STUDY OF CORRELATION COEFFICIENT AND PATH COEFFICIENT ANALYSIS IN GLADIOLUS (*GLADIOLUS HYBRIDUS* HORT.)

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Abstract: Correlation coefficient and path analysis in fifteen genotypically diverse genotypes of gladiolus (*Gladiolus hybridus* Hort.) were studied at Horticultural Research Centre (HRC) of SVPUAT, Meerut, U.P. during the years 2013-14 for seventeenth important characters. Number of corms per plant showed positive and significant genotypic and phenotypic associations with diameter of corm, number of spikes per corm and flower. Path coefficient analysis provides an effective means of a critical examination of specific force action to produce a given correlation and measure the relative importance of each factor. Path results showed that maximum positive direct effect was observed for length of rachis followed by, leaf length, visibility of spike and spikes per corm and rest of the characters showed negative correlation at genotypic and phenotypic level.

Keywords: Gladiolus, Correlation, Path analysis, Flower characters

INTRODUCTION

Gladiolus (*Gladiolus hybridus* Hort.) is one of the most important bulbous ornamentals for cut flower trade in India. It is also ideal both for garden display, floral arrangements for table and interior decoration as well as making high quality bouquet (Lepcha *et al.,* 2007). Gladiolus is very rich in varietal wealth and every year there is an addition of new varieties (Kumar and Yadav 2005). It is also known that the modern cultivars are derived from inter-specific hydrides among several species. Hence, wide variation is exhibited by gladiolus cultivars for their growth habit, size, shape and color of as well as spikes, and florets. The assessment of natural genetic variation is important not only for ethical and aesthetic reasons but also to ensure that genetic resources may be used even more efficiently and sustainably in agriculture and other industries. Thus, there is urgent need to assess the variation that already exist and how it can be conserved and utilized effectively.

MATERIAL AND METHOD

The present investigation was carried out at Horticulture Research Centre (HRC), Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Uttar Pradesh, India during Rabi session 2013-2014. The experimental material for the present investigation was use fifteen varieties/genotypes Punjab Pink, Punjab Glance, Pacific, Orange Ginger, Prabha, Sylvia, Aldebaran, Pricilla, Novalux, Gold Field, Ocilla, Kum-Kum, Arka Keshar, Arka Gold and American Beauty the trail was laid out in randomized complete block design and replicated thrice. Following observations for morphological characters based on five randomly selected plants in each treatments/genotype of all replications were recorded at 30 days interval, respectively. The following characters were taken in the study i.e. pant height, number of leaf per plant, leaf length, leaf width, number of suckers per corm, length of spike, length of rachis, number of spikes per corm, diameter of spike, number of flower per spike, flower diameter, visibility of spike in (day), opening of first flower in (day), longevity of spike in (day), diameter of corm, weight of corm, number of corms per plant and cormlets per plant. The recorded data were statistically analysed i.e. phenotypic and genotypic correlation coefficients calculated by the formula suggested by Al-Jibauri *et al.* (1958) and Miller *et al.* (1958) and path estimated by Dewey and Lu (1959).

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RESULT AND DISCUSSION

In the present investigation correlation coefficient was estimated with seventeen characters at genotypic and phenotypic levels (Table. 1). The data presented in table-1 showed that all most characters exhibited genotypic correlation to each other in positive and negative ways. Cormlets per plant showed positive correlation with plant diameter of corm (0.43**), followed by, weight of corm (0.37**), Number of spike per corm (022**) opening of first flower in days (0.16). Number of corms per plant showed positive significant correlation with length of spike (0.28**), followed by, length of rachis (0.25**). Weight of corm showed positive and highly significant correlation with diameter of corm (0.93**) followed by, spikes per corm (0.41**), flower diameter (0.24**). Flower diameter exhibited positive and highly significant correlation with diameter of corm (0.26**), Number of flower per spike revealed positive and highly significant correlation with spikes per corms (0.77**), followed by length of rachis (0.76**), length of spike (0.66*). Length of rachis showed positive and highly correlation with length of spike (0.94**), followed by leaf width (0.31**). Leaf width showed positive and highly correlation with number of leaf per plant (0.81**).

