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Response of Gibberellic Acid and Corm Division on Floral Attributes of Gladiolus

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

This study was conducted to assess the response of Gibberellic acid and corm division on floral attributes of gladiolus cv. Punjab Dawn at Horticulture Research Farm of Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, India during two consecutive year (2017-2019). The treatments comprised of growth regulators with two concentration i.e. GA_3 100 ppm and 200 ppm including control (distilled water) and corms which are cut having 1bud, 2 buds and 3 buds and whole corm having 4 buds, 5 buds and 6 buds. The experiment was laid out in Randomized Block Design and three replications. The flowering characteristics of Gladiolus are mainly affected by higher concentration of GA_3 (200 ppm) as well as whole corm under natural climatic condition. Regarding flowering parameters, it was found that GA_3 200 ppm and whole corm i.e. 4 bud, 5 bud and 6 bud influence the quality and quantity parameters, viz. days to spike emergence, days to colour show, days to opening of florets, days to open florets without withering of basal floret, number of florets per spike, longevity of spike, length of spike and rachis (cm) and diameter of florets (cm) as compared to other treatments of GA_3 100 ppm and control (distilled water) and cut corms which have 1 bud, 2 buds and 3 buds.

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1. INTRODUCTION

Gladiolus occupies a prestigious position among the bulbous cut flower. It is commonly known as 'sword lily' because of the shape of its foliage with beautiful spikes having brilliant colours of florets and different sizes [1]. It is an herbaceous perennial plant belonging the family Iridaceae. It is not only grown for cut flower but also for corms as propagating material and commonly grown in West Bengal, Himachal Pradesh, Sikkim, Karnataka, Tamil Nadu, Punjab, Delhi, Jammu-Kashmir, Andhra Pradesh and Gujarat and also for market purpose of Lucknow, Meerut, Ghaziabad and Varanasi district of Uttar Pradesh [2]. Flower growers of Uttar Pradesh region are growing gladiolus commercially due to its easy cultivation and get profit through their marketing. The uses of plant growth regulators has now became very popular in many ornamental plants including gladiolus for manipulating the vegetative and floral attributes in field as well as postharvest condition. It helps in modulating physio- morphological traits of plants even if used in very small concentrations [3]. The application methods of PGRs include foliar application, pre-soaking, drenching, etc. Pre-planting soaking of corms in growth regulators has great potential in improving growth, quality and yield of flowers [4]. Gibberellin has a regulatory impact on plant growth and development by inducing floral parameters such as spike length, rachis length, and floral diameter and also hastened flowering [5,6]. Therefore, the main purpose of this work was to enhance quality and quantity of flowers to fulfil the domestic as well as global demand. Hence, an experiment was conducted to study the "Response of Gibberellic acid and corm division on floral attributes of gladiolus".

2. MATERIALS AND METHODS

2.1 Study Site

An experiment on "Response of Gibberellic acid and corm division on floral attributes in gladiolus cv. Punjab Dawn" was conducted at Horticulture Research Farm of Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, India during two successive year (2017-2019). The soil condition of this region is alluvial, well-drained and moderately fertile with low organic carbon, available nitrogen, and medium in available phosphorus and potassium. During the investigation, the temperature ranged in day time was 15°C-38.5°C and 6 °C-23 °C during night hour.

2.2 Sampling and Protocol

There were two factors in this study, first was corm (cut as well as whole corm with different number of buds) and second was treatment of GA_3 (100 ppm and 200 ppm) and control (distilled water). Healthy and average size of corms were selected, scales of corms were removed to find out number of buds in corms and then radial cuts according to number of buds with sharp knife or secateurs. Cut corms have 1 to 3 buds and whole corms with 4 to 6 buds that used for planting and treatment of corms with GA_3 100 ppm, 200 ppm and controlled in distilled water before planting. Dipping of corms in different concentration of GA_3 solution for 24 hours including control (distilled water) and next day treated corms were ready for planting.

2.3 Experimentation

Experimental plot were opened and prepared by several ploughings to obtained good field condition having proper drainage of water. The basal doses of manures and fertilizers were applied during final field preparation and remaining dose were applied during growth period. The trial was laid out in a Randomized Block Design (RBD) with 18 treatments having three replications. There were 54 (18 treatment and 3 replication i.e. 18×3) unit plots and size of each unit plot was 1.2 m×1 m and distance between the block was 0.5 m.

2.4 Data Analysis

Data were recorded in respect of the following parameters such as early days to spike emergence, colour show, opening of florets, open florets without withering of basal floret, number of florets per spike, longevity of spike, length of spike (cm) and rachis (cm) and diameter of florets (cm) at regular interval for two successive years 2017-2018 and 2018- 2019. The mean values of all the parameters were statistically analysed by adopting the standard procedures of Gomez and Gomez [7] at 5 % level of significance.

