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## Studies on floral attributes and crossing in gladiolus

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### Abstract

An experiment was carried out at the Experimental Farm of Department of Floriculture and Landscaping, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during the year 2024-2025. Ten treatments as varieties i.e., Punjab Flame, Candyman, Dhanvantari, White Chifan, Pink Lady, Arka Pratham, Cheops, Yellow Stone, Flavo Sovonier and Darshan were used. The field experiments were laid out in Randomized Block Design (RBD) with three replications. The results revealed that the variety Flavo Sovonier and Dhanvantari performed better for number of florets per spike, length of spike, floret diameter and internodal distance. Highest percent of successful cross (100%) found in Arka Pratham × Pink Lady followed by Arka Pratham × Yellow Stone (80%). Since Arka Pratham showed better general combining ability with male parents with more number of seed setting results. So, it can be used as female parent.

**Keywords:** Self-incompatibility, hybridization, seed setting, cross compatibility

### 1. Introduction

The name gladiolus was originally coined by Pliny the Elder (A.D. 23-79) deriving from the Latin word 'gladius' meaning a 'sword', on account of its sword-like shape of foliage. Gladiolus (*Gladiolus grandiflorus* L.) is one of the most popular ornamental bulbous flowers grown for cut flower and garden display in many parts of the world. It is native of Mediterranean region, tropical Africa and Asia, belongs to family 'Iridaceae', sub-family 'Ixiodeae' tribe-3, sub tribe 'Gladiolinene'. The current number of the species in genus Gladiolus is 250-260 and ploidy level varies from diploid ( $2n=30$ ) in the Cape region to dodecaploid ( $2n=12x=180$ ) in the European regions.

With the intensive and systematic breeding programme carried over two to three decades, many promising varieties of gladiolus have been developed in India. (Rao and Janakiram, 1998) [14]. Hybridization work in gladiolus was started in 1806 by William Herbert. Natural cross pollination in gladiolus is rare as the presence of self-incompatibility. Position of stigma is above the anthers, Pollen is heavy and is not carried away by wind and the bees rarely contact stigma. The hybridization in gladiolus is done by hand emasculation and hand pollination (Randhawa and Mukhopadhyay, 1986) [12]. The study of floral biology is the pre-requisite for undertaking conventional breeding programme, so that maximum number of viable seeds may be produced in the shortest possible time. (Poon, 2009) [12].

### 2. Materials and Methods

The experimental materials for the present investigation comprised of ten commercially superior gladiolus varieties i.e. Punjab Flame, Candyman, Dhanvantari, White Chifan, Pink Lady, Arka Pratham, Cheops, Yellow Stone, Flavo Sovonier and Darshan available at Department of Floriculture and Landscaping, Dr. PDKV, Akola. The crop was raised under open field conditions by planting the healthy commercial grade corms during normal growing season on 5<sup>th</sup> December 2024. The number of florets, floret diameter, length of spike and internodal distance of each individual spike were counted and the average values are calculated and recorded. The number of spikes per plant were counted and the average values are calculated and recorded. Fully developed flower buds of female parents were emasculated in evening hours by removing anthers using plastic straws as a protecting material. Simultaneously, sufficient number of matured flower buds from selected male parents were bagged for pollen purpose.

The fresh pollen from bagged flowers were dusted on stigmatic surface using brush in morning hours. After pollination flowers were covered with butter paper bags and labelled. Forceps were used for pollination.

### 3. Results and Discussion

#### 3.1 Number of florets per spike

The number of florets per spike varied significantly among the varieties. Maximum number of florets per spike (15.27) were noted in Flavo Sovonier which was at par with Dhanvantari (14.67) whereas minimum number of florets per spike (6.07) found in Darshan. The data revealed that the varieties in respect of spike length also recorded higher values or at par values with higher number of florets per spike. Similarly, the varieties bearing shorter spikes were found to bear lesser number of florets per spike. The variation in number of florets per spike might due to genetic traits of the varieties. Similar results on floret number have been reported by Rani and Singh (2005) [13] and Ram *et al.* (2005) [11]. Market value and marketability of gladiolus spikes depends upon the number of florets per spike.

