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STUDY ON CORRELATION AND PHENOTYPIC STABILITY OF GLADIOLUS GENOTYPES

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ABSTRACT
The genotypic and phenotypic correlationbetween fifteen character and phenotypic stability of twelve gladiolus genotypes were studied during the year 2011-12 in field experiment. The results indicated that yield attribute i.e. number of cormels per plant were positively associated with floret size (1.025 and 0.545), number of florets per spike (0.614 and 0.501), duration of flowering (0.431 and 0.247) and weight of spike (0.317 and 0.383) at both genotypic and phenotypic level, respectively. The phenotypic stability results revealed that the regression coefficient (b_i) ranged from -4.00 to 4.12 for various characters. Cultivar Red Beauty was regarded as good performer with respect to duration of flowering (11.67 days) and size of corms (4.59 cm) with b_i of 0.99 and 1.006 and S^2di approaching zero; whereas, cv. Punjab Glance and Punjab Pink Elegance exhibited high performance for days taken to sprouting of corms (7.95 and 8.45 days) with average stability (b_i 0.99 and 1.28).Thus, it was concluded that for cormels yield improvement more emphasis should be given on the characters like floret size, number of florets per spike and number of corms per plant; whereas, with respect to phenotypic stability cv. Red Beauty was widely adapted and stable.

INTRODUCTION

Though the bulbous crops have potential for cultivation but only a few bulbous crops like Tuberose, Heliconia, Alstromeria and Gladiolus are commerciallyexploited (Alam*et al*., 2013). Gladioluscalled as 'Queen of bulbous flowers', belonging to family Iridaceae is a bulbous crop valued for its beauty, elegance and majestic spikes (Chanda*et al*., 2000; Riaz *et al*., 2007). Genetic makeup and environment are the features which depict the performance of a variety by affecting all important traits (Khan *et al*., 2001; Mushtaq*et al*., 2013). Heritable traits such as yield and quality are known to be collectively influenced by various polygenically inherited traits which are highly vulnerable to environmental changes and the phenotypic performance of a genotype is not necessarily the same under diverse agro-ecological conditions (Ali *et al*., 2003).The correlation studies in gladiolus has been studied by Maitra and Satya (2004), Rashmi and Kumar (2014). The stability was defined as adaptation of varieties to unpredictable and transient environmental conditions with high mean yield and regression coefficient (b_i = 1.0) and deviations from regression as small as possible (S^2di = 0). The stable genotypes are of great importance because environmental conditions may vary from season to season or year to year. Differential stability status has been reported across seven genotypes of gladiolus (Naik *et al*., 2011). There was lack of knowledge regarding the association of characters for improvement of cormels yield attributes and stability of gladiolus genotypes under different environment conditions. Keeping in view the above facts, the present investigation was undertaken to determine the characters having greater interrelationship with cormel yield utilizing correlations and to evaluate the phenotypic stability of these characters under different environments.

MATERIALS AND METHODS

The experimental material comprises of twelve gladiolus genotypes viz. Punjab Flame, Punjab Pink Elegance, Punjab Glance, Punjab Lemon Delight, Sylvia, Suchitra, CPG, Jacksonville Gold, Red Advance, Red Beauty, Fidelio and Rose Supreme planted under five different planting times i.e. 10th October, 25th October, 10th November, 25th November and 10th December in the experiment farm area of Department Floriculture and Landscaping, Punjab Agricultural University, Ludhiana, during 2011-2012. The corms were planted as per Randomized Block Design (RBD) with three replications at spacing of 30x20 cm with plot size of 2.4 m^2 and recommended cultural practices were followed to raise the crop. The twelve genotypes were evaluated for 15characters under five different planting dates and datawas pooled. The statistical analysis forestimates of correlation coefficient were done by the method proposed by Al- Jibouri*et al*., 1958 and phenotypic stability analysis by linear regression model (Eberhart and Russell, 1966).

