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Genetic Variability Studies in Gladiolus (*Gladiolus* Species L.)

RAHUL KUMAR, SANJAY KUMAR* AND YOGESH CHANDRA YADAV

Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University Lucknow 226025, India
E-mail : sanjay123bhu@gmail.com
**Correspondence*

Abstract

The study was carried out during October to April 2009-10. The experiment was laid out in randomized block design with three replications. The row to row and plant to plant spacing were maintained at 30 × 25 cm. The 12 genotypes of gladiolus are True Love, Pacifica, Rigency, Yellow Stone, Sagun, Tiger Flame, Praha, Snow Princes, Picardy, Eurovision, Aldebran and Promise were used as experimental materials. The maximum weight of corms per plot was recorded in Rigency (0.964 kg) followed by Picardy (0.780 kg) and Tiger Flame (0.741 kg) and minimum weight of corms was recorded in Eurovision (0.519 kg), respectively.

Key words : Genetic variability, Gladiolus.

Gladiolus (*Gladiolus* species L.) is one of the most popular ornamental bulbous plants grown commercially for its bewitching flowers. Gladiolus is known as Sword lily and 'Corn flag'. The name gladiolus was coined by 'Pliny' to describe the shape of the leaf. The name gladiolus has been derived from Latin word 'gladius' meaning a sword as it has sword shaped leaves. The gladiolus is also known as queen of the bulbous flowers. Gladiolus belongs to the family Iridaceae and which contains about 106 genera and 226 species. Most of the members of this family are bulbous ornamentals. Gladiolus is a tender, herbaceous perennial having irregular hermaphrodite flowers with six parted perianth three stamens, single pistil and inferior ovary. The basic chromosome number in gladiolus is n=15, however most of the member of this genus are heteroploids with chromosome number ranging from 2n=30 to 120. Gladiolus is an important commercial flower crop and having pivotal place as cut flower both in domestic and international market. Gladiolus was introduced into cultivation towards the end of the sixteenth century. The fascinating spike bear a large number of florets, which exhibit varying sizes and forms with smooth, ruffled or deeply crinkled lepals. Except true blue and green, practically all colors are available in gladiolus. The keeping quality of gladiolus makes it a very popular commercial cut flower after rose. Now it's rank next to tulip in the Netherland and other European countries in trade for use as cut flowers of bulbous crops and fourth in international trade of ornamental for cut flowers. The extent of genetic variability is of paramount importance for the improvement of a crop as greater is the genetic variability in the existing germplasm better would be the chances of selecting superior genotypes. Burton and De Vane (1) have suggested the use of genotypic coefficient of variation to predict the potential advance latent with in a population in a single selection. Burton and De Vane (1) suggested that genotypic coefficient of variation combined with heritability is a correct measure to know the heritable variation and to get the best picture of the amount of advance to be expected from the selection. The heritability of characters determine how much the phenotype of a plant is a guideline to the genotype and thus, help the breeder to base his selection on the phenotypic performance of the plant (2—11).

Methods

The present experiment was carried out at the Horticulture Research Farm, Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University, Lucknow (UP) during October to April 2009-10. The experiment was laid out in randomized block design (RBD) with three replications.

Table 1. Analysis of variance for 12 genotypes of gladiolus. * Significant at 5% level of probability, ** Significant at 1% level of probability.

		Characters						
Source of variation	Degree of freedom	Plant height (cm)	Number of leaves/ plant	Leaf width (cm)	Spike initiation	No. of days taken for Full spike emergen-ce	Ist floret to open	Ist floret to show color
Replication	2	.049	.20	0.100	0.215	0.296	0.192	0.157
Treatments	11	101.15*	2.14*	1.29*	294.67*	351.27**	161.37*	299.99*
Error	22	0.163	0.26	0.123	0.0808	0.1369	0.077	0.133

Table 1. Continued.