#### 3.2 Number of spikes per plant

The number of spikes per plant varied significantly among the varieties. Maximum number of spikes per plant (3.65) observed in Candyman which was followed by Pink Lady (2.42). However, minimum number of spikes per plant found in Punjab Flame (1.35). The data revealed that the varieties that recorded higher values in number of spikes per plant showed lower values in respect of internodal distance whereas lower values in number of spikes per plant showed higher values of internodal distance. Yield increases with increase in spike numbers. The variation in number of spikes per plant might due to genetic or environmental traits of varieties. Similar findings observed in Fischer and Edmedes (2010) [4] has demonstrated spill-over effects under abiotic stress in cereals.

#### 3.3 Length of spike

Different varieties of gladiolus showed significant effects on length of spike. Maximum length of spike (103.44 cm) was recorded in Flavo Sovonier followed by Dhanvantari (94.23 cm). However, minimum length of spike observed in Candyman (64.24 cm) which was at par with Darshan

(65.66 cm). The spike length is an important parameter for commercial value of gladiolus. It is interesting to note that taller plants were found to record higher values in respect of spike lengths in the present study. The differences in spike length can be attributed to the genetic constitution of different varieties. It might also depend on food reserves in plant that could be related to growth rate of plants regulating accumulation of the requisite level of carbohydrates for slippings. The results are in conformity with the findings of Kadam *et al.* (2014) [5] and Chourasia *et al.* (2015) [3]. Naresh *et al.* (2015) [8] also observed the similar results on varietal differences for spike length and reported that the differences in spike length might due to genetic and environmental factors. Similar observation for spike length also reported by Mushtaq *et al.* (2018) [7] and Singh *et al.* (2017a) [15] and Singh *et al.* (2017b) [16] in gladiolus.

#### 3.4 Diameter of floret

Diameter of floret showed significant differences among different varieties in gladiolus. Maximum floret diameter (9.12 cm) was noted in Dhanvantari which was followed by Yellow Stone (8.50 cm). However, minimum (5.30 cm) floret diameter was observed in variety Darshan. A comparative study of the data on floret size with that of spike size and vegetative parameters gives an idea that a higher number of florets per spike was helpful in certain varieties to put forth more growth by virtue of their inherent capacity to synthesize higher quantity of food material that could be utilized for elongation of spikes as well as florets. The results of the present investigation are in conformity with findings of Beweja and Brahma (2003) [2] and Kumar and Yadav (2005) [6] in gladiolus.

#### 3.5 Internodal distance

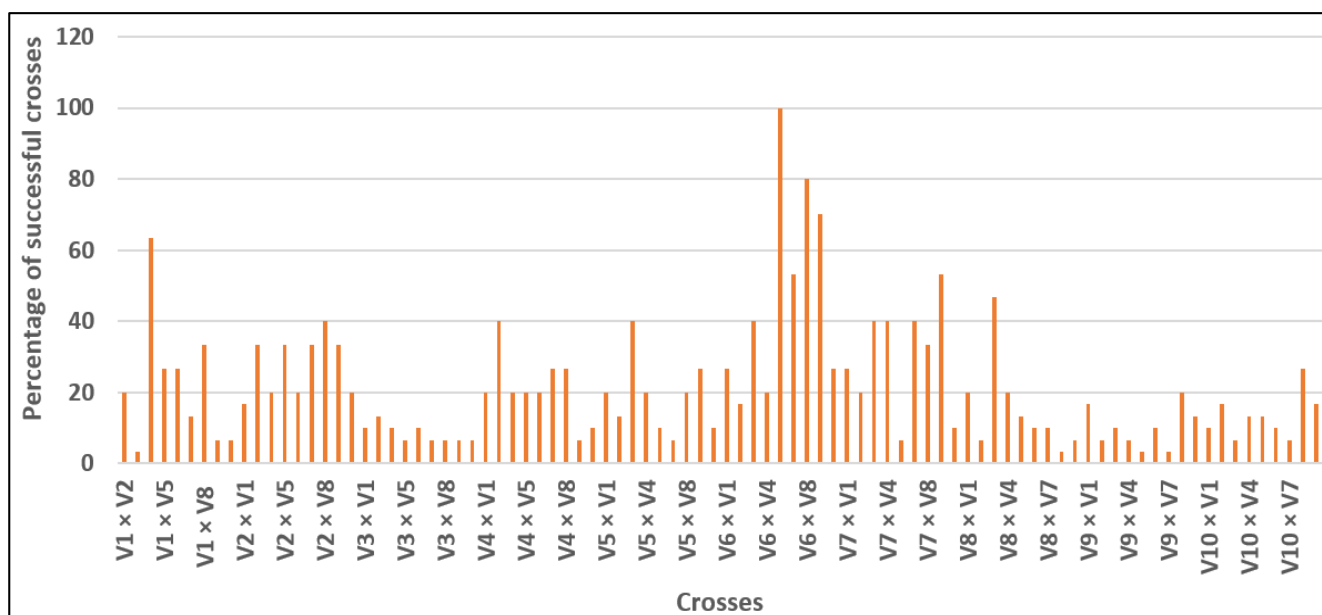
Different varieties of gladiolus showed significant effects on internodal distance. Maximum internodal distance (5.90 cm) recorded in Punjab Flame at par with Flavo Sovonier (5.77 cm) whereas minimum internodal distance observed in Candyman (3.90 cm). The result of present investigation are in confirmed with Arunachalam and Reddy (2007) [1] counted internodal length in five different species of Jasmin and Yadav *et al.* (2021) [17] recorded internodal distance in Cucumber (*Cucumis sativus* L.) cv. Arpit.

