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Genetic variability, heritability, genetic advance and Correlation coefficient in *Gladiolus hybridus*

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Abstract
Gladiolus, a majestic bulbous ornamental crop grown throughout the world, belongs to family Iridaceae. With changing lifestyle and urban culture importance of ornamental flowers increasing day by day. In this regard gladiolus gained much importance. An experiment was carried out with ten gladiolus varieties in randomizes block design, with three replications at the Dept. of Hort, B.A.U. Ranchi during the period Dec2009- May2014, to estimate genetic variability, heritability, genetic advance and genetic advance as % of mean for 11 contributing characters.

The PCV were higher than GCV for all the characters taken into consideration. Phenotypic and genotypic coefficients of variation were highest for the spike length (34.16 and 34.18 respectively) followed by number of floret per spike (33.02 and 33.25 respectively) and lowest for size of corm (14.11 and 16.16 respectively) indicated the presence of sufficient genetic variability for selection in these traits. Days taken for the spike emergence was positively and highly significant with the days taken for bud initiation, days taken for 1st floret to show colour, days taken for 1st floret to open, no. of floret open at a time, diameter of the floret and spike length. Days taken for spike emergence was however, negatively and significantly correlated with no. of floret per spike, no. of shoot per plant and vase life.

Genetic advance ranged from 0.91 to 50.76 highest for spike length and lowest for size of corm. Expected genetic advance expressed as percent of mean ranged from 25.31 and70.33%. High heritability and high genetic advance in spike length (1.00 and 70.33). The selection on the basis of spike length, number of floret per spike and vase life will be more effective for further breeding programme.

Keywords: Gladiolus, Genotypic correlation, phenotypic correlation

Introduction
Gladiolus, a majestic bulbous ornamental crop grown throughout the world, belongs to family Iridaceae. With changing lifestyle and urban culture importance of ornamental flowers increasing day by day. In this regard gladiolus gained much importance. Gladiolus is very rich in its varietal wealth and every year there is an addition of new varieties, hence varietal evaluation and creation of new varieties offers scope to improve the existing cultivars or genotypes in gladiolus. Commercial success of any crop depends upon the availability of suitable cultivars to suit the particular environment and needs of the consumer. In order to sustain the availability of cultivars, crop improvement is the need of the time. Hence, variability information about the different characters present among the individual cultivars belonging to single species or different species is important for the future breeding programme. It also helps to access the extent of combining ability between two different contributing characteristics. However, the heritability estimate helps in determining the relative amount of heritable portion of variation. Exploitation of variability is of great importance and is prerequisite for the effective screening of superior genotype. Keeping this in view an experiment was planned in the Department of Horticulture, BAU, and Ranchi.

Material and Methods
Hybridization work with seven lines and three testers was done during rabi season 2009. Seeds of twenty one crosses were obtained from the parents and in the month of October 2010 seeds

Were sown for getting the cormels. These cormels were replanted further two seasons to attain standard size of corms. Thus the twenty one crosses were grown in the Rabi season 2013 in a Randomised block design with three replications and the observations were recorded to study the variability, heritability, genetic advance and correlation. Investigation was carried out by considering with eleven qualitative traits such as size of corm, Sprouting % of corm, Days taken for spike emergence, Days taken for flower bud initiation, Days taken for first floret to show colour, Days taken for first floret opening, Number of florets per spike, Number of florets open at a time, Diameter of floret (cm), Spike length (cm) and Vase life. The standard statistical procedures were followed for calculating genetic constants.