		Characters											
Source of variation	Degree of free-dom	No. of floret open at one time	No. of shoots/ plant	Spike length (cm)	Spike weight (g)	Size of floret (cm)	No. of florets/ spike	Days for harvest-ing	No. of corms/ plant	Weight of corms/ plant (g)	Size of corm (cm)	No. of cormel/ plant	Weight of corms/ plot (kg)
Replication	2	0.194	0.0277	0.152	0.0005	0.040	0.250	0.109	0.250	0.0637	0.0912	1.36	0.001
Treatments	11	0.626**	0.209	312.93**	159.46*	1.475*	16.303**	279.96*	0.250	541.73**	4.374**	519.60 **	0.440*
Error	22	0.255	0.573	0.103	0.087	0.077	0.280	0.060	0.431	0.270	0.097	34.27	0.001

The row to row and plant to plant spacing were maintained at 30 × 25 cm respectively. The twelve genotypes of gladiolus are : True Love, Pacifica, Rigency, Yellow Stone, Sagun, Tiger Flame, Praha, Snow Princes, Picardy, Eurovision, Aldebran and Promise were used as experimental materials. The observations were recorded on nineteen characters viz., plant height (cm), number of leaves per plant, leaf width (cm), number of days taken for spike initiation, number of days taken for full emergence of spike, number of days taken for first floret to show color, number of days taken for first floret to open, number of florets opens at one time, spike length (cm), number of florets per spike, size of floret (cm), spike weight (g), number of days taken for harvesting of spike, number of shoots per plant, number of corms per plant, weight of corm per plant (g), size of corm per plant (cm), number of cormels per plant and weight of corms per plot (kg). The analysis of variance was done by standard methods (2). Variability for different quantitative characters was estimated as suggested by Burton and De Vane (1). Heritability and expected genetic advance were calculated following standard methods.

Results and Discussion

Analysis of variance for 12 characters of parents of gladiolus is given in (Table 1). The variance of different characters was partitioned into replication, treatment and error. The mean sum of square due treatment was highly significant for all the characters under study. The coefficient of variation, heritability and genetic advance value of parents for 12 characters are presented in Table 2. The phenotypic coefficient of variation (PCV) was higher than their respective genotypic coefficient of variation (GCV) for all the traits. The data showed that the plant height varied from 57.88 to 77.53 cm with a general mean of 67.70 cm. The phenotypic and genotypic coefficient of variation was recorded to be 8.88 and 8.86, respectively. The maximum plant height was recorded in Rigency (77.54 cm), whereas, minimum plant height was found in Yellow Stone (57.89 cm), respectively. The data of experiment showed that the number of leaf per plant varied from 6.66 to 9.66 with a general mean of 8.16. The phenotypic and genotypic coefficient of variation were recorded to be 11.92 and 10.05,

Table 2. Estimation of range, genotypic coefficient of variance (GCV), phenotypic coefficient of variance (PCV), heritability, genetic advance at genetic gain of 19 characters of gladiolus.

	Characters	Range Min	Range Max	Phenotypic variation	Genotypic variation	PCV (%)	GCV (%)	Heritability %	Genetic advance
1	Plant height (cm)	57.88	77.53	33.82	33.66	8.86	8.88	99.50	15.28
2	Number of leaves/plant	6.66	9.66	0.88	0.62	10.05	11.92	71.10	1.76
3	Leaf width (cm)	2.40	4.21	0.51	0.38	19.86	22.78	75.90	1.43
4	No. of days taken for spike initiation	57.33	88.83	98.27	98.19	13.64	13.64	99.10	26.15
5	No. of days taken for full spike emergence	62.75	92.91	117.18	117.04	13.93	13.94	99.00	28.54
6	No. of days taken for Ist floret to open	75.91	95.75	53.84	53.76	8.59	8.59	99.20	19.34
7	No. of days taken for Ist floret to show color	67.91	95.91	100.08	99.95	11.76	11.77	99.40	26.37
8	No. of floret open at one time	2.00	3.66	0.37	0.12	13.76	24.08	32.00	0.53
9	No. of shoots/plant	1.00	2.00	0.45	0.12	23.65	45.67	26.00	0.47
10	Spike length (cm)	54.73	88.88	014.37	104.27	14.47	14.48	99.30	26.94
11	Spike weight (g)	50.66	75.94	51.54	50.45	11.13	11.14	99.00	18.92
12	Size of floret (cm)	8.33	10.95	0.54	0.46	6.79	7.33	85.00	1.67
13	No. of floret/spike	10.33	18.66	5.62	5.34	16.91	17.40	95.00	5.94
14	Days for harvesting	72.58	102.75	93.36	93.30	10.57	10.57	99.00	25.49
15	No. of corm/plant	1.33	2.00	0.371	0.060	15.55	38.48	16.00	0.26
16	Weight of corm (g)	57.69	107.08	180.75	180.48	18.12	18.13	99.00	35.44
17	Size of corm (cm)	3.93	7.46	1.52	1.42	22.05	22.79	93.00	3.04
18	No. of cormel/plant	23.33	61.66	196.04	161.77	30.38	33.45	82.00	30.50
19	Weight of corm/plot (kg)	0.51	0.96	0.014	0.014	18.16	18.24	99.00	0.31