**Table 1:** Floral parameters of gladiolus flower.

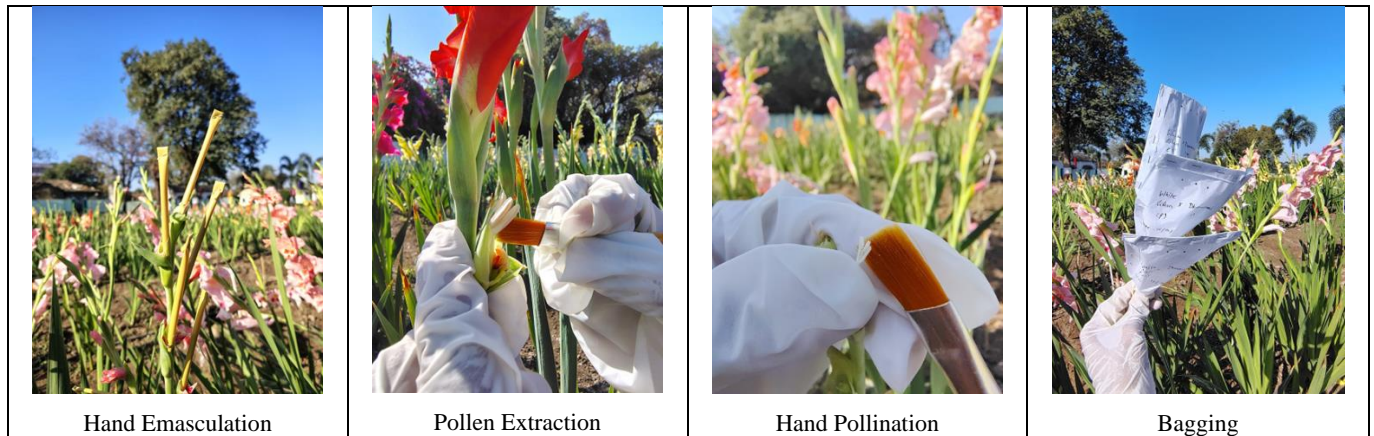
Treatments	Number of florets per spike	Number of spikes per plant	Length of spike	Floret diameter	Internodal distance
V <sub>1</sub> -Punjab Flame	7.53	1.35	85.35	7.93	5.90
V <sub>2</sub> -Candyman	12.07	3.65	64.24	5.92	3.90
V <sub>3</sub> -Dhanvantari	14.67	2.03	94.23	9.12	5.53
V <sub>4</sub> -White Chifan	12.13	2.25	76.19	7.87	5.27
V <sub>5</sub> -Pink Lady	11.87	2.42	79.40	8.37	5.16
V <sub>6</sub> -Arka Pratham	11.60	2.35	85.15	8.14	5.14
V <sub>7</sub> -Cheops	10.67	2.40	66.53	6.67	4.05
V <sub>8</sub> -Yellow Stone	11.20	1.76	86.13	8.50	5.60
V <sub>9</sub> -Flavo Sovonier	15.27	2.18	103.44	7.83	5.77
V <sub>10</sub> -Darshan	6.07	2.23	65.66	5.30	4.02
F Test	Sig	Sig	Sig	Sig	Sig
SE(m)±	0.26	0.09	0.39	0.06	0.06
CD at 5%	0.78	0.27	1.16	0.18	0.20

