Study on the Evaluation Genetic Variability of Gladiolus (*Gladiolus grandiflorus*) Cultivars Under Agro –Climatic conditions of Prayagraj"

ABSTRACT

Aims A field experiment was carried out to "Study on Evaluating Genetic Variability of Gladiolus (*Gladiolus grandiflorus L.*) Cultivars under Agro –Climatic conditions of Prayagraj"
Place and Duration of Study An experiment was carried out in the Department of Horticulture during the Rabi season of 2023-2024.
Study Design: Randomized Block Design
Methodology: The analysis of the data showed that phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) for all characters studied, indicating that environmental factors had a significant influence on these characters. In addition, positive and highly significant correlations were observed in between tuber yield per plant (gm) and various other traits including the No.of leaves at 30DAS, 60DAS and 90DAS and No.of shoots per plant, days for the first flowering, peduncle length, No.of florets per spike , No.of ears per plant, length of floret, diameter of floret, No.of corms per plant and diameter of corms, weight of corms and No.of corms per hectare and No.of corms per hectare.
Results: The mean sum of squares due to genotypes showed significant differences for all characters under study for except days taken for emergence of flower spike and days taken to show color of basal floret. High magnitude of GCV were recorded for No.of leaves (52.70), Corm yield/plant(46.40), No.of cormels/hectare(39.12), Cormel diameter(38.36), No.of corms/hectare(28.97), No.of corms per plant(28.97),No.of leaves at 60DAS(26.64), No.of shoot(26.64). The genotypic and phenotypic correlation coefficient of different characters with Corms yield/plant (g) and their relationship among themselves
Conclusion: The highest corms yield/plant (g/plant) of genotype was observed in Arka Aayush (156.60) followed by P.B Clown and Red Ginger. It was observed that PCV was higher than GCV for all the traits studied highest GCV and PCV is recorded as No.of corm per plant (46.40 and 46.61). Genotypic and phenotypic correlation coefficient analysis revealed that Corms weight/plant (g) showed positive significant association with plant height, No.of leaves per plant, No.of shoot per plant, rachis length (cm), no. of floret per spike, no. of spikes per plant, floret diameter (cm), corms weight per plot (g), weight of mother corm per plot, weight of daughter corm, corm diameter (cm), no. of corms per hectare, no. of cormels per hectare and corms yield/plant at both levels of genotypic and phenotypic variation.

Keywords: *Gladiolus, Genotypes, Genetic variability, Growth, yield and quality.*

INTRODUCTION

Floriculture is getting importance as a good source of income apart from giving pleasure and happiness. More than 150 countries are involved in floriculture trade worldwide. Approximately covered area by bulbous ornamentals in the world is 50,000 ha out of which gladiolus is cultivated in 9500 ha. In India approximately 3500 ha area is covered by bulbous ornamentals in which gladiolus is cultivated more than 1200 ha with an annual production of 707 million spikes (NHB, 2013), followed by tuberose (800 ha). In this way, gladiolus or sword lily (***Gladiolus spp***.) is the most popular ornamental bulbous plants commercially grown in our country for its excellent spikes with array of colors.

The genus of gladiolus includes about 200 species with more than 10,000 cultivars of which about 20 are grown commercially for cut flower purpose and many others are used as seasonal flowering plants in gardens and exhibitions. The colour range in gladiolus is fantastic and almost any color from near black to white, pink, violet, lilac or mauve, greenish, “smoky” and combination of these colors.

The name gladiolus was coined from Latin word *gladiolus,* meaning a sword because of shape of its foliage. Its common name is “corn flag" in Europe because *Gladiolus Illyricum* is found wild as weed in corn fields. It is also known as "water fall gladiolus" as it was found growing near the Victoria falls in the tropical forests of Africa. It was introduced into cultivation towards the end of the 16^{t}h century.

Heritability is the term used in genetics and plant breeding programmed that is used to measure the variation in a phenotypic trait, which is due to variation of gene between the individual in that population **(Wray and Visscher, 2008**). Heritability in other word estimates the fraction of phenotypic variation, which can lead to the genetic variation.
Only the genetic components of variation which are transmitted to next generation is very important factor in plant breeding programmed. The degree of contribution of genotypic variation to phenotypic variation for the characters in the group is expressed as the ratio of genetic variance to phenotypic variance for the trait. The ratio of genotypic variance to phenotypic variance for the trait in a population is known as heritability. The estimated range of Heritability is from Zero to One. Heritability which is close to Zero indicates variability in a trait among population which influence is totally caused by Environmental factors with little influence of genetic differences. A Heritability close to One indicates variability of trait among the population which influence is totally cause by genetic differences with very few influences of environmental influence.

