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STUDIES ON GENETIC PARAMETERS OF GLADIOLUS (*GLADIOLUS HYBRIDUS* H.) GENOTYPES

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ABSTRACT

Forty cultivars/varieties of gladiolus were evaluated to ascertain genetic parameters of variability during the year 2007-08 and 2008-09 at Research Farm, Department of Horticulture, Janta PG College, Bakewar, Etawah. The analysis of variance reveals that genotypic mean squares were highly significant for all the characters studied, indicating existence of sufficient heritable variation among the genotypes. The highest and lowest phenotypic and genotypic variance were observed for spike length and weight of cormels/plant, respectively for the year 2007-08 but in case of 2008-09 and pooled it was found for number of cormels/plant and weight of cormels/plant, respectively. Maximum PCV and GCV were found for number of cormels per plant while days to last floret opening and days to senescence of last floret showed minimum coefficient of variation for the year 2007-08, 2008-09 and pooled. The heritability estimate of varied from 62.10% (days to 1st floret opening) to 99.50% (rachis length), 50.90% (diameter of daughter corm) to 99.60% (no. of cormels/plant and weight of daughter corm) and 49.90% (days to 1st floret opening) to 99.40% (no. of cormels/plant and weight of daughter corm) for the year 2007-08, 2008-09 and pooled, respectively. Genetic advance as percent of mean was recorded for weight of daughter corm, number of partially opened florets/spike, spike length, rachis length, number of shoots/corm, number of daughter corms/plant, durability of spike, plant height, diameter of daughter corm, number of corms/plant, number of leaves/shoot, number of opened florets/spike, number of florets/spike and leaf area. High heritability along with high genetic advance observed for rachis length followed by durability of spike, number of cormels/plant and weight of daughter corm. Thus, apparently contribution of additive gene effects in the expression of these traits was indicated and improvement in these characters through direct selection to select better cultivars of gladiolus can easily be done. High heritability with low genetic advance indicated the contribution of non-additive gene effects.

Keywords:
Gladiolus,
Genetic variability,
Heritability,
Genetic advance,

INTRODUCTION

Gladiolus (*Gladiolus grandiflorus* Hort.) is an important bulbous cut flower crop which is commercially grown in many tropical, sub-tropical and hilly parts of the world, owing to its attractive colour and exquisite florets. Gladiolus is one of the most important cut flower and the second most popular bulbous ornamental crop of the world. It is also known as 'the queen of bulbous flowers' and suitable for floral arrangements and garden display. Success in selection for newer types depends on the extent of genetic variability, heritability and genetic advance which is a pre-requisite for initiating appropriate breeding programme in crop improvement programme (Negi *et al*., 1982).

MATERIALS AND METHODS

The present experiment was conducted at Department of Horticulture, Janta PG College, Bakewar, Etawah. The experimental material consisted of 40 genotypes (*American Beauty, Anjali, Archana, Arun, Basant Bahar, Bindiya, Bis-Bis, Chandni, Chirag, Dhanvantri, Dhiraj, Gazal, Gunjan, Hans, Indrani, Jwala, Kamini, Kalima, Kohra, Manohar, Manmohan, Manisha, Manhar, Miss America, Mohini, Mridula, Mukta, Neelam, Priyadarshani, Pusa Suhagin, Royal Supreme, Sada Bahar, Sanyukta, Shweta, Smita, Snow Princess, Suchitra, Sunayana, Swapnil* and *Triloki*) of gladiolus were obtained from NBRI, Lucknow and IARI, New Delhi. Healthy and uniform sized corms of 3-4 cm diameter were planted on 1st November during 2007-08 and 2008-09 at 7-8 cm depth with a spacing of 30 × 20 cm. All the recommended package of practices was followed to grow a successful crop (Randhawa and Mukhopadhyay, 1995).

The experiments were laid out in randomized block design with three replications. The biometrical observations were recorded on ten randomly taken plants from each variety in each replication. Observations were made on vegetative growth, flowering and corm parameters using conventional methods. The mean values obtained were used for determining phenotypic coefficient of variation (Burton and Vane, 1953), heritability (Hanson *et al*., 1956) and expected genetic advance (Johnson *et al*., 1955).