Significant phenotypic correlation coefficient was observed among the characters as indicated in table-1. Number of corms per plant showed positive significant phenotypic correlation with length of spike (0.25**), followed by, length of rachis (0.25**). Weight of corm showed positive and highly significant correlation with diameter of corm (0.84**) followed by, spikes per corm (0.38**). Flower diameter exhibited positive and highly significant correlation with diameter of corm (0.26**), followed by, spikes per corm (0.37**), flower diameter (1.00**). Number of flowers per spike revealed positive and highly significant correlation with spikes per corm (0.69**), followed by, length of rachis (0.73**), length of spike (0.60**). Length of rachis showed positive and highly correlation with length of spike (0.86**), followed by, leaf width (0.32**). Leaf width showed positive and highly correlation with number of leaf per plant (0.37**). Similar results were also reported by Rashmi *et al.* 2012, Vanlaruati *et al.* 2013, Chopde *et al.* 2012, Neeraj *et al.* 2001, Anuradha *et al.* 2000, Deshraj *et al.* 1998, and Hedge *et al.* 1997. Maximum positive direct effect was observed for diameter of spike, followed by, number of leaves per plant, visibility of spike in days, number of spikes per corms, plant height, length of spike, weight of corm. However, the maximum negative direct effect was observed for length of rachis, followed by, leaf width, leaf length, and diameter of corn. A critical perusal of result in the table revealed that diameter of spike had showed maximum direct positive effect followed by, weight of corm, spikes per corm, plant height, and number of leaves per plant respectively. At genotypic level also observed direct and indirect effects similar to those observed at phenotypic level with little variation in magnitudes. Hedge *et al.* 1997, Deshraj *et al.* 1997, Anuradha *et al.* 2000, Katwate *et al.* 2002, Chopde *et al.* 2012.

The Path coefficient analysis exhibited the direct and indirect effect of all these characters on 17th characters. The results obtained from the present study at phenotypic level are presented in (Table 2). The revealed data showed that maximum positive direct effect was observed for length of rachis (1.42) followed by, leaf length (0.57), leaf width (0.45), flower diameter (0.31), visibility of spike in days (0.29), spikes per corm (0.14) and diameter of corm. Partitioning of the correlation coefficients in to direct and indirect effects was done at the genotypic level. A data exhibited in table-2 showed that the length of rachis had the maximum direct positive effect (2.20) followed by, visibility of spike in days (0.66), spikes per corm (0.66), leaf width (0.93), leaf length (0.98), weight of corm (0.25).

The data presented in Table- 2 explained that correlation coefficient was estimated with seventeen characters at genotypic and phenotypic levels. The genotypic correlation generally was found higher then phenotypic correlation. It might be due to that mostly phenotypic correlation is influenced by the environmental factors and genotypic correlation is not influenced by environmental factors. Cormlets per plant showed significant positive genotypic and phenotypic correlation with number of suckers per corm, diameter of corm weight of corm and also exhibited significant negative genotypic and phenotypic correlation with flower diameter at 5% level, and number of corm per plant showed positive significant genotypic and phenotypic correlation with length of spike, length of rachis. However, diameter of corm and number of corms per plant found negative significant correlation with visibility of spike (days), opening of first flower (days), diameter of corm and weight of corm. Weight of corm found significant positive correlation with suckers per corm and diameter of corm. The present results are close conformity with Rashmi *et al.* 2012, Vanlaruati *et al.* 2013, Chopde *et al.* 2012, Neeraj *et al.* 2001, Anuradha *et al.* 2000, Deshraj *et al.* 1998, and Hedge *et al.* 1997.

Correlation and path analysis indicated the effective improvement in suckers per corm rachis, length spike diameter, florets per spike, flower diameter, visibility of spike in days, opening of first flower in days, longevity of spike in days, diameter of corm, weight of corms, corms per plant also can be considered as further breeding work.

Table 1. Estimates of correlation coefficient for genotypic (G) and phenotypic (P) levels among different characters in gladiolus.