Genetic Variability

The magnitude of variability present in a crop species are importance for the effective selection. The phenotypic variation in the population is due to a genotypic and environmental effect. Phenotypic variation is observable variation in population which includes both genotypic and environmental components which results that its magnitude differs due to environmental conditions whereas genotypic variation is the component of variation which is due to gene difference among the different individuals in a population. **Fisher (1918)** divides genetic variance into three components as additive variance, dominance variance and epistatic variation. Genetic Variability is the term used in plant breeding programmed which is the presence of different gene actions in the individual. Variability is a measurement of the trait that varies in response to genetic and environmental influence. The causes for genetic variability are due to fertilization between random sample, recombination or crossing over during meiosis, and mutation.

Correlation coefficient analysis

Correlation coefficient is the mutual relationship between two or more variables that determine or estimate the component characters on which selection can be based for improvement. It is important to study about the morphological variations and identification of suitable germplasm along with the evaluation of cultivars for improvement of the crop.

Genetic Advance

It is the improvement in the mean genotypic value of selected plants over the parental population. The measure of genetic gain under selection is said to be Genetic advance. If the amount of genetic variability is high then genetic advance is also high with this intention of above significance of the gladiolus crop, the current study was proposed in the Department of Horticulture, SHUATS, Prayagraj with the following objectives to enable the farmers for this vicinity to incorporate its cultivation with serious efforts.

MATERIALS AND METHODS

Location and source of experiment

The present investigation was carried out during Rabi season 2023 at Farm of Department of Horticulture at Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences Naini, Prayagraj Uttar Pradesh. The genetic materials were consisted of 22 varieties. The experiment was laid out in Randomized Block design(RBD) with three replications.

Experimental Details

The trail was laid out in a randomized block design with twenty two varieties replicated thrice. Spacing 1m*1m. Twenty two different varieties used are Souvik Biscuits, Dhanvan Lari, Manhittan, P.B. Clown, Arka Naveen, Jester, Punjab Lemon Delight, Urmi, Arka Partham, Priscilla, Red Ginger, Arka Tilak, Phule Ganesh, Aly Anyque, Chandni, Yellow Stone, Punjab Flame, Pusa Suhagin, Arka Aayush, P.S Hybrid, Phule Neelrekha, Punab Bink Chalnu.

Results and Discussion

Analysis of variance showed significant differences among the genotypes for the 22 characters studied analysis of variance showed significant difference among the genotypes for the different characters at 1% significance. The mean sum of squares due to genotypes showed is significant in differences of all characters under this study, except days taken to emergence of flower spike and days taken to show color of basal floret. In other words, the performance of the genotypes with respect to these characters was statistically different, suggesting scope for growth, flowering and corm yield characters improvement in Gladiolus. The present investigation confirms the earlier finding **Bhujbal *et al.,* (2013), Ahmad *et al*., (2012) and Ramzan *et al*., (2016).**

Table 3.1: Analysis of variance for 23 different growth, flowering and corm yield of Gladiolus.

S.No.	Characters	Analysis of Variance			
		Replication df=2	Genotypes df=14	Error df=28	Total=44
1.	Plant height (cm) 30DAS	0.21	107.15**	4.12	36.73
2.	Plant height (cm) 60DAS	20.21	174.91	7.74	61.50
3.	Plant height (cm) 90DAS	17.08	172.41**	18.65	67.50
4.	No.of leaves per plant at 30DAS	0.07	41.35**	0.11	13.23
5.	No.of leaves per plant at 60DAS	0.04	23.20**	0.21	7.52
6.	No.of leaves per plant at 90DAS	0.62	14.12**	0.60	4.90
7.	No.of shoots per plant	0.001	0.500**	0.004	0.161
8.	Days taken for 50% sprouting	0.001	1.390**	0.065	0.484
9.	Rachis length(cm)	17.57	347.64**	4.63	114.36
10.	No.of days to emergence of flower spike	14.36	65.00**	9.06	27.10
11.	Days to show colour of basal floret	10.69	53.38**	10.98	24.46
12.	No. of florets per spike	0.42	8.51**	0.29	2.91
13.	No. of spikes per plant	0.000	0.467**	0.005	0.152
14.	Floret length(cm)	0.043	2.689**	0.173	0.968
15.	Floret diameter(cm)	0.319	2.991**	0.127	1.047
16.	No. of corms produced per mother plant	0.000	0.713**	0.005	0.230
17.	Corm diameter(cm)	0.01	0.341**	0.073	
18.	Weight of corms(g)	0.034	2.958**	0.036	0.966
19.	Weight of corms per plant(gm)	0.56	179.86**	4.37	60.03
20.	Cormel diameter(cm)	0.00	1.01**	0.00	0.33
21.	No. of corms/hectare	20843542	19793699048**	149260589	6393926597
22.	No. of cormels/hectare	56581729239	7389188389789**	27749460061	2371336040846
23.	Yield of corms/plant(g)	13.91	3932.11**	11.90	1259.33

