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Correlation Studies in Gladiolus

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A study on the association of various morphological traits through correlation analysis in gladiolus (*Gladiolus x hybridus* Hort.) showed that spike length had significant positive correlation with plant height, rachis length, duration of flowering and number of florets per spike, whereas it had negative correlation with number of shoots per plant, size of the floret and number of corms per plant at both phenotypic and genotypic levels. Number of florets per spike was positively and significantly correlated with number of leaves per plant, rachis length, leaf area, spike length and number and weight of cormels produced per plant at both phenotypic and genotypic levels. The results of investigation revealed that spike length, number of florets per spike and floret size are important spike quality characters. Hence, these characters may be considered as selection indices in gladiolus breeding programme.

Key words: Gladiolus (*Gladiolus x hybridus* Hort.), correlation, spike length, variability

Gladiolus (*Gladiolus x hybridus* Hort.) is a very important bulbous cut flower crop grown for its beauty, elegance and majestic spikes. It has colourful florets borne on spike. Development of varieties having higher yield and improved quality have been main objectives of most of the breeding programmes. Heritable traits such as yield and quality are complex characters known to be collectively influenced by various polygenically inherited traits which are highly vulnerable to environmental changes. Hence, for an effective and efficient selection of genotypes in gladiolus for yield and quality parameters, the knowledge of direction and magnitude of association between yield and quality and their components and within components themselves become necessary. Such relationship can be known through precise estimation of genotypic and phenotypic correlation between yield and its components. Correlations between different characters helps in finding out the degree of inter relationship among various characters and in evolving selection criteria for improvement of the available germplasm. Studies on genetic association are useful to ascertain the important component characters on which selection can be made. Therefore, the present investigation was undertaken to find out the correlations among various component characters.

MATERIALS AND METHODS

The present investigation was carried out during 2008- 09, at the Research Farm of Department of Floriculture and Landscaping, College of Horticulture and Forestry, Jhalarapatan, Jhalawar (Rajasthan). Twelve genotypes of gladiolus (*Gladiolus x hybridus* Hort.) collected from diverse source were used for the present study. The genotypes *Viz*., 'Jyotsna', 'Sancerre', 'Urmil', 'TS-14', 'GS-2', 'Punjab Dawn', 'Spic-n-Span', 'Dhanvantari', 'Priscilla', 'Peter Pears', 'Sabnam' and 'Chandani' were included in the study. The experiment was laid out in randomized block design (RBD) with three replications. Healthy and uniform size corms of 3-5 cm diameter were planted at a depth of 6-8 cm in plots of 1.55 m × 1.10 m size at spacing of 40 cm between rows and 25 cm between plants. The experimental data were recorded on five randomly selected plants in each plot and subjected to variance and covariance analysis described by Panse and Sukhatme (1967). The correlation at phenotypic and genotypic levels between all possible pairs of characters were calculated from variance and covariance components as proposed by Al- Jibouri *et al*. (1958).

RESULTS AND DISCUSSION

Although, variability estimates provide information on the extent of improvement possible in different characters, they do not throw light on the extent and nature of relationship prevalent between the contributory characters and economically important characters. This could be obtained from simple association analysis that determines the direction and action of different characters. The estimate of genotypic correlations along with phenotypic correlations not only display clear picture of the extent of inherent association, but also indicate the extent to which these phenotypically expressed correlations are influenced by the environment. These results are supported by findings of Misra and Saini (1990) and Balaram and Janakiram (2009). Based on this analysis, the traits that can be selected in improving the desired variables can be ascertained. The phenotypic and genotypic correlation coefficients were computed in all possible combinations for 17 quantitative characters and are presented in Tables 1 and 2. In the present study, the genotypic correlation coefficients were observed to be higher than the phenotypic correlation coefficient for most of the traits.