RESULTS AND DISCUSSION

Correlation coefficient

Correlation coefficient between fifteen character pair of twelve gladiolus genotypes were computed in all possible

Table I: Genotypic correlation coefficient of number of cormels per plant and other characters of gladiolus

Traits	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15
X1		0.728**	0.485	-1.409**	-0.799**	0.749 **	0.735 **	-0.550 *	-0.478	-0.777**	-0.906**	0.417	0.000	0.669 **	-0.983**
X2			-0.829**	-1.435**	-0.902**	0.827 **	0.810 **	-0.765**	-0.987**	-0.890**	-1.052**	-0.135	0.000	0.461	-0.682**
X3				-1.203**	-0.448	0.417	0.379	0.411	0.291	-0.361	-0.303	0.834**	0.000	0.878**	-0.415
X4					1.340**	-0.743 **	-1.382**	0.547*	0.783**	1.738**	2.909**	-0.660**	0.000	-1.442 **	1.025**
X5						-0.857**	-0.949**	0.374	0.747**	1.043**	1.357**	-0.290	0.000	-0.841**	0.614*
X6							1.040	-0.101	-0.581*	-0.941**	-1.284**	0.387	0.000	0.770**	-0.490
X7								-0.231	-0.685**	-0.931**	-1.090**	0.341	0.000	0.809**	-0.565*
X8									0.722**	0.434	0.739**	0.292	0.000	-0.018	0.431
X9										0.817**	1.139**	0.370	0.000	-0.222	0.317
X10											1.144**	-0.222	0.000	-0.815**	0.707**
X11												-0.190	0.000	-0.968**	1.005**
X12													0.000	0.789**	-0.284
X13														0.000	0.000
X14														-	-0.641*
X15															-

Table II: Phenotypic correlation coefficient of number of number of cormels per plant and other characters of gladiolus

Traits	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15
X1	-	0.695**	0.299	-0.388	-0.672**	0.550 *	0.661**	-0.164	-0.352	-0.727**	-0.499*	0.337	-0.248	0.590*	-0.537 *
X2		-	-0.087	-0.408	-0.781**	0.605*	0.714**	-0.401	-0.757**	-0.837**	-0.550*	-0.190	-0.320	0.298	-0.446
X3			-	0.168	-0.083	-0.007	0.275	0.374	0.425	-0.298	-0.435	0.663**	-0.347	0.472	-0.225
X4				-	0.749**	-0.607*	-0.280	0.475	0.683**	0.332	-0.300	0.130	-0.558*	-0.322	0.545*
X5					-	-0.815**	-0.760**	0.395	0.765**	0.843**	0.310	-0.083	-0.041	-0.566*	0.501 *
X6						-	0.849**	-0.152	-0.589 *	-0.629*	-0.131	0.124	0.213	0.496	-0.409
X7							-	0.037	-0.429	-0.852**	-0.610*	0.307	-0.290	0.619*	-0.298
X8								-	0.565*	0.193	-0.119	0.310	-0.203	0.221	0.247
X9									-	0.564*	0.050	0.442	-0.173	-0.135	0.383
X10										-	0.760**	-0.217	0.469	-0.618*	0.341
X11											-	-0.324	0.909**	-0.435	-0.022
X12												-	-0.170	0.597*	0.027
X13													-	-0.169	-0.222
X14														-	-0.236
X15															-

*Significant at probability level 0.05; ** Significant at probability level 0.01; X1 = Days taken to sprouting of corms ; X2 = Days taken to bud initiation ; X3 = days taken from bud initiation to flowering; X4 = Floret size ; X5 = No. of florets/ spike ; X6 = Plant height; X7 = Spike length X8 = Duration of flowering; X9 = Weight of spike; X10 = No. of florets opened at one time; X11 = No. of corm/ plant; X12 = Weight of corm/ plant; X13 = Size of corm;X14 = Vase life; X15 = No. of cormels/ plant