3. RESULTS AND DISCUSSION

3.1 Effect of GA3 and Corm Division on Days to Spike Emergence and Colour Show

Various flowering parameters were influenced significantly due to treatment of GA_3 as well as corm section (whole and cut) at different levels. Early days to spike emergence was reported in the 5 budded corm showed early spike emergence (71.05 days) followed by 4 buds and 6 buds corm. In respect of GA_3 treatment, GA_3 (100 ppm) showed early spike emergence (72.73 days) which was at par with GA_3 200 ppm (73.03) and control exhibited minimum days (78.39 days) to spike emergence (Table 1). Single budded, 2 budded and 3 budded as well as controlled (distilled water) corms showed late spike emergence.

Neetu et al. [8], Devadanam et al. [9] also noticed that higher concentration of GA_3 influenced early initiation of spike in gladiolus. On the other hand Bharti et al. [10] observed that early spike emergence was influenced by the size of corm (whole corm). In respect of days to colour show, early days to colour was observed in 5 bud (84.29) and late in single bud (78.63) of corm. In context of treatment of GA_3 200 ppm showed minimum days to colour show (84.94 days) and combine effect of treatment of GA_3 and corm division showed that minimum days to colour showed was observed in 4 bud and 200 ppm GA_3 (81.28 days) which was significantly higher than other treatment combination during experimentation. Similar observation has also been made by Parween et al. [11] in gladiolus and Kapri et al. [12] in lily.

3.2 Effect of GA3 and Corm Division on Days to Opening of Florets

The data on number of days to opening of first floret, third floret and fifth floret open were observed in the Table 2. For the first floret, early opening of floret was observed in 6 budded (90.89 days) and 200 ppm GA_3 (90.94 days) treated corm and interaction between treatment of GA_3 and corm division, minimum days to full blooming was reported in 6 budded and 100 ppm GA_3 corm (89.01), in respect of third floret, early blooming was observed in 6 budded corm (92.07days) and in GA_3 treatment, minimum days to third floret blooming was reported with 200 ppm GA_3 (91.76 days). Early blooming of third floret was observed in the 4 budded and 200 ppm GA_3 (89.69 days) treated corm. Early days to full bloom of fifth floret was observed in 6 budded corm (94.08 days) and in treatment of 200 ppm GA_3 (94.28 days) and interaction of treatment showed early blooming of floret in 6 bud and 200 ppm GA_3 (91.64 days). This might have been due to whole or large corm have higher food reserve than small/ cut corm, therefore it enhances quality of flowers. These findings are in agreement with the observations made by Sowjanya et al. [13], Dogra et al. [14] and Asil et al. [15] in gladiolus.

3.3 Effect of GA3 and Corm Division on Days to Open Florets without Withering of Basal Floret, Number of Florets per Spike and Longevity of Spike

The data presented in Table 3 revealed that there was significant effect of corm division and GA_3 on the number of open florets without withering of floret per spike, number of florets per spike and longevity of spike. Maximum number of open florets without withering basal floret was recorded with 6 bud (5.04) followed by and treatment of 200 ppm GA_3 (4.62) and combine effect of treatment i.e. 5 bud and 200 ppm GA_3 (5.12) exhibited maximum number of florets opening without withering of basal floret. Maximum number of florets per spike was recorded in 5 bud (12.91) followed by 6 bud (11.83) and 4 bud (11.09) and in context of GA_3 treatment, maximum number of florets per spike was observed in 200 ppm GA_3 (11.39). Treatment combination of GA_3 and corm division exhibited that maximum number of florets per spike was observed in 5 bud and 100 ppm GA_3 (12.83) and minimum was observed in 2 bud and control (9.37). Maximum number of floret per spike was also observed in GA_3 treated whole corm which might have higher food reserve in compared to small corms [16,17] and GA_3 application that increase the number of leaves per plant and leaf size which might have enhanced the production of photosynthates that are necessary to enhance the reproductive growth [18]. Similar results are in line with the findings of Sudhakar and Kumar [19], Sarkar et al. [20] and Mahasen et al. [21] in gladiolus. Maximum longevity of spike was recorded in 6 bud (13.76) and in respect of gibberellins treatment, GA_3 200 ppm (12.74) influence the spike longevity as well as freshness of florets. In combined effect of treatment, maximum longevity of spike was observed in 6 bud and 100 ppm GA_3 (14.47). The findings confirm the result of

Reshma et al. [22] in gladiolus and Yadav et al. [23] in marigold. In study, length of spike and rachis was significantly influenced by various treatment of corm division as well as GA_3.