3.2.1 Genotypic coefficient of variation (GCV)

The estimates of GCV from present investigation are presented in table 4.3. Wide range of genotypic coefficient of variation (GCV) was observed for the characters ranging from No.of leaves at 30DAS (52.70) to days to show color of basal florets (4.32). High magnitude of GCV are recorded in No.of leaves (52.70), Corm yield/plant (46.41), No.of cormels/hectare (39.15), Cormel diameter (38.35), No.of corms/hectare(28.95), No.of corms per plant(28.95),No.of leaves at 60DAS(26.65), No.of shoot(26.65).

3.2.2 Phenotypic coefficient variation(PCV)

Wide range of phenotypic coefficient of variation (PCV) was observed for the characters ranging from No.of leaves at 30DAS (52.92) to days to show color of basal floret(5.79).

3.2.3 Heritability

The estimates of heritability from present investigation are presented in table 4.3. The higher heritability in broad sense is observed for the characters in Corms yield/ plant (99.10), No.of leaves 30das (99.21), Plant height at 60DAS (87.17), Floret length (83.21), No.of cormels/ hectare(99.10), Cormels diameter(97.90), No.of corms/plant(96), No.of shoot per plant(96.30), No.of leaves 60DAS(97.90), No.of spikes per plant(96.95), Weight of corm(93.06), No.of florets per spike(91.17) , Plant height at 30DAS (89.89), Floret diameter(87.32), No.of leaves(88.41), Corm diameter(97.90) , Days to first flowering(96.18), Rachis length (95.11).

3.2.4 Genetic advance

In the present investigation, the genetic advance estimates are found to be high in No.of cormels/hectare (3208828), No.of corms/hectare (164829).

3.2.5 Genetic advance % mean

In the present investigation, the genetic advance % mean estimates were found to be high for corm yield/plant (95.16), No.of cormels per hectare (80.16), Cormel diameter (78.48), No.of corms per plant (59.08).

Table 3.2. Estimation of components of variance and genetic parameters for 23 character growth, flowering and corm yield of 15 genotypes in Gladiolus

Characters	Mean	Min	Man	var (g)	var (p)	Heritability (%)	GA	GA% mean	GCV (%)	PCV (%)
Plant height cm (30 days)	47.94	40.05	61.32	34.31	38.43	89.28	11.40	23.31	12.01	12.71
Plant height cm (60 days)	72.17	58.90	93.17	55.71	63.49	87.17	14.40	19.68	10.21	10.88
Plant height cm (90 days)	106.54	88.20	118.65	51.29	69.92	73.32	12.62	12.09	6.86	8.01
No.of leaves (30 das)	7.20	2.15	12.09	13.74	13.87	99.21	7.60	108.12	52.71	52.91
No.of leaves (60 das)	10.10	6.17	14.41	7.65	7.82	97.09	5.24	54.16	26.65	27.01
No.of leaves (90 das)	18.08	14.50	21.85	4.57	5.10	88.41	4.00	22.7	11.74	12.45
No. of shoot per plant	1.52	1.10	2.21	0.11	0.15	96.30	0.89	54.62	26.65	26.96
Days taken for 50% sprouting	6.16	5.50	7.00	0.47	0.58	87.10	1.29	20.75	10.70	11.46
Days to first flowering	12.59	8.73	18.50	6.57	6.85	96.18	5.20	38.75	18.84	19.21
Rachis length (cm)	62.02	47.99	80.11	114.35	118.94	95.11	21.62	33.72	16.74	17.01
No. of days for emergence of flower spike	76.91	66.47	83.29	18.69	27.77	67.29	7.65	9.39	5.56	6.78
Days to show colour of basal floret	89.57	79.32	92.25	14.12	25.15	56.29	5.88	6.78	4.32	5.78
No. of florets per spike	14.65	11.78	17.60	2.75	3.01	91.17	3.25	22.76	11.65	12.21
No.of spikes per plant	1.62	1.87	2.14	0.17	0.11	96.95	0.87	53.70	26.41	26.88
Floret length	12.24	8.93	11.88	0.82	1.05	83.20	1.75	16.79	8.90	9.82
Floret diameter	9.50	8.07	10.96	0.91	1.01	87.32	1.85	20.21	10.32	11.01
No. of corms per plant	1.86	1.04	2.52	0.23	0.22	96	01	59.08	28.95	29.30
Corm diamter (cm)	5.82	3.43	6.45	0.98	1.07	95.91	2.10	37.96	18.66	18.96
Weight of corm(gm)	45.60	34.30	60.11	58.51	62.85	93.65	15.30	34.20	17.24	17.85
Cormel diameter(cm)	1.20	0.41	2.47	0.35	0.36	97.90	1.20	78.48	38.35	38.66
No. of corms / hectare	279339	174998	434994	6548146152	6697406740	98	164829	59.09	28.95	29.38
No.of cormels /hectare	4004537	1856311	7147009	2453812976575	2481562436630	99.10	3208828	80.16	39.15	39.38
Corms yield/plant(g)	78.10	35.49	156.61	1308	1320	99.10	74.15	95.16	46.41	46.62