Genotpyes		NLPP	LL(cm)	LW (cm)	NSPC	LS (cm)	LR (cm)	SPC	DSPC (cm)	NFPS	FD (cm)	VSD	OFFD	LSD	DC (mm)	WC (gm)	NCPP	CPP
	G	0.69**	1.02	0.02	-0.32	0.32**	0.05	-0.19	0.10	0.03	0.04	0.10	-0.02	-0.35	-0.05	-0.04	0.14	-0.43**
PH (cm)	P	0.41**	0.73**	0.02	-0.28	0.29**	0.10	-0.18	-0.03	0.01	0.20**	0.04	-0.00	-0.30	-0.12	-0.04	0.20*	-0.34
	G	1.00	0.87**	0.81**	0.08	0.10	0.10	0.01	0.40**	0.30**	0.26**	0.14	0.46**	-0.58**	-0.24	-0.12	-0.22	-0.60**
NLPP	P	1.00	0.46**	0.37**	0.09	0.01	0.03	0.16*	0.17	0.03	0.15	0.38**	0.08	-0.25	-0.14	-0.14	-0.13	-0.09
	G		1.00	0.22*	-0.19	0.19*	-0.01	-0.26	-0.02	0.03	0.12	0.32**	0.19*	-0.36	-0.20	-0.11	0.08	-0.26
LL(cm)	P		1.00	0.20*	-0.20	0.19*	-0.04	-0.25	0.12	0.05	-0.09	0.27**	0.23**	-0.34	-0.13	-0.09	-0.01	-0.24
	G			1.00	-0.15	0.26**	0.31**	0.25**	0.49**	0.53**	0.13	0.36**	0.42**	-0.28	-0.36*	-0.25	-0.25	-0.27
LW (cm)	P			1.00	-0.16	0.22*	0.32**	0.20**	0.44**	0.55**	0.10	0.21*	0.41**	-0.22	-0.36*	-0.22	-0.23	-0.31
	G				1.00	-0.33	-0.23	0.02	-0.13	-0.32	-0.01	0.21*	0.26**	0.08	0.18*	0.13	-0.17	0.22**
NSPC	P				1.00	-0.31	-0.23	0.03	-0.15	-0.32	0.02	0.23**	0.15	0.07	0.18*	0.13	-0.15	0.22**
	G					1.00	0.94**	0.33**	0.46**	0.66**	0.35**	-0.17	-0.19	-0.17	-0.14	-0.07	0.28**	-0.38*
LS (cm)	P					1.00	0.86**	0.29**	0.43**	0.60**	0.29**	-0.13	-0.12	-0.26	-0.07	-0.06	0.25**	-0.34
	G						1.00	0.47**	0.46**	0.76**	0.44**	-0.16	-0.16	-0.21	-0.14	-0.07	0.25**	-0.42*
LR (cm)	P						1.00	0.44**	0.38**	0.73**	0.39**	-0.19	-0.09	-0.15	-0.18	-0.06	0.25**	-0.40*
	G							1.00	0.13	0.77**	0.90**	-0.05	0.04	-0.22	0.39**	0.41**	-0.37	-0.30
SPC	P							1.00	0.10	0.69**	0.76**	0.01	-0.01	-0.17	0.37**	0.38**	-0.34	-0.22
	G								1.00	0.27**	0.27**	0.12	0.12	-0.40	-0.48**	-0.52	-0.00	-0.43**
DSPC (cm)	P								1.00	0.26**	0.02	0.10	0.18*	-0.36	-0.38*	-0.47**	-0.08	-0.39*
	G									1.00	0.72**	0.23**	0.24**	-0.32	0.03	0.18*	-0.24	-0.38
NFPS	P									1.00	0.55**	0.12	0.22*	-0.26	0.01	0.19*	-0.24	-0.42*
	G										1.00	0.06	0.01	-0.38*	0.26**	0.24**	-0.21	-0.55**
FD (cm)	P										1.00	-0.01	-0.03	-0.32	0.20*	0.18*	-0.03	-0.44**
	G											1.00	0.14	-0.57**	-0.04	0.04	-0.56**	0.00
VSD	P											1.00	0.70**	-0.44**	0.00	0.00	-0.51**	0.14*
	G												1.00	-0.54**	0.00	0.06	-0.63**	0.16*`
OFFD	P												1.00	-0.50	-0.00	0.06	-0.54**	0.06
	G													1.00	0.13	0.21*	0.07	0.15
LSD	P													1.00	0.01	0.20*	0.05	0.14
	G														1.00	0.93**	-0.48**	0.43**
DC (mm)	P														1.00	0.84**	-0.44**	0.37**
	G															1.00	-0.59**	0.37**
WC (gm)	P															1.00	-0.58**	0.31**
	G																1.00	-0.25
NCPP	P																1.00	-0.23
	G																	1.00
CPP	P																	1.00

*, ** significant at 5% and 1% level, respectively

Table 2. Path coefficient analysis showing the direct and indirect effect of seventeen characters gladiolus on the grain yield at genotypic and phenotypic level of gladiolus.

