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Path Coefficient Analysis in Gladiolus

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Abstract: *Experiment was carried out to find out the association between different characters and direction of those characters towards the yield taking 30 genotypes of gladiolus grown over two successive year in Department of Floriculture and Landscaping. The pooled data was analyzed for path coefficient study. Path-coefficient analysis of various quantitative characters revealed that distance between two florets and spike length could be considered for improvement of number of florets per spike because of their strong positive direct effect on this trait. Similarly characters like rachis length and leaf length had strong positive direct effect on spike length which may be considered as criteria for selection.*

I. Introduction

Gladiolus (Gladiolus grandiflorus Endra) a member of the family Iridaceae and subfamily Ixoideae, is one of the most popular ornamental bulbous plants grown commercially in many parts of the world for its fascinating flowers with variety of colours, huge form of florets and good keeping quality. As a cut flower it has earned its place of importance owing to its utility in bouquets, in indoor decoration and flower arrangements. Gladiolus is also grown as garden plant in herbaceous borders, beddings, rockeries and pots for beautification. Every now and then, a superior cultivar replaces the existing one which is in many respects very similar to it. This is a continuous process and the demand for still better cultivars is there all the time. Besides, the cultivars lose their existence in the course of time. Thus, the situation demands to continuously breed new cultivars. Thus, a new quality cultivar has a lot of possibilities as a welcome addition and also has a considerable commercial value .For this it is vital to have understanding of the association between the component characters and their relative contribution to economic yield (Length of spike, size of floret and number of florets per spike) to bring about a rational improvement in gladiolus in the desired direction. Path analysis has been used to organize the relationship between predicted variable and responsible variables. To understand the direct and indirect effects of each character on flower yield and the application of selection pressure in a better way for yield improvement, partitioning of correlation coefficient into direct and indirect effects through path coefficient analysis is very important. The correlation coefficients were used for carrying out path coefficient analysis.

II. Materials And Methods

The present investigation was carried out at Department of Floriculture and Landscaping, College of Agriculture, OUAT, Bhubaneswar for two successive year to study the path coefficient analysis in gladiolus. The experiment consisted of 30 genotypes of gladiolus grown in randomized block design with three replication with a spacing of 30cm x 20cm. Observations were recorded for five plants of each variety under each replication selected randomly for 14 and 15 important characters for two set of path coefficient analysis taking two effective characters. In the first set of analysis length of spike was taken as the effect with other characters like; plant height, girth, number of leaves at spike emergence stage, leaf length, leaf width, days to emergence of flower spike, spike diameter, rachis length, length of floret, diameter of floret, distance between two florets, weight of corm and diameter of corm related to this as the causal factors. In second set of analysis number of florets per spike was taken as the effect with other characters like; plant height, girth, number of leaves at spike emergence stage, leaf length, leaf width, days to emergence of flower spike, length of spike, spike diameter, rachis length, length of floret, diameter of floret, distance between two florets, weight of corm and diameter of corm related to this as the causal factors. The mean and pooled data were analysed for path coefficient study as per the method suggested by Dewey and Lu (1959).

III. Results And Discussion

Path analysis has been used to organize the relationship between predicted variable and responsible variables. To understand the direct and indirect effects of each character on flower yield and the application of selection pressure in a better way for yield improvement, partitioning of correlation coefficient into direct and indirect effects through path coefficient analysis is very important. Correlation coefficient which measure the association between any two characters may not give true comprehensive picture of rather complex situation due to mutual relationship among different characters which may be positive or negative. In such situation path coefficients are better indices which provide a means of measuring direct and indirect effect of each individual

variable through other variables on yield. Wright (1921) suggested that path coefficient analysis provides a better knowledge as it reveals direct and indirect causes of association and permits a critical examination of the specific forces acting to produce a given correlation and measure the relative important of each causal factor. The cause and effect relationship with values of correlation (number of florets per spike & length of spike) and path coefficient for the component traits at genotypic and phenotypic level are presented in Table 1&2(for number of florets per spike) and 3&4 (for length of spike).

The genotypic path coefficient analysis for **number of florets per spike** revealed that distance between two florets, diameter of floret, spike diameter and length of spike had shown high positive direct effect on number of florets per spike. Positive direct effects of lower magnitude were also observed for plant height, diameter of corm, weight of corm, number of leaves, girth and days to emergence of flower spike. Leaf length, rachis length, leaf width and length of floret exhibited negative direct effect being highest in leaf length followed by rachis length, leaf width, length of floret.