Table III: Stability parameters of twelve gladiolus genotypes for different traits

Genotypes	Days to sprouting of corms			Days to bud initiation			Days from bud initiation to flowering			Floret size		
	Mean	b_i	S^2_{di}	Mean	b_i	S^2_{di}	Mean	b_i	S^2_{di}	Mean	b_i	S^2_{di}
CPG	13.96	0.90	-0.07	99.98	1.27	-6.12	14.88	1.02	0.75	8.27	1.03	-0.99
Fidelio	13.42	1.63	0.58	97.26	2.18	141.98	14.80	1.05	1.01	8.61	2.26	0.75
Punjab Lemon Delight	11.68	0.74	-0.00	82.15	1.65	0.58	17.64	1.09	-0.53	8.19	0.82	0.06
Punjab Flame	13.88	0.25	0.49	100.74	-0.50	1.67	15.91	0.92	0.22	8.09	2.24	-0.01
Red Beauty	11.65	0.83	-0.14	83.38	1.69	6.04	18.40	1.10	-0.26	9.05	0.04	0.06
Punjab Pink Elegance	8.45	1.28	0.21	77.77	1.99	-2.64	17.93	0.94	0.84	8.33	0.93	-0.06
Sylvia	14.12	1.29	0.04	100.12	1.36	-2.48	15.85	1.12	1.38	7.94	0.53	-0.06
Punjab Glance	7.95	0.99	-0.09	71.86	1.34	2.55	17.48	0.62	7.45	8.85	0.39	-0.01
Red Advance	14.30	0.44	0.44	99.53	0.83	31.24	13.36	0.79	0.31	9.24	4.12	0.06
Jacksonville Gold	13.36	0.40	0.18	95.50	0.35	4.41	15.40	0.81	0.28	7.10	0.83	0.54
Rose Supreme	14.47	1.44	0.35	64.47	-0.50	1.36	22.65	1.23	-0.35	8.24	0.14	-0.10
Suchitra	16.45	1.88	1.23	67.05	0.32	-3.78	25.66	1.31	0.54	8.26	-1.32	-0.00
Mean	12.81	-	-	86.65	-	-	17.50	-	-	8.35	-	-
C.D. (p = 0.05	0.56	-	-	3.27	-	-	1.09	-	-	0.43	-	-

combination at genotypic and phenotypic level presented in Table I and II. The results revealed that in most of the cases, genotypic and phenotypic correlation was similar in direction, whereas, genotypic correlation was higher than the corresponding phenotypic correlation. These finding were supported by Diyali*et al*. (2014), Rashmi and Kumar (2014). These estimates of genotypic correlations along with phenotypic correlations display clear picture of the extent of inherent association as well as 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), Balaram and Janakiram (2009).

The yield attribute in terms of number of cormels per plant could be increased with increase in floret size (1.025 and

Table III: Cont.....

Genotypes	Number of florets per spike			Plant height			Spike length			Duration of flowering		
	Mean	b_i	S^2_{di}	Mean	b_i	S^2_{di}	Mean	b_i	S^2_{di}	Mean	b_i	S^2_{di}
CPG	13.10	0.36	7.18	89.37	1.38	125.57	71.26	2.27	38.21	11.33	0.26	2.22
Fidelio	10.10	1.72	0.27	87.01	0.56	39.21	65.04	0.68	13.26	8.52	0.97	0.19
Punjab Lemon Delight	9.58	1.42	0.55	73.56	1.54	30.67	56.07	1.49	15.57	10.03	1.43	2.02
Punjab Flame	10.24	1.08	7.88	76.13	1.47	55.43	60.08	1.18	60.67	9.71	1.97	1.39
Red Beauty	13.99	1.45	-0.21	95.86	2.03	-2.82	73.58	1.21	-1.80	11.67	0.99	-0.00
Punjab Pink Elegance	14.04	0.84	3.71	68.58	1.25	150.76	52.29	0.66	102.66	11.54	2.72	4.34
Sylvia	12.22	-0.21	1.76	84.55	1.45	102.21	66.29	2.08	49.24	10.24	0.56	-0.11
Punjab Glance	12.13	0.56	1.29	77.86	1.24	33.00	61.88	0.43	-0.49	11.05	0.86	2.22
Red Advance	12.94	0.77	0.86	79.52	0.75	68.06	59.66	0.96	53.49	10.06	1.14	0.35
Jacksonville Gold	9.32	1.84	1.17	69.33	0.04	31.31	51.35	0.41	26.19	7.13	0.78	2.06
Rose Supreme	12.62	1.07	-0.14	84.20	0.18	-9.72	67.62	0.46	-9.21	12.09	0.50	0.44
Suchitra	12.44	1.09	-0.09	73.21	1.09	-10.38	55.75	0.16	-11.35	10.84	-0.15	0.81
Mean	11.89	-	-	79.93	-	-	61.74	-	-	10.35	-	-
C.D. (p = 0.05)	0.88	-	-	4.42	-	-	4.49	-	-	0.91	-	-