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RESULTS AND DISCUSSION

Genetic variability is a complex phenomenon, which is measured by the estimation of the range, mean, genotypic and phenotypic coefficient of variance and heritability and genetic advance. The extent of genetic variability indicates the amenability of a given character for its improvement (Burton, 1952).

The analysis of variance reveals that mean squares were highly significant for all the characters studied, indicating existence of sufficient heritable variation among the genotypes. Gowda (1989) also found wide variability in plant height, spike length, spike weight, number of days to flowering. Soorianathasunderam and Nambisan (1991) found that characters *viz*., spike weight, number of florets/spike, spike length and floret size exhibited greater variability. Similarly Negi *et al.* (1982) found high coefficient of variation for weight of cormels/corm, number of cormels/corm and weight of corm produced. Phenotypic variance (σ2p) was higher as compared to their respective genotypic variance (σ2g) for all the characters under the studies during the year 2007-08, 2008-09 and pooled data (Table 1).

The highest and lowest phenotypic and genotypic variance were observed for spike length (346.94 and 333.90) and weight of cormels/plant (0.06 and 0.059), respectively for the year 2007-08 but in case of 2008-09 and pooled it was found for number of cormels/plant and weight of cormels/plant, respectively. The different characters like, spike length, plant height, rachis length, weight of daughter corm, leaf area, days to spike initiation, days to first floret opening, days to 50% heading, days to last floret opening and days to senescence of last floret were also showed the high value for phenotypic and genotypic variance the years 2007-08, 2008-09 and pooled, much lower genotypic variances in comparison to their corresponding phenotypic variances indicated less influence of environment on the expression of genetic effects (Bichoo *et al.*, 2002; Nimbalkar *et al.*, 2007).

It was observed that PCV and GCV were maximum for no. of cormels/plant for the year 2007-08, 2008-09 and pooled (Table 1), while days to last floret opening and days to senescence of last floret showed minimum coefficient of variation. On the basis of pooled data, the characters like no. of cormels/plant, weight of daughter corm, number of partially opened florets, rachis length, spike length and weight of cormels had high value of GCV and PCV, which indicate high variation in these characters.

It indicates responsiveness of these traits to appropriate selection for evaluation of improved varieties of gladiolus due to low influence of environment. The characters possessing high GCV value have better scope of improvement through selection. Similar finding have also been reported by (Bichoo *et al.*, 2002; Neeraj *et al.*, 2005; Nimbalkar *et al.*, 2007) in gladiolus. Most of the characters had close PCV and GCV estimate and moderate variability except for diameter of daughter corm, diameter of first floret and no. of leaves/shoot, thus amenable for improvement (Nimbalkar *et al.*, 2007). Moderate estimate of PCV and GCV indicating that present study material can be used in improvement programme (Gowda, 1989; Sindhu and Arora, 2000). Narrow difference between PCV and GCV were observed for all the attributes under study and this indicates a lesser degree of environmental influence in the expression of the characters, which showed that the phenotypic variability may be a good measure of variability for all the characters under study.

In the present study, the estimate of heritability varied from 62.10% (days to 1st floret opening) to 99.50% (rachis length), 50.90% (diameter of daughter corm) to 99.60% (no. of cormels/plant and weight of daughter corm) and 49.90% (days to 1st floret opening) to 99.40% (no. of cormels/plant and weight of daughter corm) for the year 2007-08, 2008-09 and pooled, respectively. High heritability (>80%) was recorded for the characters like, rachis length, durability of spike, weight of cormels/plant, spike length, plant height, leaf area, number of daughter corms/plant, number of partially opened florets/spike, days to 50% sprouting of corm, number of cormels/plant and number of leaves/plant, while rest of the characters showed moderate heritability (70%).

High estimates of heritability for the characters studied suggested that selection based on phenotypic performance could be effective as advocated by Johnson *et al.* (1955). Neeraj *et al.*, 2005 viewed that characters, which had low heritability are not dependable, because there genotypic expression is superimposed by the environmental influences. Low heritability estimates for a character indicate larger role of environmental effect and selection based on phenotypic value may not be effective. This finding was supported by (Bichoo *et al.*, 2002;; Pratap and Rao, 2006; Lepcha *et al.*, 2007; Nimbalkar *et al.*, 2007) in gladiolus.