Result and Discussion

The estimates of heritability in broad sense specifying the heritable portion of total variation, helps in identifying the appropriate characters for selection. Even though the heritability values indicate of effectiveness of selection based on the phenotypic performance. Heritability along with estimates of expected genetic advance should be considered while making selection. In crop improvement only the genetic component of variation is important, since only this can guide the breeder. In this experiment the characters exhibited high hb^2 with high genetic advance in this study were in almost all the flowering characteristics but the highest values were in spike length (1.00 and 70.33), No. of Floret per Spike (0.99 and 67.56) and diameter of floret (0.99 and 56.54). Similar observations exhibited high hb2 along with low genetic advance in gladiolus were Days taken for Spike Initiation (1.00 and 57.04), Days taken for Bud Initiation (1.00 and 56.34) and Days taken for1st Floret to Show Colour (1.00 and 56.40). The high hb2 coupled with low genetic advance indicates non additive gene action. Similar results were reported by Negi *et al*. (1985) in gladiolus. Other remaining characters exhibited moderate heritability with low genetic advance.

Table 1: Estimate of genotypic, phenotypic, and environmental co-efficient of variance, heritability and genetic advance among the various characters

Characters	Mean	Range		GCV	PCV	Heritability (Broad sense)	Genetic Advancement 5%	Gen Adv. As % of Mean 5%
		Min	Max					
Size of Corm (cm)	3.55	2.50	4.83	14.11	16.16	0.76	0.91	25.31
Sprouting % of Corm	69.28	44.81	86.93	30.04	30.11	1.00	47.51	61.74
Days taken for Spike Initiation	67.49	65.80	83.20	27.75	27.80	1.00	38.90	57.04
Days taken for Bud Initiation	71.70	71.13	87.00	27.40	27.45	1.00	41.26	56.34
Days taken for1st Floret to Show Colour	80.42	82.53	95.73	27.42	27.47	1.00	45.90	56.40
Days taken for1st Floret to Open	83.56	82.66	100.20	27.36	27.41	1.00	47.50	56.25
No. of Floret/Spike	10.02	7.66	14.73	33.02	33.25	0.99	7.40	67.56
No. of Floret open at a time	3.98	3.46	5.26	30.92	31.67	0.95	2.55	62.20
Diameter of Floret(cm)	9.51	6.54	12.96	32.46	32.62	0.99	6.38	66.54
Spike Length(cm)	70.24	55.00	100.53	34.16	34.18	1.00	50.76	70.33
Vase Life	8.38	6.26	12.13	32.09	32.37	0.98	5.50	65.55

The estimates of genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) for eleven characters of gladiolus were presented in Table 1. All the values for eleven characters studied the phenotypic coefficient of variance were found to be higher than the genotypic coefficient of variance and the environmental factors also influenced the study. It is established that genetic variability is a basic prerequisite for plant breeding programme on which selection acts to evolve superior genotype. Thus the higher the amount of variation present for the various characters in the chosen material, greater is the scope for its improvement through selection. The GCV and PVC were computed to access the existing variability in the characters. The PCV were higher than GCV for all the characters indicating each and every character influenced by environmental factors up to some extent. These findings are in agreement with the work of Monika *et al*. (2008) [6]

The coefficient of variation for parents and crosses was maximum for no. of shoots per plant (17.41) followed by weight of corm (8.04). The minimum value showed with Spike length 1.17cm. Indicating these characters was influenced by environmental factors to greater extent. High heritability along with high genetic advance is also more important selection parameter. If the character is governed by non additive gene action it may give high heritability but low genetic advance if it is governed by additive gene action heritability and genetic advance both would be high. The high heritability in broad sense was observed in spike length, no of floret per spike, diameter of floret and vase life of the flower, these parameters also recorded high genetic advance in percentage of mean. Kumar *et al*. (2009) [4] reported in gladiolus that over dominance was exhibited by majority of the growth traits due to the action and interaction of both additive and dominant gene action.