**Table 2:** Percentage of successful crosses of different varieties of gladiolus flower.

Sr. No.	Successful crosses	Percentage	Sr. No.	Successful crosses	Percentage	Sr. No.	Successful crosses	Percentage
1	V <sub>1</sub> × V <sub>2</sub>	20.00	32	V <sub>4</sub> × V <sub>6</sub>	20.00	63	V <sub>7</sub> × V <sub>10</sub>	10.00
2	V <sub>1</sub> × V <sub>3</sub>	3.33	33	V <sub>4</sub> × V <sub>7</sub>	26.67	64	V <sub>8</sub> × V <sub>1</sub>	20.00
3	V <sub>1</sub> × V <sub>4</sub>	63.33	34	V <sub>4</sub> × V <sub>8</sub>	26.67	65	V <sub>8</sub> × V <sub>2</sub>	6.67
4	V <sub>1</sub> × V <sub>5</sub>	26.67	35	V <sub>4</sub> × V <sub>9</sub>	6.67	66	V <sub>8</sub> × V <sub>3</sub>	46.67
5	V <sub>1</sub> × V <sub>6</sub>	3.33	36	V <sub>4</sub> × V <sub>10</sub>	10.00	67	V <sub>8</sub> × V <sub>4</sub>	20.00
6	V <sub>1</sub> × V <sub>7</sub>	13.33	37	V <sub>5</sub> × V <sub>1</sub>	20.00	68	V <sub>8</sub> × V <sub>5</sub>	13.33
7	V <sub>1</sub> × V <sub>8</sub>	33.33	38	V <sub>5</sub> × V <sub>2</sub>	13.33	69	V <sub>8</sub> × V <sub>6</sub>	10.00
8	V <sub>1</sub> × V <sub>9</sub>	6.67	39	V <sub>5</sub> × V <sub>3</sub>	40.00	70	V <sub>8</sub> × V <sub>7</sub>	10.00
9	V <sub>1</sub> × V <sub>10</sub>	6.67	40	V <sub>5</sub> × V <sub>4</sub>	20.00	71	V <sub>8</sub> × V <sub>9</sub>	3.33
10	V <sub>2</sub> × V <sub>1</sub>	16.67	41	V <sub>5</sub> × V <sub>6</sub>	10.00	72	V <sub>8</sub> × V <sub>10</sub>	6.67
11	V <sub>2</sub> × V <sub>3</sub>	33.33	42	V <sub>5</sub> × V <sub>7</sub>	6.67	73	V <sub>9</sub> × V <sub>1</sub>	16.67
12	V <sub>2</sub> × V <sub>4</sub>	20.00	43	V <sub>5</sub> × V <sub>8</sub>	20.00	74	V <sub>9</sub> × V <sub>2</sub>	6.67
13	V <sub>2</sub> × V <sub>5</sub>	33.33	44	V <sub>5</sub> × V <sub>9</sub>	26.67	75	V <sub>9</sub> × V <sub>3</sub>	10.00
14	V <sub>2</sub> × V <sub>6</sub>	20.00	45	V <sub>5</sub> × V <sub>10</sub>	10.00	76	V <sub>9</sub> × V <sub>4</sub>	6.67
15	V <sub>2</sub> × V <sub>7</sub>	33.33	46	V <sub>6</sub> × V <sub>1</sub>	26.67	77	V <sub>9</sub> × V <sub>5</sub>	3.33
16	V <sub>2</sub> × V <sub>8</sub>	40.00	47	V <sub>6</sub> × V <sub>2</sub>	16.67	78	V <sub>9</sub> × V <sub>6</sub>	10.00
17	V <sub>2</sub> × V <sub>9</sub>	33.33	48	V <sub>6</sub> × V <sub>3</sub>	40.00	79	V <sub>9</sub> × V <sub>7</sub>	3.33
18	V <sub>2</sub> × V <sub>10</sub>	20.00	49	V <sub>6</sub> × V <sub>4</sub>	20.00	80	V <sub>9</sub> × V <sub>8</sub>	20.00
19	V <sub>3</sub> × V <sub>1</sub>	10.00	50	V <sub>6</sub> × V <sub>5</sub>	100.00	81	V <sub>9</sub> × V <sub>10</sub>	13.33
20	V <sub>3</sub> × V <sub>2</sub>	13.33	51	V <sub>6</sub> × V <sub>7</sub>	53.33	82	V <sub>10</sub> × V <sub>1</sub>	10.00