3.3 Correlation Coefficient

Table 4.3.1 Estimates of genotypic correlation coefficient for 23 Growth characters, Spike yield and vase life with Corms yield/plant (g)

Character	No. of florets per spike	No.of spikes per plant	Floret length	Floret diameter	No. of corms per plant	Corm diameter (cm)	Weight of corm (gm)	Cormel diameter (cm)	No. of corms / hectare	No.of cormels /hectare	Corms yield/plant (g)
	13	14	15	16	17	18	19	20	21	22	23
Plant height cm (30 days)	0.379*	0.126	0.177	0.239	0.031	0.157	0.000	0.187	0.012	0.023	0.002
Plant height cm (60 days)	0.376*	0.127	0.277	0.303*	0.002	0.146	-0.026	0.324*	0.020	-0.044	-0.003
Plant height cm (90 days)	0.357*	-0.045	0.033	0.048	-0.212	-0.153	-0.234	0.334*	-0.227	-0.239	-0.212
No.of leaves (30 das)	0.691**	0.960**	0.975**	0.977**	0.913**	0.734**	0.899**	-0.001	0.917**	0.881**	0.897**
No.of leaves (60 das)	0.754**	0.977**	0.992**	0.964**	0.907**	0.677**	0.883**	-0.016	0.902**	0.868**	0.893**
No.of leaves (90 das)	0.748**	0.966**	0.971**	1.000**	0.852**	0.675**	0.833**	0.029	0.862**	0.826**	0.852**
No. of shoot per plant	0.771**	1.006**	0.988**	0.958**	0.930**	0.689**	0.891**	0.051	0.931**	0.900**	0.918**
Days taken for 50% sprouting	-0.833**	-0.934**	-0.978**	-0.950**	-0.881**	-0.669**	-0.834**	0.015	-0.887**	-0.855**	-0.865**
Days to first flowering	0.773**	0.949**	0.917**	0.945**	0.859**	0.687**	0.847**	0.068	0.863**	0.837**	0.854**
Rachis length (cm)	0.656**	0.967**	0.893**	0.867**	0.865**	0.608**	0.848**	-0.029	0.859**	0.831**	0.860**
No. of days to emergence of flower spike	-0.766**	-0.761**	-0.688**	-0.744**	-0.646**	-0.391**	-0.617**	0.042	-0.628**	-0.685**	-0.654**
Days to show colour of basal floret	-0.641**	-0.735**	-0.716**	-0.670**	-0.633**	-0.429**	-0.633**	0.232	-0.627**	-0.603**	-0.649**
No. of florets per spike		0.760**	0.815**	0.822**	0.651**	0.484**	0.574**	0.300*	0.649**	0.656**	0.638**
No.of spikes per plant			0.993**	0.936**	0.933**	0.674**	0.878**	0.016	0.928**	0.913**	0.923**
Floret length				0.912**	0.968**	0.777**	0.941**	-0.028	0.966**	0.929**	0.950**
Floret diameter					0.911**	0.816**	0.883**	0.135	0.899**	0.884**	0.872**
No. of corms per plant						0.855**	0.994**	-0.136	1.008**	0.996**	0.998**
Corm diamter cm							0.877**	0.019	0.856**	0.841**	0.819**
Weight of corm(gm)								-0.234	0.992**	0.991**	0.994**
Cormel diameter(cm)									-0.135	-0.109	-0.206
No. of corms / hectare										0.981**	0.995**
No.of cormels /hectare											0.990**
Corms yield/plant(g)											1.000

Table 3.3.2 .Estimates of Phenotypic correlation coefficient for 23 Growth characters, Spike yield and vase life with Corms yield/plant (g)