3.4 Effect of GA3 and Corm Division on Spike and Rachis Lengths

A brief look into Table 4 reveals that maximum length of spike was observed in 4 bud (54.59 cm) and 200 ppm GA_3 (50.96 cm) and in treatment interaction of 4 bud and 200 ppm GA_3 (57.24 cm). Maximum length of rachis was observed in 4 bud (31.55 cm) which was statistically at par with 5 bud (31.23) and 6 bud (31.15) and in respect of GA_3, length of rachis (32.09 cm) increased with 200 ppm GA_3. Combine effect of treatment significantly influenced length of rachis i.e. 4 bud and 200 ppm GA_3 (33.79 cm). Gibberellin has virtue of cell elongation and influencing photosynthetic activity which might have promote good length of spikes of gladiolus [24]. These findings can be correlated with Nag et al. [25] in gladiolus and Ali et al. [26] in tuberose.

3.5 Effect of GA_3 and Corm Division on Diameter of First, Third and Fifth Florets

Data pertaining to the flower diameter studies revealed a significant difference on diameter of first, third and fifth florets owing to various treatments of GA_3 and corm division. The maximum diameter of first, third and fifth floret was observed with 4 bud (9.63 cm, 9.45 cm and 9.20 cm) and higher concentration of GA_3 (9.42 cm, 9.09 cm and 8.89 cm) than control and in respect of treatment combination, maximum diameter of fifth floret was reported with 6 bud and 200 ppm GA_3 (9.78 cm), in context of third and fifth floret, maximum diameter was noted with 4 bud and 200 ppm GA_3 (9.64 cm and 9.47cm) and found significant to other treatments (Table 5). Similar observation has also been agreed with Neetu and Kumar [27] and Chaudhray et al. [28] in gladiolus and Maurya et al. [29] in china aster.

Table 1. Effect of GA3 and corm division on days to spike emergence and colour show

No. of buds	Spike emergence				Colour show			
	GA_3 ppm				GA_3 ppm			
	0	100	200	Mean	0	100	200	Mean
1 bud	85.67	74.09	76.14	78.63	94.61	88.33	89.23	90.72
2 bud	79.93	76.23	73.38	76.51	92.73	85.95	84.23	87.63
3 bud	78.68	75.57	73.55	75.93	90.03	85.81	88.09	87.97
4 bud	71.41	71.91	72.07	71.79	88.57	83.60	81.28	84.48
5 bud	77.54	65.20	70.40	71.05	84.36	84.41	84.10	84.29
6 bud	77.11	73.39	72.67	74.39	87.00	83.83	82.74	84.52
Mean	78.39	72.73	73.03		89.55	85.32	84.94	
Factors		**Buds**	**GA_3**	**Buds× GA_3**		**Buds**	**GA_3**	**Buds× GA_3**
C.D.(P=0.05)		2.03	1.015	6.09		0.825	0.415	2.48

Table 2. Effect of GA_3 and corm division on days to opening of florets

No. of buds	Opening of First florets				Opening of Third florets				Opening of Fifth florets			
	GA_3 ppm				GA_3 ppm				GA_3 ppm			
	0	100	200	Mean	0	100	200	Mean	0	100	200	Mean
1 bud	99.85	93.11	94.42	95.79	101.8	93.17	95.95	97.00	102.9	94.46	97.65	98.35
2 bud	95.16	91.74	91.92	92.94	97.95	92.92	93.00	94.62	99.95	94.97	95.53	96.82
3 bud	96.74	92.31	89.61	92.88	98.82	93.56	91.38	94.58	98.74	97.22	93.86	96.61
4 bud	94.46	91.44	87.59	91.16	95.74	92.66	89.69	92.69	95.32	94.42	93.88	94.54
5 bud	93.21	91.53	91.31	92.02	91.99	94.53	89.78	92.10	97.20	94.06	93.14	94.80
6 bud	92.87	89.01	90.80	90.89	94.67	90.73	90.80	92.07	98.15	92.46	91.64	94.08
Mean	95.38	91.52	90.94		96.84	92.93	91.76		98.72	94.60	94.28	
Factors		**Bud**	**GA_3**	**Bud × GA_3**		**Bud**	**GA_3**	**Bud × GA_3**		**Bud**	**GA_3**	**Bud × GA_3**
C.D. P=0.05		0.86	0.43	2.59		2.56	1.14	2.30		0.78	0.39	2.34

Table 3. Effect of GA3 and corm division on days to open florets without withering of basal floret, number of florets per spike and longevity of spike