The estimates of the genotypic correlation are presented in table No2. As indicated in the table the genotypic correlation coefficient in general was higher than that of their phenotypic correlation values. In few cases, however, the genotypic correlation coefficient was lower in value than the respective phenotypic correlation coefficient. Test of significance was applied to phenotypic as well as genotypic correlation coefficient, where the genotypic correlation coefficient was found more important for varietal improvement. Weight of the corm and size of the corm was positively correlated with each other and also positive correlation was observed with sprouting percentage of corm, days taken for spike emergence, bud initiation, days taken for 1st floret to show color, days taken for 1st floret to open, No. of florets per spike, No. of floret open at a time, diameter of the floret, spike length and vase life, No. of floret per spike was observed positively correlated with no. of floret to open at a time, diameter of the floret, spike length and vase life, Spike length was positively correlated with vase life as observed and one of the important and desirable characters for good hybrid. Genotypic and phenotypic correlation among the qualitative character showed that characters like spike emergence, bud initiation, 1st floret opening, diameter of the floret, spike length and vase life are important component of

quality flower production in Gladiolus as revealed by their correlation.

Correlation between various characters specially when partitioned into Genotypic and phenotypic and environmental components can be of great value in planning and evolving any breeding programme. Balaram *et al*. (2005) [1] and Choudhary *et al*. (2011) [2] suggested that genotypic correlation provides a measure of genotypic association between characters and give indication of character that may be useful indicators.

Table 2: Genotypic Correlation Coefficient for different characters in Gladiolus

Characters	Size of corm (cm)	Sprouting % of corm	Days taken for spike emergence	Days taken for bud initiation	Days taken for 1st floret to show color	Days taken for 1st floret to open	No of floret per spike	No. of floret open at a time	Diameter of the floret(cm)	Spike length (cm)	Vase life
Size of corm(cm)	-	0.551	0.439	0.436	0.440	0.454	0.669	0.647	0.735	0.765	0.731
Sprouting % of corm			0.797	0.827	0.824	0.825	0.873	0.831	0.780	0.794	0.818
Days taken for spike emergence				0.996	0.990	0.988	0.746	0.765	0.773	0.735	0.788
Days taken for bud initiation					0.992	0.990	0.762	0.777	0.769	0.738	0.784
Days taken for 1st floret to show color						0.999	0.771	0.793	0.788	0.752	0.806
Days taken for 1st floret to open							0.771	0.805	0.792	0.753	0.814
No. of floret per spike								0.856	0.835	0.875	0.826
No. of floret open at a time									0.884	0.849	0.876
Diameter of floret (cm)										0.923	0.896
Spike length(cm)											0.908
Vase life											-

*Significant at probability level 0.05 **Significant at probability level0.01

Table 3: Phenotypic Correlation Coefficient for different characters in Gladiolus

	Size of corm (cm)	Sprouting % of corm	Days taken for spike emergence	Days taken for bud initiation	Days taken for 1st floret to show color	Days taken for 1st floret to open	No of floret per spike	No. of floret open at a time	Diameter of the floret (cm)	Spike length (cm)	Vase life
Size of corm(cm)	-	0.476**	0.377**	0.377**	0.385**	0.399**	0.578**	0.553**	0.645**	0.666**	0.627**
Sprouting % of corm			0.794**	0.824**	0.821**	0.821**	0.867**	-0.809**	-0.775**	0.792**	-0.811**
Days taken for spike emergence				0.995**	0.989**	0.985**	-0.739**	0.747**	0.768**	0.733**	-0.780**
Days taken for bud initiation					0.991**	0.988**	0.755**	0.757**	0.765**	0.736**	0.775**
Days taken for 1st floret to show color						0.998**	0.763**	0.773**	0.782**	0.731**	0.798**
Days taken for 1st floret to open							0.763**	0.783**	0.785**	0.751**	0.805
No. of floret per spike								0.832**	0.826**	0.869**	0.811**
No. of floret open at a time									0.858**	0.828**	0.846**
Diameter of floret (cm)										0.917**	0.886**
Spike length(cm)											0.900**
Vase life											-

*Significant at probability level 0.05 **Significant at probability level0.01

Summary and Conclusion

Changes or improvement in the qualitative characters must be accompanied by changes in one or more of its components. The knowledge of heritability is essential since it indicates possibility and extent to which improvement is possible through selection. Thus it is evident that these process provide desirable attribute and their exploitation in future breeding programme would be highly useful in evolving new genotypes/ hybrids for remunerative commercial farming of Gladiolus.

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