21	V <sub>3</sub> × V <sub>4</sub>	10.00	52	V <sub>6</sub> × V <sub>8</sub>	80.00	83	V <sub>10</sub> × V <sub>2</sub>	16.67
22	V <sub>3</sub> × V <sub>5</sub>	6.67	53	V <sub>6</sub> × V <sub>9</sub>	70.00	84	V <sub>10</sub> × V <sub>3</sub>	6.67
23	V <sub>3</sub> × V <sub>6</sub>	10.00	54	V <sub>6</sub> × V <sub>10</sub>	26.67	85	V <sub>10</sub> × V <sub>4</sub>	13.33
24	V <sub>3</sub> × V <sub>7</sub>	6.67	55	V <sub>7</sub> × V <sub>1</sub>	26.67	86	V <sub>10</sub> × V <sub>5</sub>	13.33
25	V <sub>3</sub> × V <sub>8</sub>	6.67	56	V <sub>7</sub> × V <sub>2</sub>	20.00	87	V <sub>10</sub> × V <sub>6</sub>	10.00
26	V <sub>3</sub> × V <sub>9</sub>	6.67	57	V <sub>7</sub> × V <sub>3</sub>	40.00	88	V <sub>10</sub> × V <sub>7</sub>	6.67
27	V <sub>3</sub> × V <sub>10</sub>	6.67	58	V <sub>7</sub> × V <sub>4</sub>	40.00	89	V <sub>10</sub> × V <sub>8</sub>	26.67
28	V <sub>4</sub> × V <sub>1</sub>	20.00	59	V <sub>7</sub> × V <sub>5</sub>	6.67	90	V <sub>10</sub> × V <sub>9</sub>	16.67
29	V <sub>4</sub> × V <sub>2</sub>	40.00	60	V <sub>7</sub> × V <sub>6</sub>	40.00		F Test	Sig
30	V <sub>4</sub> × V <sub>3</sub>	20.00	61	V <sub>7</sub> × V <sub>8</sub>	33.33		SE(m)±	4.77
31	V <sub>4</sub> × V <sub>5</sub>	20.00	62	V <sub>7</sub> × V <sub>9</sub>	53.33		CD at 5%	13.32



**Fig 1:** Percentage of successful crosses in different varieties of gladiolus.



**Fig 2:** Crossing in different varieties of gladiolus.

### 3.6 Percentage of successful crosses.

All the ten varieties were used as male and female parents which include both direct and reciprocal crosses in the present study to exploit their respective desirable characters in hybridization and to study their cross compatibility behavior. Different varieties of gladiolus showed significant effects on percentage of successful crosses. Highest percentage of successful cross (100%) recorded in Arka Pratham × Pink Lady followed by Arka Pratham × Yellow Stone (80%). However, lowest percentage of successful cross (3.33%) found in Punjab Flame × Dhanvantari, Dhanvantari × Arka Pratham, Yellow Stone × Flavo Sovonier and Flavo Sovonier × Pink Lady. The findings are in confirmed with the findings of Poon and Pokhrel (2012)<sup>[9]</sup> as the interspecific cross 'Psittacinus hybrid × G-4' contributed to the highest percent (100%).

### 4. Conclusion

Dhanvantari and Flavo Sovonier performed better for number of florets per spike, length of spike, floret diameter and internodal distance. Since the variety Arka Pratham showed better general combining ability with more number of seed setting results, it can be used as a female parent.

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