No. of buds	Open florets without withering of basal floret				Number of florets per spike				Longevity of spike			
	GA_3 ppm				GA_3 ppm				GA_3 ppm			
	0	100	200	Mean	0	100	200	Mean	0	100	200	Mean
1 bud	4.08	4.00	3.98	4.02	9.93	9.47	10.40	9.93	11.27	11.64	11.00	11.30
2 bud	4.31	4.77	4.61	4.56	9.37	10.60	9.84	9.94	11.14	11.92	11.18	11.41
3 bud	4.58	3.75	4.59	4.31	9.90	10.15	11.68	10.57	11.24	11.99	13.14	12.12
4 bud	3.92	4.58	4.67	4.39	10.92	11.19	11.16	11.09	13.29	12.98	13.60	13.29
5 bud	4.42	4.34	4.75	4.50	13.25	12.83	12.66	12.91	13.40	12.52	14.28	13.40
6 bud	5.00	5.00	5.12	5.04	11.27	11.58	12.64	11.83	13.53	14.47	13.28	13.76
Mean	4.38	4.41	4.62		10.77	10.97	11.39		12.31	12.58	12.74	
Factors		**Bud**	**GA_3**	**Bud× GA_3**		**Bud**	**GA_3**	**Bud× GA_3**		**Bud**	**GA_3**	**Bud× GA_3**
C.D. (P=0.05)		0.20	0.09	0.60		0.46	0.23	1.38		0.57	0.23	1.70

Table 4. Effect of GA3 and corm division to length (cm) of spike and rachis

No. of buds	Spike length (cm)				Rachis length (cm)			
	GA_3 ppm				GA_3 ppm			
	0	100	200	Mean	0	100	200	Mean
1 bud	47.46	49.02	51.70	49.39	29.90	29.88	32.08	30.62
2 bud	49.42	46.96	47.78	48.05	31.87	29.18	29.15	30.06
3 bud	45.28	44.92	47.25	45.82	28.63	28.39	30.93	29.31
4 bud	51.28	55.25	57.24	54.59	31.58	29.28	33.79	31.55
5 bud	46.49	48.77	53.81	49.69	29.91	30.24	33.54	31.23
6 bud	45.89	55.78	47.97	49.88	29.21	31.22	33.04	31.15
Mean	47.63	50.12	50.96		30.18	29.69	32.09	
Factors		**Bud**	**GA_3**	**Bud × GA_3**		**Bud**	**GA_3**	**Bud × GA_3**
C.D. P=0.05		1.64	0.82	4.93		1.20	0.60	0.36

Table 5. Effect of GA_3 and corm division on diameter (cm) of first, third and fifth florets

No. of buds	Diameter of first florets (cm)				Diameter of third florets (cm)				Diameter of fifth florets (cm)			
	GA_3 ppm				GA_3 ppm				GA_3 ppm			
	0	100	200	Mean	0	100	200	Mean	0	100	200	Mean
1 bud	9.07	8.73	9.20	9.00	8.95	8.74	8.80	8.83	8.31	8.40	8.99	8.57
2 bud	9.50	8.53	9.19	9.07	9.06	8.75	8.74	8.85	8.36	8.27	8.35	8.33
3 bud	8.63	9.19	9.27	9.03	8.44	8.79	9.03	8.75	8.45	8.68	9.26	8.79
4 bud	9.73	9.68	9.47	9.63	9.14	9.57	9.64	9.45	8.88	9.25	9.47	9.20
5 bud	9.05	9.17	9.62	9.28	9.10	8.92	9.28	9.10	9.18	9.30	8.72	9.06
6 bud	9.35	8.66	9.78	9.26	8.55	8.97	9.06	8.86	8.78	9.43	8.43	8.88
Mean	9.22	8.99	9.42		8.87	8.95	9.09		8.66	8.89	8.87	
Factors		**Buds**	**GA_3**	**Buds ×GA_3**	**Factor**	**Buds**	**GA_3**	**Buds ×GA_3**	**Factor**	**Buds**	**GA_3**	**Buds × GA_3**
C.D. (P=0.05)		0.28	0.15	0.84		0.22	0.11	0.68		0.18	0.09	0.51

4. CONCLUSION

Present observation demonstrated that treatment of higher concentration of GA_3 (pre-soaking) and whole corm showed positive correlation with most of the observations which would improve market desirable characteristics of gladiolus.

CONFERENCE DISCLAIMER

Some part of this manuscript was previously presented in the conference: 6th International Conference on Strategies and Challenges in Agricultural and Life Science for Food Security and Sustainable Environment (SCALFE-2023) on April 28-30, 2023 in Himachal Pradesh University, Summer Hill, Shimla, HP, India. Web Link of the proceeding: https://www.shobhituniversity.ac.in/pdf/Souvenir-Abstract%20Book-Shimla-HPU-SCALFE-2023.pdf

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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