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GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE IN GLADIOLUS HYBRIDS

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Abstract

Eight gladiolus hybrids and one check variety were evaluated for 20 characters to study the genetic variability, heritability, genetic advance and correlation for identifying suitable gladiolus cultivar for coastal conditions of Andhra Pradesh, India. The magnitude of phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV). High heritability coupled with high genetic advance as per cent of mean was noticed in plant height at maturity, number of cormels per plant, number of corms per plant, days taken to sprouting of corm and weight of corm and cormels per plant.

Key words : Gladiolus, hybrids, genetic variability, heritability, genetic advance.

Introduction

Cultivation of gladiolus in India dates back to 19th century as 'Firmingers Manual of Gardening in India' published in 1863, mentions that Charles Gray of Coonoor grew some gladioli from corms and seeds in his garden. Gladiolus is an important bulbous ornamental prized for its beautiful spikes as well as longer vase-life and said to be "Queen of bulbous flower crops" (Pandey *et al*., 2010). The current number of species in the genus gladiolus is 255 (Pragya *et al*., 2010). Gladioli have more than 10,000 cultivars of which about 20 are grown commercially for cut flower purpose. The major states growing gladiolus are Uttar Pradesh, Himachal Pradesh, Haryana, Delhi, Karnataka, Punjab, West Bengal, Assam, Sikkim and Meghalaya (Kolavalli *et al*., 1991). In order to meet the growing demand for cut flowers in the fast growing cities of coastal tract of Andhra Pradesh, introduction and popularization of modern flowers is needed. The present study was conducted with an objective of studying the genetic variability, heritability and genetic advance among different hybrids of gladiolus.

Materials and Methods

The present investigation entitled "Genetic variability, heritability and genetic advance in gladiolus hybrids" was carried out during the period 2014-15 at Horticulture College and Research Institute, Dr. Y.S.R. Horticultural University, Venkataramannagudem, Tadepalligudem mandal, West Godavari District (Andhra Pradesh), India. The experiment was laid out in RBD with three replications. The experiment consisted of nine treatments namely (American Beauty, Arun, Darshan, Green Star, Limoncello, Meridiana, Pink Lady, White Prosperity and Dhiraj as a check). Plot size was 1.8 m × 1.5 m. Corms were dipped in Carbendazim (0.2%) solution for 30 minutes before planting. They were planted at a spacing of 30 cm × 20 cm in each row along the sides of ridges at a depth of 5-6 cm. Statistical significance was tested by 'F' value at 5 per cent level of significance. It helps in working out the variance due to different sources and also provides the basis for test of significance (Singh and Choudhary, 1979). Analysis of variance was carried out as per the procedure given by Panse and Sukhatme (1967) using the mean values of five randomly selected plants in each replication from all the treatments to find out the significance of treatment effect.

Results and Discussion

Genetic variability is a basic pre requisite for plant breeding programme on which selection acts to evolve superior genotype. Thus, the higher the amount of variation for different characters in the chosen material, greater is the scope for its improvement through selection. In the present study, observations were recorded on different quantitative traits and the analysed values of GCV, PCV,

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heritability and genetic advance for twenty characters of gladiolus are presented in table 1. The data showed that the earliest sprouting of corms (4.46 days) was recorded by Meridiana and latest sprouting was observed in American Beauty (11.93 days). At maturity the highest plant height (131.77 cm) was recorded by White Prosperity and minimum (71.13 cm) was recorded by American Beauty. Maximum number of leaves per plant (8.66) was recorded by Green Star and minimum was observed in American Beauty (7.06). Highest leaf area per plant was recorded by White Prosperity (1148.40 cm^2), whereas, least was observed in Darshan (658.83 cm^2). The minimum number of days taken for spike initiation, full emergence of spike, basal floret to show colour and basal floret to fully open was observed in Limoncello (50.06, 53.20, 56.24 and 63.03 days, respectively). The highest number of days taken for spike initiation full emergence of spike, basal floret to show colour and basal floret to fully open was observed in Meridiana (68.80, 72.23, 77.26 and 81.73 days, respectively). Spike length and rachis length was highest in White Prosperity (103.07 cm and 45.00 cm). The lowest spike length was observed in Dhiraj (58.39 cm) and least rachis length was recorded (32.01 cm) in Limoncello. White Prosperity recorded the highest number of florets per spike (12.73). The least number of florets per spike was recorded in Green Star (8.36). White Prosperity recorded maximum floret length and diameter (10.78 cm and 10.06 cm) whereas, the minimum values (8.34 cm and 8.06 cm) was recorded by Darshan. Maximum vase life was recorded by White Prosperity (10.96 days) and minimum vase life was observed in Darshan (7.43 days). The highest number of corms per plant was recorded by hybrid Darshan (2.73) while the lowest number of corms (1.00) was produced in Meridiana. White Prosperity recorded the highest (100.13 g) corm weight per plant while the minimum corm weight was observed in Limoncello (49.28 g). Corm diameter was recorded at highest (5.73 cm) in White Prosperity and the lowest was observed in Darshan (3.93 cm). The number of cormels per plant was at maximum in White Prosperity (47.33) and minimum (15.70) in Limoncello. The highest weight of corm and cormels per plant 121.80 g was recorded in White Prosperity. Limoncello (52.84 g) was recorded minimum.