The study showed that at both phenotypic and genotypic levels, spike length was found positively and significantly associated with plant height, rachis length, duration of flowering and number of florets per spike (Tables 1 and 2) and non significant positive correlation was found with number of leaves per plant, days to sleeping, leaf area, duration of flowering, size of the floret, number of florets open at a time, cormels produced per plant, corm weight and diameter of corm at both phenotypic and genotypic levels. It shows that spike length, which is an important attribute of cut flower quality, can be increased with increase in any one of these characters, specially the height of the plant, number of florets per spike and weight and diameter of corm. Similarly, the market value and marketability of gladiolus spikes depends upon the number of florets per spike, floret size and number of florets open at a time and as these characters had positive correlation with spike length, so a direct selection from germplasm lines may be effective for the improvement of this crop. The results obtained are in full agreement with the findings of Gil *et al*. (1978) and De and Misra (1994) suggesting selection of varieties on the basis of average to long spike length for improved number of florets per spike. However, Misra and Saini (1990) recorded negative or poor correlation of spike length with number of florets per spike. Floret size was positively correlated with number of leaves per plant, rachis length, leaf area, number of florets open at a time, and corm weight and diameter. It indicated that increase in floret size was possible with the increase in any of these traits. The results find support from findings of Katwate *et al*. (2002).
Plant height was positively and significantly correlated with rachis length, spike length, duration of flowering and number of florets per spike both at phenotypic and genotypic levels (Tables 1 and 2). This association of plant height with the characters mentioned is a desirable feature in this crop. Non-significant positive correlation was recorded between plant height and number of leaves per plant, leaf area, shoots per plant, number of cormels produced per plant, weight of cormels produced per plant, corm weight and diameter

of corm. Negative correlation was observed between plant height and size of floret, number of florets open at a time and corms produced per plant.

Number of leaves per plant had significant positive correlations with days to sleeping, leaf area, number of florets per spike and corm weight at both genotypic and phenotypic level indicating the importance of photosynthetic area for these characters. Non-significant positive correlation was recorded between number of leaves per plant and rachis length, spike length and size of the floret. Significant positive association of number of shoots per plant with number of corms per plant indicated that with increase in the number of shoots per plant increased the corm production which is a desirable attribute with respect to corm production and multiplic-ability of the genotype. However, for cut flower production more number of shoots per planted corm is a negative attribute as this character was negatively correlated with number of florets per spike, size of floret and corm weight. Jhon *et al.* (2002) also reported a similar trend in gladiolus. For early flowering, importance of reduced number of shoots per planted corm was indicated by negative correlation of days to sleeping with number of shoots per plant. The lack of association between number of florets per spike with days to sprouting, number of shoots per plant and number of corms produced per plant at genotypic level leads to the conclusion that these characters could be improved indepen-dently through selection. Corm diameter was positively and significantly correlated with rachis length, leaf area, size of the floret and corm weight at phenotypic level, whereas significant negative correlation was recorded for number of shoots and corms produced per plant at both genotypic and phenotypic levels. Corm weight exhibited positive and significant correlation with number of leaves per plant, leaf area, size of the floret and cormels weight per plant. De and Misra (1994) also obtained similar trends in gladiolus.

The yield in terms of cormels produced per plant can be increased with increase in plant height, rachis length, leaf area, spike length, shoots per plant, florets per spike, size of floret, number of floret open at a time, corms per plant, corm weight and diameter because these characters were positively correlated with cormels produced per plant at both phenotypic and genotypic levels. Negative correlation between cormel weight with cormels per plant indicated that with the increase in one parameter there will be decrease in another. Similar results were reported by Jhon *et al*. (2002).

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Table: 1. Phenotypic correlation co-efficients between different characters in gladiolus cultivars