Data of genetic advance expressed as percentage of mean showed a wide ranged from 2.01 (for no. of shoots/corm) to 290.44 (for no. of cormels/ plant), 9.81 (for days to first floret opening) to 266.76 (for no. of cormels/plant) and 4.96 (for senescence of last floret) to 273.16 (for no. of cormels/plant) for the year 2007-08, 2008-09 and pooled, respectively. The high value of genetic advance as percent of mean was recorded for weight of daughter corm, number of partially opened florets/spike, spike length, rachis length, number of shoots/corm, number of daughter corms/plant, durability of spike, plant height, diameter of daughter corm, number of corms/plant, number of leaves/shoot, number of opened florets per spike, number of florets/spike and leaf area, while lowest was found in senescence of last floret, days to first floret opening, days to 50% heading and days to senescence of first floret.

Table 1: Estimates of general mean, range and genotypic, phenotypic variance for twenty five characters in forty genotypes of gladiolus of two year

S. No.	Characters	2007-08					2008-09					Pooled				
		General mean	Range		σ^2p	σ^2g	General mean	Range		σ^2p	σ^2g	General mean	Range		σ^2p	σ^2g
			Min.	Max.				Min.	Maxi.				Min.	Max.		
1	Days to 50% Sprouting of corm	30.30	24.14	42.75	13.84	12.46	28.29	15.62	33.47	12.12	11.10	29.30	22.84	37.49	6.261	5.277
2	Plant height (cm)	100.04	67.26	132.41	206.69	194.15	99.57	68.72	132.67	193.12	189.29	99.80	67.99	131.40	199.42	191.33
3	No. of leaves/shoots	6.44	4.31	8.81	1.61	1.30	7.09	5.11	9.62	1.39	1.31	6.77	4.71	8.65	0.981	0.785
4	Leaf area (cm^2)	96.12	75.21	121.41	136.69	129.45	95.94	79.42	118.46	96.26	89.32	96.03	78.37	119.94	113.21	106.17
5	Days to spike initiation	104.87	88.33	123.85	96.32	72.06	98.61	81.14	117.63	66.28	55.21	101.74	87.83	116.62	51.01	77.99
6	Days to 50% heading	111.23	90.17	126.23	75.21	50.37	105.13	88.04	122.47	57.04	44.44	108.18	92.18	122.39	41.57	22.86
7	Days to first floret opening	117.58	92.17	129.31	73.85	45.88	111.82	92.75	127.32	54.93	39.47	114.70	96.60	128.32	43.35	21.57
8	Diameter of first floret (cm)	11.02	8.16	13.81	2.12	1.39	11.89	8.96	14.84	2.44	1.93	11.46	8.56	13.94	2.05	1.26
9	Diameter of third floret (cm)	11.33	8.51	14.51	2.23	2.05	11.95	8.91	14.36	1.86	1.27	11.64	8.72	14.29	1.70	1.31
10	Days to senescence of first floret	124.22	111.31	138.92	46.65	41.57	119.42	102.06	137.64	63.72	48.76	121.82	109.92	136.53	38.75	28.81
11	No. of florets/spike	13.45	9.86	18.21	12.78	12.67	14.01	10.21	15.98	3.17	2.49	13.73	10.04	17.94	3.26	2.86
12	No. of opened florets/spike	12.49	8.11	18.11	5.11	4.84	12.52	9.57	16.21	2.48	1.84	12.51	9.04	17.16	1.72	2.51
13	No. of partially opened florets/spike	1.23	0.12	2.51	0.54	0.52	1.58	0.24	0.73	0.45	0.42	1.41	0.39	2.51	0.27	0.245
14	Durability of spike	20.98	9.44	33.21	40.11	39.87	19.64	11.16	31.71	15.73	15.46	20.31	10.85	26.85	9.34	9.17
15	Days to last floret opening	131.56	119.41	145.75	52.35	33.74	124.85	104.61	139.92	63.72	53.97	128.20	117.38	142.71	40.27	26.03
16	Senescence of last floret	139.52	124.21	156.54	62.70	41.89	131.51	110.81	147.01	63.70	52.10	135.52	126.51	150.93	3427	18.12
17	Spike length (cm)	69.24	32.34	103.41	346.94	333.90	70.84	39.57	104.89	281.06	270.64	70.04	35.51	104.05	284.45	296.87
18	Rachis length (cm)	46.35	26.17	78.83	217.18	216.11	47.19	28.13	73.31	163.4	159.02	46.77	28.69	75.63	17.74	183.96
19	No. of shoots/corm	1.81	1.11	2.78	0.214	0.208	1.76	0.91	2.78	0.24	0.16	1.78	1.12	2.71	0.102	0.095
20	No. of corms/plant	2.20	1.42	3.21	0.210	0.205	2.13	1.21	3.46	0,20	0.17	2.17	1.54	3.03	0.11	0.09
21	No. of daughter corms/plant	1.56	0.90	2.71	0.179	0.175	1.46	0.87	2.61	0.24	0.21	1.51	0.93	2.38	0.058	0.055
22	No. of cormels/plant	13.07	4.11	120.11	344.55	342.04	14.20	4.91	118.37	340.85	339.47	13.64	4.67	119.24	331.23	329.30
23	Diameter of daughter corm (cm)	4.02	2.81	6.71	0.95	0.70	4.16	3.04	5.62	0.55	0.28	4.09	2.98	0.17	0.69	0.432
24	Weight of daughter corms (g)	26.59	10.41	65.31	158.47	157.34	25.77	11.11	72.17	147.81	147.25	26.18	10.94	68.74	147.44	146.61
25	Weight of cormels/plant (g)	0.85	0.31	1.31	0.06	0.059	0.69	0.13	1.02	0.082	0.08	0.77	0.25	1.17	0.045	0.04

