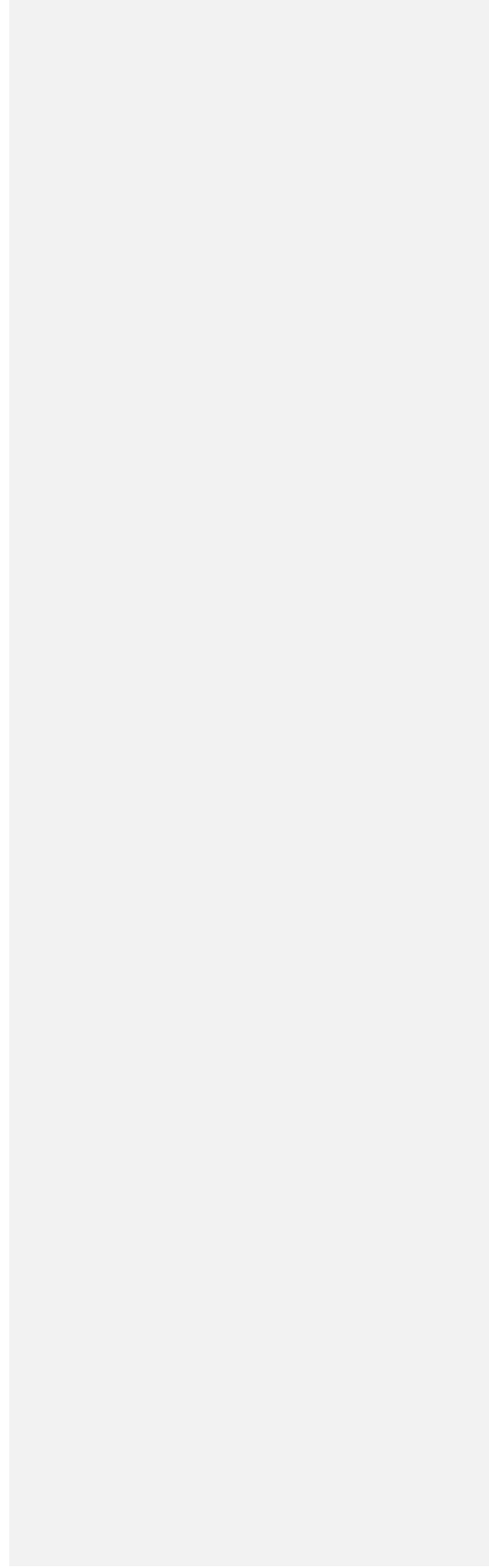


Table 2. Floral and quality parameters of different varieties of gladiolus

Notation	Varieties	Number of days for Spike emergence	Spike length(cm)	Number of florets per spike	Floret diameter(mm)	Corm Diameter(cm)	Vase life(days)
V ₁	Priscilla	81.83	111	14.33	23.5	5.33	9.66
V ₂	Joshika	86.82	106	14.66	25.1	4.74	8.66
V ₃	Dhanvantari	78.16	101.66	13.33	21.2	5.55	7.66
V ₄	Phule Neel Rekha	74.83	109.66	14	35.1	5.21	8.33
V ₅	Souvik Biscuits	83.16	91.66	14.33	29.4	3.73	7.33
V ₆	Pusa Suhagin	70.83	113.6	13	22.7	6.55	7.5
V ₇	Chandani	69.16	81.33	16	32.1	4.55	9.66
V ₈	Arka Amar	73.16	99.66	16.16	23.9	3.52	10.66
V ₉	Arka Pratham	76	112	12.66	27.2	6.49	11.66
V ₁₀	Smoky Lady	82.16	97	13.66	27.3	4.55	9.83
V ₁₁	Arka Tilak	71.83	104	15.66	28.3	5.52	11.5
V ₁₂	Panibica Beauty	78.5	88	15.66	28.9	3.74	9.33
V ₁₃	Arka Naveen	81.16	111.3	13.33	26.3	4	8.83
V ₁₄	Manhattan	76.16	79	12.66	28	4.48	8.5
V ₁₅	Snow Board	90	74.66	10.66	25.1	2.63	7.16
	F-TEST	S	S	S	S	S	0.8
	SE(d)±	0.46	0.97	0.58	0.41	0.41	0.8
	C D _{0.05}	1.36	2.01	1.20	0.84	0.20	0.38
	C.V.	0.66	1.22	5.08	1.87	5.29	5.25