Genotpyes		PH (cm)	NLPP	LL(cm)	LW (cm)	NSPC	LS (cm)	LR (cm)	SPC	DSPC (cm)	NFPS	FD (cm)	VSD	OFFD	LSD	DC (mm)	WC (gm)	CPP	r value with ch 17
PH (cm)	G	**-0.74**	-0.45	1.01	0.02	0.19	-0.07	0.11	-0.13	-0.08	-0.12	0.02	0.07	0.11	0.13	0.12	-0.01	0.15	0.14
	P	**-0.44**	-0.21	0.42	0.01	0.08	-0.04	0.15	-0.02	0.02	-0.01	0.06	0.01	0.10	0.08	0.10	0.01	0.08	0.20
	G	-0.51	**-0.65**	0.86	0.76	-0.04	-0.12	0.22	0.01	-0.33	-0.97	0.11	0.09	-0.26	0.22	0.10	-0.03	0.22	-0.22
NLPP	P	-0.18	**-0.52**	0.26	0.17	-0.02	-0.10	0.04	0.02	-0.12	-0.05	0.05	0.11	-0.03	0.06	0.00	0.05	0.02	-0.13
LL(cm)	G	-0.76	-0.57	**0.98**	0.21	0.11	-0.04	-0.03	-0.17	0.01	-0.11	0.05	0.21	-0.11	0.14	0.08	-0.02	0.09	0.08
	P	-0.32	-0.24	**0.57**	0.09	0.06	-0.03	-0.06	-0.13	-0.09	-0.08	-0.02	0.08	-0.10	0.09	0.00	0.03	0.06	-0.01
	G	-0.01	-0.53	0.22	**0.93**	0.09	-0.06	0.68	0.16	-0.40	-1.70	0.05	0.24	-0.24	0.10	0.15	-0.06	0.10	-0.26
LW (cm)	P	-0.01	-0.19	0.11	**0.45**	0.04	-0.03	0.45	0.13	-0.31	-0.92	0.03	0.06	-0.18	0.06	-0.11	0.08	0.08	-0.23
NSPC	G	0.24	-0.05	-0.19	-0.14	**-0.61**	0.08	-0.50	0.11	0.11	1.03	-0.10	0.14	-0.14	-0.03	-0.08	0.03	-0.08	-0.17
	P	0.12	-0.05	-0.12	-0.07	**-0.28**	0.05	-0.33	0.10	0.11	0.53	0.10	0.06	-0.07	-0.02	0.11	-0.04	-0.05	-0.15
	G	-0.23	-0.06	0.19	0.24	0.20	**-0.24**	2.07	0.22	-0.37	-2.12	0.15	-0.11	0.10	0.06	0.06	-0.01	0.13	0.28
LS (cm)	P	-0.12	-0.00	0.11	0.10	0.09	**-0.15**	1.23	0.04	-0.30	-1.01	0.09	-0.03	0.05	0.07	0.00	0.02	0.08	0.25
LR (cm)	G	-0.04	-0.06	-0.01	0.28	0.14	-0.22	**2.20**	0.31	-0.37	-2.42	0.19	-0.11	0.09	0.08	0.06	-0.01	0.15	0.25
	P	-0.04	-0.01	-0.02	0.14	0.06	-0.13	**1.42**	0.06	-0.27	-1.23	0.12	-0.05	0.04	0.04	0.00	0.02	0.10	0.25
	G	0.14	-0.01	-0.25	0.23	-0.11	-0.08	1.05	**0.66**	-0.11	-2.46	0.40	-0.03	-0.02	0.08	-0.17	0.10	0.11	-0.37**
SPC	P	0.08	-0.08	-0.14	0.09	-0.11	-0.04	0.63	**0.14**	-0.07	-1.15	0.24	0.00	0.10	0.04	0.00	-0.13	0.05	-0.34
DSPC (cm)	G	-0.07	-0.26	-0.02	0.45	0.08	-0.11	1.01	0.09	**-0.81**	-0.87	0.12	0.08	-0.06	0.15	0.21	-0.13	0.15	-0.20