respectively. The maximum number of leaves per plant was recorded in Eurovision (9.67) and minimum number of leaves were found in genotype Promise (6.67), respectively. The leaf width varied from 2.40 to 4.21 cm with a general mean of 3.31 cm. The phenotypic and genotypic coefficients of variation were recorded to be 22.78 and 19.86, respectively. The maximum leaf width was recorded in Snow Princes (4.22 cm), whereas the minimum leaf width was observed in Pacifica (2.40 cm), respectively. The number of days taken for spike initiation varied from 57.33 to 88.83 with a general mean of 73.08. The phenotypic and genotypic coefficients of variation were recorded to be 13.64 and 13.64, respectively. The minimum days taken for spike initiation was recorded in Snow Princes (57.33). In contrast, genotype Pacifica (88.83) took maximum days for spike initiation. The number of days taken for full spike emergence varied from 62.75 to 92.91 with a general mean of 77.83. The phenotypic and genotypic coefficient of variation were recorded to be 13.94 and 13.93, respectively. The number of days taken for full spike emergence was observed maximum in Sagun (92.91 days) and minimum number of days taken for full spike emergence was recorded in Snow Princes (62.75 days), respectively. The number of days taken for first floret open varied from 75.91 to 95.75 with a general mean of 85.83. The phenotypic and genotypic coefficients of variation were recorded to be 8.59 and 8.59, respectively. Minimum days taken for first floret open was recorded in Snow Princes (75.92 days), whereas, Pacifica (95.75 days) took maximum days for first floret open. The number of days taken for first floret to show color varied from 67.91 to 95.91 with a general mean of 81.91. The phenotypic and genotypic coefficients of variation were recorded to be 11.77 and 11.76, respectively. Minimum days taken for first floret to show color was recorded in Snow Princes (67.92 days). In contrast Pacifica (95.91 days) took maximum number of days for first floret to show color. The number of floret open at one time varied from 2.00 to 3.66 with a general mean of 2.83. The phenotypic and genotypic coefficients of variation were recorded to be 24.08 and 13.76, respectively. The maximum number of florets opening at one time was recorded in Snow Princes (3.67) and minimum number of florets opening at one time was recorded

in Eurovision (2.00), respectively.