Table 3. Yield parameters of different varieties of gladiolus

Notation	Varieties	Number of Spikes per plant	Corm yield per plant	Corm weight per plant(g)
V ₁	Priscilla	1.66	6.2	42.68
V ₂	Joshika	1.33	2.66	45.52
V ₃	Dhanvantari	2.16	3.33	49.6
V ₄	Phule Neel Rekha	2	3.33	55.5
V ₅	Souvik Biscuits	1.5	3.66	51.4
V ₆	Pusa Suhagin	2.83	6.8	62.8
V ₇	Chandani	1.83	3.2	54.8
V ₈	Arka Amar	2.66	6.66	57.8
V ₉	Arka Pratham	2.16	4	55
V ₁₀	Smoky Lady	2.33	2.66	50.7
V ₁₁	Arka Tilak	2.66	6.66	40.8
V ₁₂	Panibica Beauty	1.33	4	44.6
V ₁₃	Arka Naveen	1.66	3	52.7
V ₁₄	Manhattan	1.83	2	44.8
V ₁₅	Snow Board	1	1.33	38.6
	F-TEST	S	S	S
	SE(d)±	0.46	0.39	6.39
	C D _{0.05}	0.95	0.91	2.25
	C.V.	29.27	13.81	0.89

Yield parameters

Number of spikes per plant

Significantly, more number of spikes per plant (2.83) was recorded in the variety V6 (Pusa Suhagin), followed by variety V8 (Arka Amar, 2.66) whereas, the less number of spikes per plant recorded in V15 (Snow Board, 1).

The result indicated that highly significant difference among different cultivars with respect to spikes produced per plant being genetically controlled factor, variation occurred due to the hereditary traits of different cultivars under prevailing environment. The results are in spikes per plant is in accordance with **Patil et al. (2009), Ramchandrudu and Thangam (2009)** in gladiolus.

Number of corms yield per plant

Significantly, more number of corm yield per plant (6.8) was recorded in the variety V6 (Pusa Suhagin), followed by variety V8 (Arka Amar, 6.6) whereas, the less number of corm yield recorded in V15 (snow Board, 1.33).

Corm weight - Significantly, higher corm weight (62.8) was recorded in the variety V6 (Pusa Suhagin), followed by variety V8 (Arka Amar, 57.8) whereas, the lesser corm weight recorded in V15 (Snow Board, 1.33).

The higher yield might be due to increased morphological characters viz. plant height, a greater number of leaves which help in the production of more photosynthesis resulting in greater accumulation of dry matter which related to the production of a higher weight and higher number of bulb per hectare. Similar results were also found by **Nagaraja (1996)**.

4. CONCLUSION

From the present investigation, it is concluded that among the different variety of gladiolus, V6 (Pusa Suhagin) performed significantly better in plant height, number of leaves, spike length, more number of spike per plant, more number floret per spike, however less number of days taken for first sprouting recorded in V15 (Snow Board) and Vase life higher in variety V9(Arka Pratham).

REFERENCES

1. Anuradha, S. and Gowda, J.V.N. (1990). Genetic variability in Gladiolus Prog.Hort., 22 (1-4) 55-59.
2. Arora, J.S. and Khanna, K. (1986). Variability studies in some quantitative characters in gladiolus. P.AU.J. Res., 23(4): 578-582.
3. Akpinar E, Bulut Y. A study on the growth and development of some gladiolus (Gladiolus L.) varieties planted in different time under the ecological conditions of Erzurum. Afr. J. Agr. Res. 2011; 6(13):3143-3148.
4. Balaram, M. V. and Janakiram, T. (2009). Genetic variability in gladiolus genotypes for corm characters. J. Orna. Hortic., 12(2): 123-126.
5. Bhattacharjee SK, Yadav LP, Mukhopadhyay T. Effect of bulb size, planting depth and spacing on tuberose (Polianthes tuberosa L.). Lal Baugh. 1979; 24:24-29.