Genetic variability

Assessment of genetic variability is necessary to evaluate the performance of individual cultivars. The analysis of variance permits estimation of phenotypic and genotypic coefficients of variability of various polygenic traits. The genotypic coefficient of variation measures the extent of variability among the different traits caused due to the inherent capacity of the genotype. The genotypic and phenotypic coefficients of variation are required to understand the effect of environment on various polygenic traits. The values of GCV were found to be in high range for number of cormels per plant (43.82), number of corms per plant (42.00), days taken to sprouting of corms (32.39), number of spikes per plant (27.99), weight of corm and cormels per plant (26.92) and corm weight per plant (22.26) in the order. The moderate values of GCV are recorded for leaf area per plant at maturity (19.93), spike length (19.50), plant height at maturity (19.01), vase life (13.29), number of florets per spike (12.41), corm diameter (11.80) and rachis length (11.71). The least values of GCV were recorded for days taken for spike initiation (8.39), days taken for basal floret to show colour (7.98), days taken for full spike emergence (7.91), floret length (6.86), days taken for basal floret to fully open (6.52), number of leaves per plant at maturity (5.91) and floret diameter (5.72).

The highest values of PCV was recorded for number of cormels per plant (46.52), number of corms per plant (43.62), days taken to sprouting of corms (33.15), number of spikes per plant (30.33), weight of corm and cormels per plant (27.67), corm weight per plant (23.53), leaf area per plant at maturity (22.22) and spike length (20.67). The moderate values of PCV are recorded for plant height at maturity (19.66), number of florets per spike (14.84), vase life (14.83), corm diameter (13.89) and rachis length (13.01). The height values of PCV was recorded for days taken for spike initiation (9.83), floret length (9.74), days taken for basal floret to show colour (9.48), days taken for full spike emergence (9.38), floret diameter (8.99), days taken for basal floret to fully open (8.24) and number of leaves per plant at maturity (7.79).

The estimates of genotypic coefficients of variation in the present study were found to be lesser than those of phenotypic coefficient of variation indicating that the apparent variation is not only due to genotype, but also due to the influence of environment. Similarly, Pratap and Rao (2006) also reported higher PCV than GCV for most of the characters studied. Narrow differences between genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were observed for the all 20 characters. Narrow difference between GCV and PCV values indicate the least influence of environment on these characters. Similar results were obtained by Pragnyasree *et al*. (2014) and Pratap and Rao (2006) in gladiolus.

Table 1 : Genetic parameters of different gladiolus hybrids.