Character	No. of florets per spike	Number of spikes per plant	Floret length	Floret diameter	No. of corms per plant	Corm diameter (cm)	Weight of corm (gm)	Cormel diameter (cm)	No. of corms / hectare	No.of cormels /hectare	Corms yield/plant (g)
	13	14	15	16	17	18	19	20	21	22	23
Plant height cm (30 days)	0.323*	0.142	0.150	0.243	0.024	0.129	0.022	0.161	0.058	-0.001	0.021
Plant height cm (60 days)	0.332*	0.100	0.277	0.259	0.015	0.126	-0.062	0.312*	-0.018	-0.006	-0.027
Plant height cm (90 days)	0.253	-0.007	-0.014	0.052	-0.174	-0.112	-0.158	0.259	-0.148	-0.240	-0.137
No.of leaves (30 das)	0.668**	0.931**	0.892**	0.916**	0.901**	0.723**	0.862**	-0.001	0.895**	0.875**	0.885**
No.of leaves (60 das)	0.690**	0.950**	0.881**	0.923**	0.872**	0.653**	0.829**	-0.007	0.883**	0.849**	0.876**
No.of leaves (90 das)	0.625**	0.893**	0.822**	0.827**	0.830**	0.596**	0.780**	0.019	0.812**	0.769**	0.799**
No. of shoot per plant	0.741**	0.977**	0.889**	0.887**	0.900**	0.682**	0.828**	0.055	0.898**	0.892**	0.898**
Days taken for 50% sprouting	-0.733**	-0.862**	-0.874**	-0.838**	-0.822**	-0.631**	-0.710**	-0.005	-0.812**	-0.803**	-0.802**
Days to first flowering	0.719**	0.910**	0.823**	0.876**	0.831**	0.655**	0.771**	0.079	0.824**	0.823**	0.826**
Rachis length (cm)	0.622**	0.918**	0.812**	0.822**	0.827**	0.585**	0.777**	-0.031	0.838**	0.808**	0.835**
No. of days to emergence of flower spike	-0.617**	-0.626**	-0.635**	-0.547**	-0.518**	-0.364*	-0.503**	0.018	-0.547**	-0.528**	-0.558**
Days to show colour of floret	-0.500**	-0.518**	-0.539**	-0.564**	-0.438**	-0.318*	-0.433**	0.151	-0.447**	-0.479**	-0.447**
No. of florets per spike		0.704**	0.707**	0.737**	0.594**	0.474**	0.529**	0.276	0.598**	0.621**	0.597**
No of spikes per plant			0.873**	0.858**	0.910**	0.640**	0.858**	0.013	0.919**	0.890**	0.915**
Floret length				0.856**	0.862**	0.713**	0.769**	-0.004	0.865**	0.854**	0.852**
Floret diameter					0.828**	0.740**	0.781**	0.116	0.849**	0.822**	0.819**
No. of corms per plant						0.824**	0.960**	-0.138	0.985**	0.981**	0.985**
Corm diamter (cm)							0.824**	0.024	0.821**	0.819**	0.800**
Weight of corm(gm)								-0.237	0.963**	0.936**	0.969**
Cormel diameter(cm)									-0.139	-0.104	-0.208
No. of corms / hectare										0.972**	0.990**
No. of cormels /hectare											0.972**
Corms yield/plant (g)											1.000

CONCLUSION

Based on the present investigation it was concluded that the high magnitude of heritability (in broad sense) coupled with high genetic gain was observed for most of traits exhibiting additive genetic effect. The analysis of variance for different quantitative characters reviled significant differences among the genotypes for parameters like Growth, and floret diameter with Corms weight/plant (g) of gladiolus. The highest corms yield/plant (g/plant) of genotype was observed in Arka Aayush (156.60) followed by P.B Clown and Red Ginger. It was observed that PCV was higher than GCV for all the traits studied highest GCV and PCV is recorded in No.of corms per plant (46.41 and 46.62). Genotypic and phenotypic correlation coefficient analysis revealed that Corms weight/plant (g) showed positive significant association with plant height, no.of leaves per plant, no.of shoot per plant, rachis length (cm), no. of floret per spike, no. of spike per plant, floret diameter (cm), corm weight per plot (g), weight of mother corm per plot, weight of daughter corm, corm diameter (cm), no. of corm per hectare, no.of cormels per hectare and corm yield/plant at both levels genotypic and phenotypic. Revealed that the highest direct positive effect on Corm Yield/Plant was exhibited by No.of leaves per plant, No.of shoots per plant, rachis length (cm), days for colour of basal floret, no of floret per spike, no. of spike per plant, corm weight per plot (g), weight of mother corm per plot, and no. of corm per hectare at both levels of genotypic and phenotypic.

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