Table2: Estimates of phenotypic and genotypic coefficient of variation of twenty five characters in forty different genotypes of gladiolus of two year

S. No.	Characters	2007-08		2008-09		Pooled	
		PCV	GCV	PCV	GCV	PCV	GCV
1	Days to 50% Sprouting of corm	12.12	11.65	12.31	11.78	8.56	7.48
2	Plant height (cm)	14.37	13.93	13.96	13.82	14.15	13.86
3	No. of leaves/shoots	19.71	17.73	16.60	16.11	14.63	13.09
4	Leaf area (cm^2)	12.16	11.84	10.23	9.85	11.08	10.73
5	Days to spike initiation	9.36	8.09	8.26	7.53	7.02	5.68
6	Days to 50% heading	7.80	6.38	7.18	6.34	5.96	4.42
7	Days to first floret opening	7.31	5.76	6.63	5.62	5.74	4.05
8	Diameter of first floret (cm)	13.21	10.69	13.15	11.69	11.98	9.81
9	Diameter of third floret (cm)	13.17	12.61	11.42	9.42	11.21	9.85
10	Days to senescence of first floret	5.50	5.19	6.68	5.85	5.11	4.41
11	No. of florets/spike	15.48	15.29	12.72	11.27	13.15	12.32
12	No. of opened florets/spike	18.11	17.63	12.58	10.82	13.76	12.66
13	No. of partially opened florets/spike	59.48	58.56	42.42	41.01	36.72	35.10
14	Durability of spike	30.19	30.10	20.20	20.02	15.12	14.91
15	Days to last floret opening	5.50	4.41	6.39	5.88	4.95	3.98
16	Senescence of last floret	5.68	4.64	6.07	5.49	4.32	3.14
17	Spike length (cm)	26.90	26.39	23.67	23.22	24.08	24.60
18	Rachis length (cm)	31.80	31.72	27.42	26.72	29.37	29.00
19	No. of shoots/corm	25.53	25.19	24.83	24.30	17.95	17.34
20	No. of corms/plant	20.96	20.66	21.31	19.56	15.29	13.89
21	No. of daughter corms/plant	27.03	26.72	31.89	31.62	16.03	15.49
22	No. of cormels/plant	141.98	141.47	130.02	129.76	133.43	133.04
23	Diameter of daughter corm (cm)	24.26	120.83	17.79	12.70	20.33	16.07
24	Weight of daughter corms (g)	47.35	47.18	47.17	47.09	46.38	46.25
25	Weight of cormels/plant (g)	29.47	29.19	42.49	41.98	27.63	27.12

High genetic advance as percent of mean for number of cormels/plant was also reported by (Bichoo *et al.,* 2002; Neeraj *et al.,* 2005; Lepcha *et al.,* 2007). The heritability and genetic advance, estimated together are useful for predicting the resultant effect and selecting the best individual. In the present study, high genetic advance as percent of mean coupled with high heritability was noticed for the traits like, number of cormels/plant, weight of daughter corm, rachis length, durability of spike, weight of cormels/plant, spike length, plant height, number of daughter corms/plant, number of shoots/corm, number of partially opened florets/spike, number of florets/spike, number of opened florets/spike, number of corms/plant and number of leaves/shoot.