The phenotypic path coefficient analysis revealed that diameter of floret, distance between two florets, length of spike and girth had high positive direct effect on number of florets per spike whereas plant height, spike diameter, weight of corm, diameter of corm had shown positive direct effects of lower magnitude. Leaf length, number of leaves, leaf width, days to emergence of spike, rachis length and length of floret exhibited negative direct effect being highest in leaf length. On the basis of results obtained in respect of genotypic and phenotypic path coefficient analysis it can be concluded that selection for distance between two florets, diameter of floret, spike diameter, length of spike and girth of plant may improve the number of florets per spike in gladiolus. The observed results in accordance with the findings of Choudhary et al. (2011) for spike length who concluded that improvement in spike length, rachis length and plant height would directly increase number of florets per spike. The findings are in agreement with the findings of Sirohi et al. (2000), Mishra and Jha (2001), Nimbaikar et al. (2001), Anuradha et al. (2000) reported direct and indirect effect of various characters on number of florets per spike similar to the present findings.

The genotypic path coefficient analysis for **length of spike** revealed that rachis length, leaf length, diameter of floret, distance between two florets, number of leaves, girth, spike diameter and days to emergence of flower spike have shown positive direct effect having maximum in rachis length followed by leaf length and diameter of floret. Length of floret, plant height, diameter of corm, leaf width and weight of corm exhibited negative direct effect being highest in length of floret.

The phenotypic path-coefficient analysis revealed that rachis length, leaf length, distance between two florets, number of leaves, spike diameter, days to emergence of spike have shown direct positive effect having maximum in rachis length followed by leaf length. Length of floret, plant height, leaf width, weight of corm, diameter of corm and diameter of floret exhibited negative direct effect being highest in length of floret. On the basis of findings of the present study in respect of genotypic and phenotypic path coefficient analysis it was inferred that by improving rachis length, leaf length and diameter of florets we can bring about improvement in spike length. Similar results have been reported by Choudhary et al. (2011) who observed that rachis length exhibited direct effect on spike length in gladiolus. The findings are also in agreement with Lalet al.(1985),Balaram and Janakiram (2009) in gladiolus.

IV. Conclusion

On the basis of the findings of the present investigation it is concluded that direct selection for number of florets per spike indirect selection through distance between two florets and spike length should be considered for further improvement of number of florets per spike in gladiolus because of their strong positive direct effect. Besides, diameter of floret and girth may also be considered as criteria for selection.

Similarly, in addition to direct selection for spike length, indirect selection through rachis length and leaf length should be considered for further improvement in spike length because of their strong positive direct effect. Other character like diameter of floret may also be considered as criterion for selection.

Table 1 Direct and indirect effects of component characters on no. of florets per spike at genotypic level in gladiolus genotypes

Effect of character	Effect via character														
	Plant height (cm)	Girth (cm)	No. of leaves at spike emergence stage	Leaf length (cm)	Leaf width (cm)	Days to emergence of flower spike	Length of spike (cm)	Spike diameter (cm)	Rachis length (cm)	Length of floret (cm)	Diameter of floret (cm)	Distance between two florets (cm)	Weight of corm (cm)	Diameter of corm (cm)	Genotypic correlation coefficient of no. of florets per spike
Plant height(cm)	.246	.006	-.007	-.364	-.025	.006	.043	.128	-.022	-.009	.075	.163	-.011	-.022	.206
Girth(cm)	.018	.086	.010	-.058	-.025	-.001	.075	.251	-.056	-.004	-.057	.167	-.006	-.014	.386
No. of leaves at spike emergence stage	-.019	.009	.093	-.119	.000	-.004	.045	-.052	-.022	-.027	.091	-.001	-.001	-.013	-.021
Leaf length(cm)	.171	.009	.021	-.523	-.025	.004	.061	.174	.028	-.008	.048	.113	-.007	-.023	.043
Leaf width(cm)	.040	.014	.000	-.085	-.156	.001	.024	.129	-.075	-.011	-.024	-.078	.042	.079	-.100
Days to emergence of flower spike	.081	-.007	-.021	-.135	-.010	.017	.002	.025	.018	-.011	.087	.163	.013	-.067	.156
Length of spike(cm)	.026	.016	.010	-.078	-.009	.000	.406	.164	-.408	-.011	.056	.432	-.015	-.026	.563
Spike diameter(cm)	.069	.047	-.011	-.200	-.044	.001	.146	.454	-.163	-.029	.085	.109	.003	-.022	.445
Rachis length(cm)	.011	.010	.004	.030	-.025	-.001	.346	.155	-.478	-.051	.184	.408	-.006	-.004	.585
Length of floret(cm)	.016	.003	.019	-.030	-.013	.001	.033	.099	-.184	-.133	.463	.191	-.013	-.038	.416
Diameter of floret(cm)	.036	-.010	.017	-.049	.007	.003	.045	.076	-.174	-.121	.507	.195	-.020	-.040	.472
Distance between two florets(cm)	.058	.021	.000	-.086	.018	.004	.255	.072	-.284	-.037	.144	.687	-.048	-.102	.701
Weight of corm(cm)	-.026	-.005	-.001	.036	-.065	.002	-.058	.011	.030	.017	-.102	-.329	.101	.105	-.285
Diameter of corm(cm)	-.027	-.006	-.006	.059	-.060	-.006	-.052	-.049	.009	.024	-.099	-.340	.051	.206	-.293