The number of shoots per plant varied from 1.00 to 2.00 with a general mean of 1.5. The phenotypic and genotypic coefficients of variation were recorded to be 45.67 and 23.65. The maximum number of shoots per plant was recorded in Picardy (2.00) and minimum number of shoots per plant was recorded in Praha (1.00), respectively. Spike length varied from 54.73 to 88.88 cm with a general mean of 71.81. The phenotypic and genotypic coefficients of variation were recorded to be 14.48 and 14.47, respectively. The maximum spike length was observed in Eurovision (88.80 cm), whereas minimum spike length was found in Regency (54.73 cm), respectively. The spike weight varied from 50.66 to 75.94 g with a general mean of 63.30 g. The phenotypic and genotypic coefficients of variation were recorded to be 11.14 and 11.13 respectively. The maximum weight of spike was observed in Snow Princes (75.94 g), while, minimum weight of spike was recorded in Aldibran (50.67 g), respectively. Size of florets varied from 8.33 to 10.95 cm with a general mean of 9.64 cm. The phenotypic and genotypic coefficients of variation were recorded to be 7.33 and 6.79, respectively. The maximum floret size was observed in Pacifica (10.95 cm) and minimum floret size was recorded in Picardy (8.33 cm), respectively. Number of floret per spike varied from 10.33 to 18.66 with a general mean of 14.49. The phenotypic and genotypic coefficients of variation were recorded to be 17.40 and 16.91 respectively. The maximum number of florets per spike was recorded in Pacifica (18.67) followed by Snow Princes (16.33) and Tiger Flame (15.33) and minimum number of florets per spike was recorded in Promise (10.33), respectively. Number of days taken for harvesting varied from 72.58 to 102.75 with a general mean of 87.67. The phenotypic and genotypic coefficients of variation were recorded to be 10.57 and 10.57, respectively. The minimum days to reach the stage of harvesting were observed in Snow Princes (72.58 days), whereas, the maximum number of days taken for harvesting was found in Sagun (102.75 days), respectively. Number of corms per plant varied from 1.33 to 2.00 with a general mean of 1.67. The phenotypic and genotypic coefficients of variation were recorded to be 38.48 and 15.55, respectively. The maximum number of corms per plant was recorded in cultivar Rigency (2.50) and minimum number of corms was found in Praha (1.23), respectively. Weight of corms per plant varied from 57.69 to 107.08 with a general mean of 82.39. The phenotypic and genotypic coefficients of variation were recorded to be 18.13 and 18.12, respectively. The maximum weight of corms per plant was observed in Regency (107.08 g) and minimum weight of corms was observed in Eurovision (57.70 g), respectively. Size of corms per plant varied from 3.93 to 7.46 with a general mean of 5.7. The phenotypic and genotypic coefficients of variation were recorded to be 22.79 and 22.05, respectively. The maximum size of corms per plant was recorded in Regency (7.47 cm) and minimum size of corms per plant was observed in True Love (3.93 cm), respectively. The number of cormels per plant varied from 23.33 to 61.66 with a general mean of 42.49. The phenotypic and genotypic coefficients of variation were recorded to be 33.45 and 3.38 respectively. The maximum number of cormels per plant was recorded in Regency (61.67), whereas, minimum number of cormels per plant was recorded in Picardy (23.33), respectively. Weight of corms per plot varied from 0.519 to 0.964 kg with a general mean of 0.74 kg. The phenotypic and genotypic coefficients of variation were recorded to be 18.24 and 18.16 respectively. The maximum weight of corms per plot was recorded in Regency (0.964 kg) and minimum weight of corms was recorded in Eurovision (0.519 kg), respectively. Most of the characters under study exhibited moderate to low phenotypic variation. The highest phenotypic variation value was recorded for number of cormels per plant (196.04) followed by weight of corms per plant (180.75), full spike emergence (117.18), spike length (104.37) and number of days taken for first floret open (100.08). The other characters exhibited low phenotypic variation.

Table 2 reveals that most of the characters exhibited moderate to low genotypic variation. The highest value of genotypic variation was recorded for weight of corms per plant (180.48) followed by number of corms per plant (161.77), number of days taken for full spike emergence (117.04), spike length (104.27) and number of days taken for first floret to show color (99.95). The remaining characters showed low genotypic variation value. The lowest value of genotypic variation was recorded in number of corms per plant (0.06) and number of shoots per plant (0.12). The assessed heritability of the studied trait ranged from 16.00 to 99.50. Most of the characters under study

exhibited moderate to high heritability. The highest heritability was observed for the character spike length (99.50%) followed by number of days taken for first floret to show color (99.40%), spike length (99.30%), number of days taken for first floret open (99.20%), weight of corms per plot (99.15%), number of days taken for spike initiation (99.10%), weight of corms per plant (99.08%), number of days taken for harvesting (99.05%), spike weight (99.01%), number of days taken for full spike emergence (99.00%), number of floret per spike (95.00%), size of corms per plant (93.00%), size of florets (85.00%), number of cormels per plant (82.00%), leaf width (75.90%) and number of leaves per plant (71.10%). However, lowest heritability was recorded for number of corms per plant (16.00%) followed by number of shoots per plant (26.00%) and number of floret open at one time (32.00%). Genetic coefficient of variation and heritability (broad sense) in individually are not sufficient to determine the amount of variation which are heritable variations could be determined with great accuracy when heritability along with genetic advance in study. In the present study, most of the characters exhibited/expressed lows to moderate genetic advance as per cent of mean. The highest genetic advance was observed for weight of corms per plant (35.44%) followed by number of cormels per plant (30.50%), number of days taken for full spike emergence (28.54%), spike length (26.94%), number of days taken for first floret to show color (26.37%), number of days taken for spike initiation (26.15%), number of days taken for harvesting (25.49%), number of days taken for first floret to open (19.34%), spike weight (18.92%), plant height (15.28%). Whereas the minimum genetic advance was recorded for the number of corm per plant (0.26%) followed by weight of corms per plot (0.31%), number of shoots per plant (0.47%), number of florets open at time (0.53%), leaf width (1.34%), size of floret (1.67%), leaf per plant (1.76%), size of corms per plant (3.04%) and number of florets per spike (5.94%).

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