CONCLUSION

Thus, apparently contribution of additive gene effects in the expression of these traits was indicated. Consequently, improvement in these characters through direct selection to develop better cultivars of gladiolus can easily be done. High heritability with low genetic advance indicated the contribution of non-additive gene effects. Hybridization and asexual propagation of F_1 can be done to exploit. The non-additive gene effects from the improvement of such traits.

Table 3: Estimates of heritability, genetic advance, genetic advance as % of mean for twenty five characters in forty genotypes of gladiolus of two years

S. No.	Characters	2007-08			2008-09			Pooled data of 2007-08 and 2008-09		
		Heritability	Genetic Advance	Genetic Advance as % of mean	Heritability	Genetic Advance	Genetic Advance as % of mean	Heritability	Genetic Advance	Genetic Advance as % of mean
1	Days to 50% Sprouting of corm	92.40	6.99	23.07	91.60	6.57	23.22	83.80	4.33	14.78
2	Plant height (cm)	93.90	27.82	27.80	98.00	28.06	28.18	95.90	27.90	27.96
3	No. of leaves/shoots	80.90	2.21	34.32	94.10	2.28	32.16	80.10	1.63	24.08
4	Leaf area (cm^2)	94.70	22.81	23.73	92.80	18.75	19.54	93.70	20.55	21.39
5	Days to spike initiation	74.80	15.12	14.42	83.30	13.97	14.17	65.40	9.62	9.46
6	Days to 50% heading	67.00	11.96	10.75	77.90	12.12	11.53	55.00	7.31	6.75
7	Days to first floret opening	62.10	11.00	9.36	71.90	10.97	9.81	49.90	6.76	5.89
8	Diameter of first floret (cm)	65.50	1.97	17.88	79.00	2.55	21.45	67.00	1.89	16.49
9	Diameter of third floret (cm)	91.80	2.82	24.89	68.10	1.91	15.98	77.20	2.08	17.87
10	Days to senescence of first floret	89.10	12.54	10.09	76.50	12.58	10.53	74.20	9.52	7.81
11	No. of florets/spike	97.50	4.18	31.07	78.50	2.88	20.56	87.90	3.27	23.82
12	No. of opened florets/spike	94.70	4.41	35.31	74.10	2.40	19.17	84.60	3.00	23.98
13	No. of partially opened florets/spike	96.90	1.46	118.69	93.50	1.29	81.65	91.40	0.97	68.79
14	Durability of spike	99.40	12.97	61.82	98.30	8.03	40.89	97.30	6.15	30.28
15	Days to last floret opening	64.40	9.60	7.29	84..70	13.93	11.16	64.70	8.46	6.59
16	Senescence of last floret	66.80	10.90	7.81	81.80	13.45	10.23	52.70	6.36	4.96
17	Spike length (cm)	96.20	36.93	53.33	96.30	33.26	46.95	96.20	34.81	49.70
18	Rachis length (cm)	99.50	30.21	43.63	95.00	25.32	53.66	97.50	27.59	58.99
19	No. of shoots/corm	97.30	0.93	2.01	95.80	0.86	48.86	93.30	0.62	34.83
20	No. of corms/plant	97.20	0.92	50.83	54.20	0.79	37.09	82.40	0.56	25.81
21	No. of daughter corms/plant	97.70	0.85	54.49	98.30	0.94	64.38	93.40	0.47	31.12
22	No. of cormels/plant	99.30	37.96	290.44	99.60	37.88	266.76	99.40	37.26	273.16
23	Diameter of daughter corm (cm)	73.70	1.48	36.82	50.90	0.78	18.75	62.50	1.07	26.16
24	Weight of daughter corms (g)	99.30	25.75	96.84	99.60	24.95	96.82	99.40	24.87	94.99
25	Weight of cormels/plant (g)	98.10	0.51	60.00	97.60	0.59	85.50	96.40	0.42	49.41

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