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6. Bose TK, Yadav LP, Pal P, Parthasarathy VA, Das P. Commercial Flowers. Naya Udhog, Kolkata, India (Research report). 2003; 2:137-140.
7. Chourasia A, Viradia RR, Ansar H, Madle SN. Evaluation of different gladiolus cultivars for growth, flowering, spike yield and corm yield under Saurashtraregion of Gujarat. *Int. J. Life Sci.* 2015; 10(1):131-134.
8. Das R, Boro A, Medhi T, Medhi B. Performance studies of some gladiolus cultivars under rain fed condition of Assam. *Hort. Sci.* 2014;89:789-797.
9. Devi Priya. Evaluation of gladiolus cultivars under open field conditions for growth, yield and vase life in southern zone of Andhra Pradesh. M. Sc. Thesis. Horticultural college and research institute Anantharajupet; 2014
10. Kadam Ganesh B., Kumar Gunjeet, Saha T.N., Tiwari A.K. and Kumar Ramesh (2014). Varietal evaluation and genetic variability studies on gladiolus. *Indian J. Hort.* 71(3) 379-384.
11. Singh, M. J. P. (1981) Studies on flowering, corm multiplication and floral biology of gladiolus. M.Sc. thesis. I.A.R.I., New Delhi (Unpublished).
12. Verty P., Prasad VM., Collis JP and Nazir Manoj (2017) Correlation analysis in gladiolus (*Gladiolus grandiflorus* L.). *Agri Res & Tech: Open Access J* 10(4):1-6
13. Jagdish, Singh, N. Solanki and Kumar, M. (2018) Performance of different cultivars of gladiolus under Allahabad agro-climatic conditions. *journal of Pharmacognosy and Phytochemistry* 2018; SP4: 27-29
14. Ganesh B. Kadam, Gunjeet Kumar, T.N. Saha, A.K. Tiwari and Ramesh Kumar (2017) Varietal evaluation and genetic variability studies on gladiolus. *Indian J. Hort.* 71(3), September 2014: 379-384
15. Mohit Chaudhary, Sunil Malik, Mukesh Kumar, Vimal Chaudhary and Rohan Tomar (2021) Effect of organic and chemical fertilizers on vegetative and quality parameters of gladiolus (*Gladiolus grandiflorus* L.). *The Pharma Innovation Journal* 2021; 10(12): 428-43
16. Geeta SV, Shirol AM, Kulkarni BS, Omem T, Pujer (2014). Performance of gladiolus (*Gladiolus hybridus* hort.) varieties for growth, yield and flower quality characters. *Plant Arch.* 2014;14(2):1147-1149. 6.
17. Gupta P, Pathak AC, Banafar RNS. Studies on the performance of gladiolus cultivar in Malwa region of Madhya Pradesh. *South Indian Hortic.* 2002; 50(4- 6):641-644.
18. Ghadage P. Evaluation of different gladiolus varieties (*Gladiolus hybridus* hort.) under Pune conditions of Maharashtra, c2020. 7. Mahawer TC, Mahawer LN, Bairwa HL. Performance of gladiolus cultivars under subhumid southern plains of Rajasthan. *J Hort. Sci.* 2013;8(2):204-209.
19. Hartman HT, Flocker WJ, Kofrang AM. Ornamental grown from bulbs, corms, tubers and rhizomes. In *Plant Sci. Growth, Dev. & Utilization of Cultiv Plants*, 1981, pp. 429-453.
20. Momin MA. Evaluated corm size on growth, flowering and corm cornel yield of gladiolus. Floriculture survey in a consultancy report. FAO /UNDP (IHNDP/BGD/97/06).
21. Nalage NA. Evaluation of different gladiolus varieties (*Gladiolus hybridus* Hort.). *Int. J Chem. Stud.* 2019;7(2):2018-2021.
22. Nazir, M. (2004). Cultivating gladiolus scientifically. *Ind.J. Hort.* 49(1):12-13.