	P	0.01	-0.09	0.07	0.20	0.04	-0.06	0.55	0.01	**-0.71**	-0.44	0.10	0.03	-0.08	0.09	-0.20	0.17	0.09	-0.18
	G	-0.02	-0.20	0.03	0.49	0.19	-0.16	1.67	0.51	-0.22	**-3.19**	0.31	0.15	-0.13	0.12	-0.11	0.04	0.14	-0.24
NFPS	P	-0.00	-0.01	0.03	0.24	0.09	-0.09	1.04	0.10	-0.19	**-1.67**	0.17	0.03	-0.09	0.07	0.10	-0.07	0.10	-0.24
FD (cm)	G	-0.03	-0.17	0.11	0.12	0.10	-0.08	0.98	0.60	-0.22	-2.31	**0.44**	0.04	-0.10	0.14	-0.11	0.06	0.20	-0.21
	P	-0.08	-0.08	-0.05	0.04	-0.20	-0.04	0.56	0.11	-0.01	-0.93	**0.31**	-0.10	0.11	0.08	0.10	-0.06	0.11	-0.23
	G	-0.08	-0.09	0.32	0.33	-0.13	0.04	-0.36	-0.13	-0.09	-0.75	0.12	**0.66**	-0.64	0.22	0.21	0.11	-0.10	-0.56**
VSD	P	-0.02	-0.20	0.16	0.09	-0.06	0.02	-0.27	0.10	-0.07	-0.20	-0.10	**0.29**	-0.31	0.11	0.10	-0.10	-0.03	-0.51
OFFD	G	0.01	-0.30	0.19	0.39	-0.16	0.04	-0.35	0.13	-0.09	-0.76	0.20	0.75	**-0.56**	0.21	0.10	0.01	-0.05	+0.63**
	P	0.00	-0.04	0.13	0.18	-0.04	0.02	-0.14	-0.10	-0.12	-0.37	-0.01	0.20	**-0.44**	0.13	0.20	-0.02	-0.11	+0.54**
	G	0.26	0.38	-0.36	-0.26	-0.05	0.14	-0.46	-0.14	0.32	1.03	-0.16	-0.37	0.30	**-0.38**	-0.05	0.05	-0.15	0.07
LSD	P	0.13	0.13	-0.19	-0.10	-0.02	0.14	-0.22	-0.02	0.26	0.44	-0.10	-0.12	0.22	**-0.27**	0.00	-0.07	-0.03	0.05
DC (mm)	G	0.04	0.16	-0.19	-0.33	-0.11	0.13	-0.30	0.26	0.39	-0.11	0.11	-0.02	0.10	-0.05	**-0.43**	0.24	-0.15	-0.48**
	P	0.05	0.07	-0.07	-0.16	-0.05	0.21	-0.26	0.05	0.27	-0.01	0.06	0.10	0.10	-0.00	**0.00**	-0.30	-0.09	-0.44**
	G	0.03	0.08	-0.10	-0.23	-0.08	0.11	-0.16	0.27	0.43	-0.57	0.11	0.12	-0.03	-0.08	-0.40	**0.25**	-0.13	-0.59**
WC (gm	P	0.01	0.07	-0.05	-0.10	-0.03	0.11	-0.09	0.05	0.33	-0.33	0.05	0.20	-0.02	-0.05	0.00	**-0.36**	-0.07	-0.58**
	G	0.32	0.39	-0.26	-0.25	-0.13	0.09	-0.94	-0.20	0.35	1.23	-0.24	0.10	-0.09	-0.05	-0.18	0.09	**-0.36**	-0.25
CPP	P	0.15	0.05	-0.14	-0.14	-0.06	0.05	-0.57	-0.03	0.27	0.71	-0.13	0.04	-0.02	-0.03	0.00	-0.11	**-0.25**	-0.23

Residual values (G) = 0.085, Residual values (P) =0.017.

Bold values indicate direct effects

*, ** Significant at 5% and 1% level, respectively

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