Figures underlined denote the direct effects
Residual effect = 0.441 , R^2 = 80.532

Table 2 Direct and indirect effects of component characters on no. of florets per spike at phenotypic level in gladiolus genotypes

Effect of character	Effect via character														
	Plant height (cm)	Girth (cm)	No. of leaves at spike emergence stage	Leaf length (cm)	Leaf width (cm)	Days to emergence of flower spike	Length of spike (cm)	Spike diameter (cm)	Rachis length (cm)	Length of floret (cm)	Diameter of floret (cm)	Distance between two florets (cm)	Weight of corm (cm)	Diameter of corm (cm)	Phenotypic correlation coefficient of no. of florets per spike
Plant height(cm)	.165	.018	.004	-.150	-.019	-.001	.032	.024	-.003	-.005	.055	.088	-.008	-.003	.198
Girth(cm)	.012	.248	-.006	-.020	-.020	.000	.045	.054	-.005	-.001	-.040	.080	-.004	-.002	.341
No. of leaves at spike emergence stage	-.012	.030	-.054	-.043	-.002	.001	.029	-.009	-.002	-.015	.067	-.001	-.001	-.002	-.014
Leaf length(cm)	.111	.022	-.010	-.224	-.018	-.001	.044	.036	.003	-.006	.034	.063	-.004	-.003	.045
Leaf width(cm)	.023	.037	-.001	-.031	-.132	.000	.013	.030	-.007	-.007	-.017	-.042	.030	.010	-.093
Days to emergence of flower spike	.051	-.018	.012	-.054	-.007	-.003	.000	.005	.002	-.008	.070	.093	.009	-.009	.141
Length of spike(cm)	.018	.038	-.005	-.034	-.006	.000	.291	.034	-.042	-.007	.043	.237	-.010	-.003	.553
Spike diameter(cm)	.032	.105	.004	-.062	-.031	.000	.077	.128	-.012	-.015	.049	.051	.001	-.002	.323
Rachis length(cm)	.008	.024	-.003	.011	-.019	.000	.241	.031	-.051	-.032	.144	.230	-.005	.000	.581
Length of floret(cm)	.009	.003	-.009	-.014	-.010	.000	.024	.022	-.018	-.089	.369	.109	-.009	-.005	.382
Diameter of floret(cm)	.021	-.023	-.008	-.018	.005	-.001	.030	.015	-.017	-.078	.424	.108	-.015	-.005	.438
Distance between two florets(cm)	.036	.049	.000	-.035	.014	-.001	.171	.016	-.029	-.024	.114	.403	-.035	-.013	.666
Weight of corm(cm)	-.017	-.014	.001	.013	-.052	.000	-.040	.002	.003	.011	-.083	-.186	.075	.014	-.274
Diameter of corm(cm)	-.017	-.014	.003	.027	-.047	.001	-.033	-.009	.001	.014	-.075	-.185	.037	.029	-.269

Figures underlined denote the direct effects
Residual effect = 0.563 , R2 = 68.344

Table 3 Direct and indirect effects of component characters on length of spike at genotypic level in gladiolus genotypes

