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Path Coefficient Analysis of Floret Diameter with Growth and Floral Characters in Gladiolus

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ABSTRACT

An experiment was conducted with 12 gladiolus *(Gladiolus x hybridus* Hort.) cultivars under tropical conditions of Tirupati.. It was observed that the floret diameter exhibited a high level of positive and significant correlation with spike diameter, spike neck diameter and corm diameter. Path analysis revealed that spike diameter had greatest positive direct effect on floret diameter in gladiolus.

Key words: *Correlation, Diameter of floret, Gladiolus, Path analysis*

Gladiolus *(Gladiolus x hybridus* Hort.) is an important cut-flower crop in domestic as well as international markets. It belongs to family Irridaceae and is attributed as "Queen of bulbous ornamentals" due to its high popularity amongst the bulbous ornamentals cultivated in the world. It is also called as 'sword lily' due to its sword shaped leaves. Its cut-spikes are in great demand for bouquets and flower arrangements because of long spike length with magnificent inflorescence in exhaustive range of colors, different shades, varying number and size of the florets, arrangement of florets and extended post harvest life. Besides, it is also grown in beds for garden display and in pots for indoor gardening. Commercial cultivation of gladiolus is getting momentum day-by day being a potential money-spinner for the aesthetic world with more returns per unit area than the other horticultural crops. In India, there is wide fluctuation in the climatic parameters like temperature, light intensity and relative humidity which not only affects the quality parameters of the cut-flowers but also limit their availability for a particular period of the year.

Development of high yielding varieties with better quality blooms has been main objective of most of the breeding programmes. Heritable traits of yield and flower quality are complex characters and are known to be collectively influenced by various polygenically inherited traits which are highly vulnerable to environmental effects. 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 its components and quality components and within components themselves becomes necessary. The path coefficient analysis method splits the correlation coefficients into direct and indirect effects which help in assessing the relative influence of each important character on the ultimate floret quality. With this background information, a study on path coefficient analysis was undertaken in gladiolus.

MATERIAL AND METHODS

The experiment was conducted at Citrus Research Station, Tirupati during November 2015-16 and 2016 –17. The soil of the experimental field is red loamy with pH 6.4. The region lies in Seshachalam hill ranges dominated by sedimentary rocky-hilly terrain. The source of planting material is from Indian Institute of Horticultural Research and Lalbagh, Bangalore.

The cultivars included for study were Arka Gold , Arka Amar , Arka Ayush , Arka Kesar, Arka Naveen, American Beauty, Summer Sunset, Arka Darshan , Arka Sanjeevini , Arka Kum Kum, Arka Tilak, and Arka Aarthi. The corms of these 12 varieties were planted in randomized block design at a spacing of 30 x 30 cm in beds of 2x2 m size at a depth of 6-8 cm on November 2015 in three replications. All the fertilizer and protection measures were carried out as per the recommendations were followed to grow a successful crop.

The observations were recorded on various parameters viz., plant height, number of leaves per plant, leaf area, number of florets per spike, corm diameter, spike length, rachis length, spike diameter and floret neck diameter on five randomly selected plants. Path coefficient analysis was carried out using phenotypic correlation coefficient for diameter of floret as dependent variables as suggested by Wright (1921) and illustrated by Dewey and Lu (1959).

RESULTS AND DISCUSSION

The path coefficient analysis of diameter of floret as dependent variable and direct and indirect effects of independent variables is presented in Table.

Table. Direct (diagonal) and indirect (above and below diagonal) effects of nine characters on floret diameter in gladiolus at phenotypic level

Characters.	Plant height	No of leaves	Leaf area	No of florets	Corm diameter	Spike length	Rachis length	Spike diameter	Spike neck
Plant height	0.0622	-0.0009	-0.0022	-0.0098	0.0096	-0.0385	-0.0641	0.0271	0.0514
No of leaves	0.0039	-0.0152	-0.0089	-0.0548	0.0534	-0.0100	-0.0260	0.1330	-0.0201
Leaf area	0.0076	-0.0075	-0.0179	0.0856	0.0795	-0.0097	-0.0378	0.2363	0.0458
No of florets	-0.0014	-0.0019	0.0035	-0.4372	-0.0566	-0.0020	0.0157	-0.2484	-0.0737
Corm diameter	0.0037	-0.0050	-0.0088	0.1531	0.1617	0.0074	-0.0163	0.2224	0.0631
Spike length	0.0403	-0.0026	-0.0029	-0.0146	-0.0202	-0.5950	-0.0748	0.1190	-0.0223
Rachis length	0.0440	-0.0044	-0.0074	0.0754	0.0290	-0.0490	0.0908	0.1981	-0.0026
Spike neck diameter	-0.0039	-0.0047	-0.0098	0.2512	0.0832	-0.0164	-0.0416	0.4324	0.0804
Correlation with floret diameter	-0.0239	0.0023	-0.0061	0.2402	0.0761	0.0099	0.0018	0.2592	0.1341

Residual effect = 0.3868.