Traits	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	X_{16}	X_{17}
X_1	1.000	0.129	0.115	0.278	0.366	0.165	0.302	0.394	-0.309	0.022	0.112	-0.110	-0.237	0.219	0.299	-0.064	0.160
X_2		1.000	0.064	-0.009	0.712**	0.122	0.653**	0.653**	0.078	0.387	-0.105	-0.018	-0.009	0.204	0.062	0.167	0.052
X_3			1.000	0.428*	0.288	0.501**	0.169	0.323	-0.744**	0.471*	0.053	0.084	-0.710**	-0.051	0.400*	-0.029	0.334
X_4				1.000	0.057	0.078	0.040	0.079	-0.459*	0.027	-0.332	-0.098	-0.444*	-0.456*	-0.078	-0.287	-0.108
X_5					1.000	0.419*	0.827**	0.622**	-0.153	0.761**	0.193	0.409*	-0.134	0.406*	0.396	0.430*	0.810**
X_6						1.000	0.162	0.139	-0.352	0.584**	0.386	0.509**	-0.389	0.604	0.619**	0.689**	0.498**
X_7							1.000	0.672**	-0.051	0.544**	-0.041	0.248	-0.007	0.101	0.078	0.132	0.128
X_8								1.000	-0.260	0.421*	-0.230	-0.048	-0.176	-0.123	0.100	0.053	-0.110
X_9									1.000	-0.158	-0.280	0.078	0.909**	0.176	-0.556**	0.158	0.428
X_{10}										1.000	0.210	0.060	-0.168	0.538**	0.350	0.621**	0.144
X_{11}											1.000	0.215	-0.305	0.539**	0.779**	0.379	0.596**
X_{12}												1.000	0.154	0.596**	0.171	0.707**	0.140
X_{13}													1.000	0.140	-0.574**	0.150	-0.416*
X_{14}														1.000	0.532**	-0.837**	0.365
X_{15}															1.000	0.414*	0.774**
X_{16}																1.000	0.298
X_{17}																	1.000

***= Significant at 5% level, ** = Significant at 1% level**

X_1= Days to corm sprout, X_2= Plant height (cm), X_3= No. of leaves/plant, X_4= Days to slipping, X_5=Rachis length (cm) , X_6=leaf area (cm^2), X_7= Spike length (cm), X_8= Duration of flowering, X_9= No. of shoots/plant, X_{10}= No. of florets/spike, X_{11}= Size of floret (cm), X_{12}= No. of florets open at a time, X_{13}= No. of corms/plant, X_{14} = No. of cormels/plant, X_{15}= Weight of corm (g), X_{16}= Cormels weight/plant (g), X_{17}= Diameter of corm (cm)

Table: 2. Genotypic correlation co-efficients between different characters in gladiolus cultivars

Traits	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	X_{16}	X_{17}
X_1	1.000	0.334	0.456*	0.383	0.436*	0.276	0.565**	0.718**	-0.597**	-0.117	0.160	-0.162	-0.515**	-0.373	0.482**	-0.167	0.386
X_2		1.000	0.103	0.136	0.821**	0.105	0.761**	0.745**	0.037	0.493**	-0.153	-0.036	0.016	0.226	0.060	0.173	-0.163
X_3			1.000	0.641**	0.304	0.631**	0.184	0.400*	-0.899**	0.466**	0.001	-0.160	-0.921**	-0.058	0.447*	0.007	0.436*
X_4				1.000	0.035	0.123	0.049	0.195	-0.512**	-0.003	-0.395	-0.128	-0.603**	-0.560**	0.168	-0.377	-0.155
X_5					1.000	0.462*	0.899**	0.738**	-0.150	0.803**	0.214	0.461*	-0.165	0.429*	0.408*	0.402*	0.210
X_6						1.000	0.139	0.155	-0.398*	0.703**	0.456*	0.543**	-0.424*	0.626**	0.686**	0.726**	0.692**
X_7							1.000	0.919**	-0.051	0.628**	-0.113	0.287	-0.005	0.117	0.089	0.167	0.235
X_8								1.000	-0.248	0.462*	-0.285	-0.075	-0.218	-0.145	0.123	0.009	-0.155
X_9									1.000	-0.179	-0.311	0.081	0.993**	0.189	-0.590**	0.161	0.700**
X_{10}										1.000	0.150	0.798**	-0.187	0.635**	0.380	0.737**	0.248
X_{11}											1.000	0.282	-0.331	0.609**	0.899**	0.481**	0.015
X_{12}												1.000	0.175	0.647**	0.174	0.784**	0.169
X_{13}													1.000	0.148	-0.625**	0.147	-0.702**
X_{14}														1.000	0.471*	-0.863**	0.533**
X_{15}															1.000	0.438*	0.040
X_{16}																1.000	0.436*
X_{17}																	1.000

***= Significant at 5% level, ** = Significant at 1% level, Characters as in Table 1**