Effect of character	Effect via character													
	Plant height (cm)	Girth (cm)	No. of leaves at spike emergence stage	Leaf length (cm)	Leaf width (cm)	Days to emergence of flower spike	Spike diameter (cm)	Rachis length (cm)	Length of floret (cm)	Diameter of floret (cm)	Distance between two florets (cm)	Weight of corm (cm)	Diameter of corm (cm)	Genotypic correlation coefficient of length of spike
Plant height(cm)	-.153	.004	-.005	.192	-.005	.004	.006	.044	-.032	.022	.018	.002	.009	.106
Girth(cm)	-.011	.050	.006	.030	-.005	-.001	.012	.111	-.014	-.017	.018	.001	.005	.186
No. of leaves at spike emergence stage	.012	.005	.058	.063	.000	-.003	-.002	.045	-.100	.027	.000	.000	.005	.110
Leaf length(cm)	-.106	.005	.013	.277	-.005	.003	.008	-.055	-.027	.014	.012	.001	.009	.150
Leaf width(cm)	-.025	.008	.000	.045	-.029	.001	.006	.149	-.040	-.007	-.008	-.009	-.031	.059
Days to emergence of flower spike	-.051	-.004	-.013	.071	-.002	.012	.001	-.036	-.040	.026	.018	-.003	.026	.006
Spike diameter(cm)	-.043	.027	-.007	.106	-.008	.001	.021	.324	-.105	.025	.012	-.001	.009	.361
Rachis length(cm)	-.007	.006	.003	-.016	-.005	.000	.007	.950	-.186	.054	.045	.001	.002	.854
Length of floret(cm)	-.010	.001	.012	.016	-.002	.001	.005	.366	-.482	.136	.021	.003	.015	.081
Diameter of floret(cm)	-.023	-.006	.010	.026	.001	.002	.004	.345	-.440	.149	.021	.004	.016	.111
Distance between two florets(cm)	-.036	.012	.000	.046	.003	.003	.003	.564	-.134	.042	.075	.010	.040	.629
Weight of corm(cm)	.016	-.003	-.001	-.019	-.012	.002	.001	-.060	.061	-.030	-.036	-.022	-.041	-.144
Diameter of corm(cm)	.017	-.003	-.004	-.031	-.011	-.004	-.002	-.018	.088	-.029	-.037	-.011	-.081	-.127

Figures underlined denote the direct effects
Residual effect = 0.322 , R2 = 89.652

Table 4 Direct and indirect effects of component characters on length of spike at phenotypic level in gladiolus genotypes

Effect of character	Effect via character													
	Plant height (cm)	Girth (cm)	No. of leaves at spike emergence stage	Leaf length (cm)	Leaf width (cm)	Days to emergence of flower spike	Spike diameter (cm)	Rachis length (cm)	Length of floret (cm)	Diameter of floret (cm)	Distance between two florets (cm)	Weight of corm (cm)	Diameter of corm (cm)	Phenotypic correlation coefficient of length of spike
Plant height(cm)	-.117	.002	-.004	.167	-.008	.010	.008	.045	-.016	-.002	.017	.005	.004	.111
Girth(cm)	-.008	.022	.007	.022	-.009	-.002	.019	.087	-.004	.001	.016	.002	.002	.154
No. of leaves at spike emergence stage	.009	.003	.056	.048	-.001	-.007	-.003	.043	-.048	-.002	.000	.000	.002	.100
Leaf length(cm)	-.078	.002	.011	.249	-.008	.008	.012	-.046	-.018	-.001	.012	.003	.005	.150
Leaf width(cm)	-.016	.003	.001	.034	-.058	.002	.010	.130	-.022	.000	-.008	-.017	-.014	.046
Days to emergence of flower spike	-.036	-.002	-.012	.061	-.003	.032	.002	-.038	-.026	-.002	.018	-.005	.012	.000
Spike diameter(cm)	-.022	.009	-.004	.069	-.014	.001	.044	.221	-.049	-.001	.010	-.001	.003	.266
Rachis length(cm)	-.006	.002	.003	-.013	-.008	-.001	.011	.905	-.106	-.004	.045	.003	.001	.831
Length of floret(cm)	-.006	.000	.009	.015	-.004	.003	.007	.327	-.293	-.011	.021	.005	.006	.081
Diameter of floret(cm)	-.015	-.002	.009	.020	.002	.005	.005	.308	-.255	-.012	.021	.009	.007	.102
Distance between two florets(cm)	-.025	.004	.000	.039	.006	.007	.006	.518	-.079	-.003	.079	.020	.018	.589
Weight of corm(cm)	.012	-.001	-.001	-.015	-.023	.004	.001	-.054	.035	.002	-.036	-.044	-.019	-.139
Diameter of corm(cm)	.012	-.001	-.003	-.030	-.021	-.010	-.003	-.012	.047	.002	-.036	-.022	-.039	-.114

Figures underlined denote the direct effects
Residual effect = 0.416 , R^2 = 82.672

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