Parameters	Range		Mean	Genoty-pic variance	Pheno-typic variance	GCV (%)	PCV (%)	(h^2)	GA	GAM (%)
	Minimum	Maximum								
Days taken to sprouting of corm	4.46 (Meridiana)	11.93 (American Beauty)	7.62	6.09	6.38	32.39	33.15	95.40	4.96	65.20
Plant height at maturity	71.13 (American Beauty)	131.76 (White Prosperity)	96.63	337.64	361.03	19.01	19.66	93.50	36.60	37.88
Number of leaves per plant at maturity	7.06 (American Beauty)	8.66 (Green Star)	7.60	0.20	0.35	5.91	7.79	57.60	0.70	9.25
Leaf area per plant at maturity	658.83 (Darshan)	1148.40 (White Prosperity)	848.07	28573.69	35510.89	19.93	22.22	80.50	312.35	36.83
Days taken for spike initiation	50.06 (Limoncello)	68.80 (Meridiana)	61.38	26.55	36.45	8.39	9.83	72.80	9.06	14.75
Days taken for full spike emergence	53.20 (Limoncello)	72.73 (Meridiana)	65.18	26.60	37.42	7.91	9.38	71.10	8.95	13.74
Days taken for basal floret to show colour	56.24 (Limoncello)	77.26 (Meridiana)	69.05	30.42	42.92	7.98	9.48	70.90	9.56	13.85
Days taken for basal floret to fully open	63.03 (Limoncello)	81.73 (Meridiana)	73.63	23.06	36.84	6.52	8.24	62.60	7.82	10.63
Spike length	58.39 (Dhiraj)	103.07 (White Prosperity)	74.13	209.06	234.86	19.50	20.67	89.00	28.10	37.90
Rachis length	32.01 (Limoncello)	45.00 (White Prosperity)	38.75	20.61	25.44	11.71	13.01	81.00	8.42	21.72
Number of florets per spike	8.36 (Green Star)	12.73 (White Prosperity)	10.41	1.67	2.38	12.41	14.84	69.90	2.22	21.38
Number of spikes per plant	1.00 (Meridiana)	2.26 (Darshan)	1.43	0.16	1.19	27.99	30.33	85.20	0.76	53.22
Floret length	8.34 (Darshan)	10.78 (White Prosperity)	9.13	0.39	0.79	6.86	9.74	49.60	0.91	9.95
Floret diameter	8.06 (Darshan)	10.06 (White Prosperity)	9.08	0.27	0.66	5.72	8.99	40.50	0.68	7.51
Vase life (days)	7.43 (Darshan)	10.96 (White Prosperity)	8.39	1.24	1.55	13.29	14.83	80.30	2.06	24.53
Number of corms per plant	1.00 (Meridiana)	2.73 (Darshan)	1.67	0.49	0.53	42.00	43.62	92.70	1.40	83.31
Corm weight per plant	49.28 (Limoncello)	100.13 (White Prosperity)	70.20	244.35	273.02	22.26	23.53	89.50	30.46	43.39
Corm diameter	3.93 (Darshan)	5.73 (White Prosperity)	4.74	0.31	0.43	11.80	13.89	72.20	0.98	20.67
Number of cormels per plant	15.70 (Limoncello)	47.33 (White Prosperity)	25.39	123.86	139.61	43.82	46.52	88.70	21.59	85.03
Weight of corm and cormels per plant	52.84 (Limoncello)	121.80 (White Prosperity)	85.12	525.37	554.87	26.92	27.67	94.70	45.94	53.97

GCV : Genotypic coefficient of variation **h^2 :** Heritability in broad sense **GAM :** Genetic advance as per cent over mean (at 5%)
PCV : Phenotypic coefficient of variation **GA :** Genetic advance.

Table 2 : Relationship between different parameters in gladiolus (*Gladiolus hybrid* L.) as analysed through rank procedure.

	Parameters	GCV (%)	PCV (%)	Heritability (%)	GA	GAM (%)	Total
1.	Days taken to sprouting of corm	3	3	1	12	3	22
2.	Plant height at maturity (cm)	9	9	3	3	8	32
3.	Number of leaves per plant at maturity	19	20	18	19	19	95
4.	Leaf area per plant at maturity (cm^2)	7	7	10	1	9	34
5.	Days taken for spike initiation	14	14	12	8	14	62
6.	Days taken for full spike emergence	16	17	14	9	16	72
7.	Days taken for basal floret to show colour	15	16	15	7	15	68
8.	Days taken for basal floret to fully open	18	19	17	11	17	82
9.	Spike length (cm)	8	8	6	5	7	34
10.	Rachis length (cm)	13	13	9	10	11	56
11.	Number of florets per spike	11	10	16	13	12	62
12.	Number of spikes per plant	4	4	8	18	5	39
13.	Floret length (cm)	17	15	19	17	18	86
14.	Floret diameter (cm)	20	18	20	20	20	98
15.	Vase life (days)	10	11	11	14	10	56
16.	Number of corms per plant	2	2	4	15	2	25
17.	Corm weight per plant (g)	6	6	5	4	6	27
18.	Corm diameter (cm)	12	12	13	16	13	66
19.	Number of cormels per plant	1	1	7	6	1	23
20.	Weight of corm and cormels per plant (g)	5	5	2	2	4	18