23. Naresh S, Rao AVD, Vijaya Bhaskar V, Uma Krishna K, Paratpara Rao M. Evaluation of gladiolus (*Gladiolus hybrida* L.) hybrids under coastal Andhra Pradesh conditions. *Plant Arch.* 2015;15(1):451-454.
24. Nath V, Sharma S, Singh A. Response of different preservatives on vase life and quality of gladiolus flower cv. yellow stone. *Plant. Arch.* 2020;20(1):1615-1618.
25. Neeraj HP, Misra BP Jha. Evaluation of gladiolus germplasm under North Bihar. conditions. *Indian J. Hort.* 2000;57(2):178-181
26. Negi R, Kumar S, Dhiman SR. Evaluation of different cultivars of gladiolus (*Gladiolus grandifloras* L.) *Ind. J. Sci. Res. Tech.* 2014;2(6):6-11.
27. Pasannavar R, Patil AA, Nalawadi UG, Sulikeri MGS. Evaluation of gladiolus cultivars for cut flower production. *Karnataka J. Agri. Sci.* 1998;11(3):855-857.
28. Rao KD, Sushma K. Performance of different new genotypes of gladiolus. *Agri. Sci. Dig. A Research Journal.* 2015;35(2):134-137.
29. Kem JC, Yadav SK, Kumar S. Performance of gladiolus cultivars under valley conditions of Uttaranchal. *Prog. Hortic.* 2003; 35(1):108-110.
30. Kumar R, Yadav DS. Evaluation of gladiolus cultivars under sub-tropical hills of Meghalaya. *J.Oma. Hortic.* 2005; 8(2):86-90.
31. Rao TM, Janakiram T. Performance of exotic Orchidolus and 1. 1. H. R. gladiolus cultivars. *Ora Hortic.* 2006; 9(1):61-62.
32. Rathod DM, Chawla SL, Ahirand TR, Patel MA. Effect of planting time and chemical on growth, flowering and yield of gladiolus. *J Orna. Hortic.* 2011; 14(1&2):24-27.
33. Rocky T, Singh US. Effect of time and depth of planting on growth, flowering and yield of tuberose cv. Single. *Indian. J hort.* 2015; 72(4):581-585.
34. Singh, A., Singh, A.K., Sisodia, A., Padhi, M. and Pal A.K. (2018). Evaluation of tuberose cultivars for postharvest characters. *Journal of Pharmacognosy and Phytochemistry* 7(4): 1310-1312
35. Singh, A. and Singh, S.S. (2019) Response of Commercial Varieties of Gladiolus (*Gladiolus grandiflorus* Linn.) on Agro-Climatic Conditions of Chitrakoot, Satna (M.P.), India. *International Journal of Current Microbiology and Applied Sciences* (2019) 8(8): 1618-1623
36. Safiullah, Ahmed MJ. Evaluation of exotic cultivar of gladiolus (*Gladiolus grandifloras* L.) under Rawalkot conditions. *Sarhad J. Agric.* 2001; 7(2):171- 174.
37. Sheikh MQ, Jhon AQ. Response of planting dates and genotypes on vegetative and floral characters in gladiolus. *J Hortic.* 2005; 8(3):219-221.
38. Swaroop K, Singh KP, Singh KP. Performance of gladiolus under Delhi condition. *J Oma. Hortic.* 2005; 8(1):32-35.
39. Swain SC, Rath S, Sethi BK. Evaluation of gladiolus cultivars under valley conditions of Uttaranchal. *Orissa J. Hortic.* 2008; 36:120-23.
40. Saaie MS, Ahlawat VP, Sehwat SK, Yadav BS. Effect of different planting dates and growing condition on growth and flowering of gladiolus cv. American Beauty. *Orna. Hortic.* 2012; 15(3&4):183-190.
41. Shaukat S, Syed SHAH, Shaoukat S. Performance of gladiolus (*Gladiolus grandiflora* L.) cultivars under the climatic conditions of Bagh Azad Jammu and Kashmir Pakistan. *J Cent. Euro. Agric.* 2013;14(2):158-167
42. Sanghamitra Pattanaik, Amitava Paul and Pravu Charan Lenka (2023) Performance of

gladiolus genotypes: growth, flowering and corm production. *J. Hortl. Sci.* Vol. 10(2):194-198, 2015

43. Singh Anil K., Amaresh Kumar, Anjana Sisodia (2013). Growth, flowering and bulb yield in tuberose as influenced by cultivars. *Environment and ecology* 31 (4A): 1823-1825.
44. Sindhu SS, Kumar R, Chaudhary V. Evaluation of gladiolus (*Gladiolus grandiflorus* L.) varieties under drip irrigation System. *Prog. Hort.* 2014; 46(1):124-126.
45. Usha Bala TR, Chandra Sekhar, Reddy YN. Vase life studies of three gladiolus cultivars as influenced by dates of planting and iron sulphate sprays. *J Res. ANGRAU.* 2002; 30(3):40-43.
46. Zubair M, Wazir FK, Akhtar S, Ayub G. Planting dates affect floral characteristics of gladiolus under the soil and climatic conditions of Peshawar. *Pak J Biol. Sci.* 2006; 9(9):1669-1676.

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