The results indicated that all the characters except number of florets per spike and spike length showed significant positive correlation with diameter of floret, indicating that selection for any of these characters results in increase in diameter of floret. Positive association of diameter of floret with floret length and spike weight was confirmed by Balaram and Janakiram (2009) in gladiolus, and positive association with floret length and spike length by Anuradha *et al.* (2002) in gladiolus. Path coefficient for floret diameter as the dependent variables showed that spike diameter (0.4324) had maximum direct effect followed by corm diameter (0.1617) and spike neck diameter (0.1341)

Hence, spike diameter and corm diameter are the two major factors influencing diameter of floret directly. The high magnitude of phenotypic correlation of spike diameter (r=0.7709), spike neck diameter (r=0.6936) and corm diameter (r=0.5814) with diameter of floret was mainly due to their direct effects. Similarly, positive correlation of flower diameter with flower stalk thickness in gerbera was reported by Singh and Singh (2006). However, Balaram and Janakirarn (2009) observed positive correlation of floret diameter with spike weight, plant height, rachis length and number of florets open at one time in gladiolus.

Though plant height and floret neck diameter exhibited low positive direct effects, yet their phenotypic correlations were positive and significant indicating that they had high indirect effects through other traits viz, spike diameter, floret neck and corm diameter in accordance with the results obtained by Anuradha (1990) for floret length and plant height. Rao (1982) reported negative direct effect of plant height of flower size in China aster. This also indicated that their positive and significant correlations at the phenotypic level were due to their direct effects. Among indirect effects, plant height recorded positive influence via spike diameter and spike neck diameter only. Number of leaves, leaf area, number of florets, spike length and rachis length recorded negative direct effect on diameter of floret but exerted positive and high indirect effect except number of florets through spike diameter. Anuradha *et al.* (2002) observed negative direct effect of number of leaves, leaf area and spike length on floret diameter in gladiolus.

Number of leaves and leaf area had negative direct effect on floret diameter but exerted positive and high indirect effect through spike diameter (0.2363). Number of florets per spike had negative direct effect (-0.4372) with positive and significant phenotypic correlation indicating positive indirect effect via rachis length. The result is in accordance with the findings by Balaram and Janakiram (2009) for number of florets per spike and spike length. Diameter of corm had maximum direct effect (0.1617) for floret diameter and high positive indirect effect through spike diameter (0.2224) and floret neck diameter (0.0631).

Spike length and rachis length recorded negative direct effects on diameter of floret but their indirect effect via spike diameter was high. Similarly, spike neck diameter recorded high positive indirect effect through spike diameter (0.2592) on floret diameter.

The residual effects indicated that the characters studied contributed 61.32% of variation in diameter of floret, while 38.68% was due to unidentified factors like other characters which were not included

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	X10	X11	X12	X13	X14	X15	X16	X17
X_1	1.000	0.129	0.115	0.278	0.366	0.165	0.302	0.394	-0.309	0.022	0.112	-0.11	-0.237	0.219	0.299	-0.064	0.16
X_2		1	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	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	0.057	0.078	0.04	0.079	-0.459*	0.027	-0.332	-0.098	-0.444*	-0.456*	-0.078	-0.287	-0.108
X_5					1	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	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	0.672**	-0.051	0.544**	-0.041	0.248	-0.007	0.101	0.078	0.132	0.128
X_8								1	-0.26	0.421*	-0.23	-0.048	-0.176	-0.123	0.1	0.053	-0.11
X_9									1	-0.158	-0.28	0.078	0.909**	0.176	-0.556**	0.158	0.428
X10										1	0.21	0.06	-0.168	0.538**	0.35	0.621**	0.144
X11											1	0.215	-0.305	0.539**	0.779**	0.379	0.596**
X12												1	0.154	0.596**	0.171	0.707**	0.14
X13													1	0.14	-0.574**	0.15	-0.416*
X14														1	0.532**	-0.837**	0.365
X15															1	0.414*	0.774**
X16																1	0.298
X17																	1

***= 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	X10	X11	X12	X13	X14	X15	X16	X17
X_1	1.000	0.334	0.456*	0.383	0.436*	0.276	0.565**	0.718**	-0.597**	-0.117	0.16	-0.162	-0.515**	-0.373	0.482**	-0.167	0.386
X_2		1	0.103	0.136	0.821**	0.105	0.761**	0.745**	0.037	0.493**	-0.153	-0.036	0.016	0.226	0.06	0.173	-0.163
X_3			1	0.641**	0.304	0.631**	0.184	0.400*	-0.899**	0.466**	0.001	-0.16	-0.921**	-0.058	0.447*	0.007	0.436*
X_4				1	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	0.462*	0.899**	0.738**	-0.15	0.803**	0.214	0.461*	-0.165	0.429*	0.408*	0.402*	0.21
X_6						1	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	0.919**	-0.051	0.628**	-0.113	0.287	-0.005	0.117	0.089	0.167	0.235
X_8								1	-0.248	0.462*	-0.285	-0.075	-0.218	-0.145	0.123	0.009	-0.155
X_9									1	-0.179	-0.311	0.081	0.993**	0.189	-0.590**	0.161	0.700**
X10										1	0.15	0.798**	-0.187	0.635**	0.38	0.737**	0.248
X11											1	0.282	-0.331	0.609**	0.899**	0.481**	0.015
X12												1	0.175	0.647**	0.174	0.784**	0.169
X13													1	0.148	-0.625**	0.147	-0.702**
X14														1	0.471*	-0.863**	0.533**
X15															1	0.438*	0.04
X16																1	0.436*
X17																	1

***= 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)

in the analysis i.e. it indicates that some more characters need to be included in the path analysis.

CONCLUSION

From the above results, it can be inferred that selection for spike diameter, floret neck diameter and corm diameter directly increases diameter of floret.

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