Heritability and genetic advance

Heritability in broad sense and genetic advance as per cent mean was calculated for 20 characters. Heritability and genetic advance are important selection parameters. Heritability estimates along with genetic advance are more useful in predicting the gain under selection than heritability estimates alone. However, it is not necessary that a characters showing high heritability will also exhibit high genetic advance. Estimates of heritability also give some idea about the gene action involved in the various polygenic traits. It is being used in predicting the performance of genotypes in subsequent generations and to decide the appropriate weightage to be given for improving particular character and the breeding method to be followed for improvement of specific character. In the present study, the magnitude of heritability (table 1) ranged from 40.50 to 95.40 and genetic advance was ranged from 7.51 to 85.03.

The highest heritability along with high GAM was recorded for days taken for sprouting of corm (95.40, 65.20), weight of corm and cormels per plant (94.70, 53.97), plant height per plant at maturity (93.50, 37.88), number of corms per plant (92.70, 83.31), corm weight per plant (89.50, 43.39), spike length (89.00, 37.90), number of cormels per plant (88.70,85.03), number of spikes per plant (85.20, 53.22), rachis length (81.00, 21.72), leaf area per plant (80.50, 36.83), vase life (80.30, 24.53), corm diameter (72.20, 20.67), and number of florets per spike (69.90, 21.38). High heritability coupled with high genetic advance indicates the lesser influence of environment in the expression of these characters and prevalence of additive gene action in their inheritance. Since, there is less phenotypic variation for these characters they are proved to be more suitable for selection. Similar results were observed by Pragnyasree *et al*. (2014) and Pratap and Rao (2006) and Balaram and Janakiram (2009) in gladiolus. The highest heritability along with moderate GAM was recorded for days taken for spike initiation (72.80, 14.75), days taken for full emergence of spike (71.10, 13.74), days taken for basal floret to show colour (70.90, 13.85) and days taken for basal floret to fully open (62.60, 10.63). The highest heritability along with low GAM was recorded for number of leaves per plant at maturity (57.60, 9.25), floret length (49.60, 9.95) and floret diameter (40.50, 7.51). A high heritability coupled with moderate genetic advance over per cent mean and high heritability with low GAM was indicating non-additive gene action and because of less phenotypic variation for these characters. It is implied that these characters are relatively more influenced by environment and selection based on these traits would be ineffective and they can be improved through hybridization or heterosis breeding.

Relationship between different parameters in gladiolus

The data presented in table 2 indicated that the five characters *viz*., weight of corm and cormels per plant (g), days taken to sprouting of corm, number of cormels per plant, number of corms per plant and corm weight per plant (g) recorded the lowest sums of ranks over the genetic parameters thereby implying that these characters could be considered as guide parameters in order to make selections for improvement in gladiolus germplasm. The results on GCV, PCV and heritability also are in conformity with these findings.

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References

Balaram, M. V. and T. Janakiram (2009). Genetic variability in gladiolus genotypes for corm characters. *J. Ornamental Hort*., **12(2)** : 123-126.

Kolavalli, S, I. K. Atheeq and X. Jacob (1991). Floriculture industry in India, *Oxford and IBH Publication Company Limited*, New Delhi.

Pandy, R. K., D. Sheetal, P. S. Pal, J. Shivani and D. J. Bhat (2010). Performance of gladiolus cultivars under Jammu conditions. *J. Res*., **9(2)** : 210-214.

Panse, V. G. and P. V. Sukhatme (1967). *Statistical methods for Agricultural workers,* ICAR, New Delhi.

Pragya, R., K. V. Bhat, R. L. Misra, S. K. Singh and J. K. Ranjan (2010). Genetic relationships of gladiolus cultivars inferred from fluorescence based AFLP markers. *Scientia Hort*., **123** : 562–567.

Pragnyashree, M., A. K. Singh and O. P. Singh (2014). Genetic variability, genetic advance, correlation coefficient and path analysis in gladiolus. *J. Agri. and Veterinary Sci*., **7(7)** : 23-26.

Pratap, M. and A. M. Rao (2006). Assessment and variability studies in gladiolus. *J. Ornamental. Hort*., **9(2)** : 145-147.

Singh, R. H. and B. D. Choudhary (1979). Biometrical methods in quantitative genetic analysis. *Kalyani Publishers*, Ludhiana.