Table III: Cont.....

Genotypes	Weight of spike			Number of florets opened at one time			Vase life		
	Mean	b_i	S^2_{di}	Mean	b_i	S^2_{di}	Mean	b_i	S^2_{di}
CPG	31.40	0.30	-12.47	2.97	-0.04	0.24	9.16	1.46	1.96
Fidelio	27.77	1.37	-27.36	4.44	0.47	1.14	9.31	1.98	0.34
Punjab Lemon Delight	26.23	1.48	7.53	3.65	2.40	1.22	8.53	3.50	0.80
Punjab Flame	23.23	0.87	-19.66	3.83	0.37	0.81	8.17	0.97	3.01
Red Beauty	38.84	1.95	-24.64	4.51	1.25	0.98	9.65	2.45	-0.19
Punjab Pink Elegance	35.14	1.18	185.96	4.48	4.07	0.25	10.76	3.38	1.32
Sylvia	29.23	0.62	-25.68	3.54	-0.60	0.29	9.19	1.57	3.14
Punjab Glance	35.54	1.51	-17.28	6.12	2.85	0.87	10.14	1.25	0.51
Red Advance	26.00	-0.03	-21.15	3.13	1.12	0.36	7.85	1.07	0.11
Jacksonville Gold	25.53	0.64	-14.48	4.37	1.06	0.17	9.34	1.63	0.84
Rose Supreme	52.60	1.20	-23.79	6.23	-0.47	0.02	14.34	-2.25	3.69
Suchitra	57.35	0.91	-13.37	5.25	-0.49	0.70	11.90	-4.00	6.12
Mean	34.1	-	-	4.38	-	-	9.86	-	-
C.D. (p = 0.05)	6.74	-	-	0.51	-	-	0.75	-	-

Table III: Cont.....

Genotypes	Number of corms per plant			Number of cormels per plant			Weight of corms per plant			Size of corm		
	Mean	b_i	S^2_{di}	Mean	b_i	S^2_{di}	Mean	b_i	S^2_{di}	Mean	b_i	S^2_{di}
CPG	1.92	2.79	0.05	13.96	0.23	10.75	40.61	1.38	-7.37	3.34	1.01	-0.01
Fidelio	1.61	-0.31	0.03	14.30	1.38	24.36	54.20	1.76	7.14	4.16	1.41	-0.00
Punjab Lemon Delight	2.01	-0.15	0.19	20.15	2.59	120.81	36.38	1.11	-12.66	3.46	0.60	0.15
Punjab Flame	1.42	-0.34	0.07	10.54	1.08	0.07	22.16	0.53	9.95	3.16	0.72	-0.00
Red Beauty	1.26	0.28	0.00	15.17	0.52	59.03	44.64	0.86	0.61	4.59	1.00	0.09
Punjab Pink Elegance	1.34	2.44	-0.02	12.07	1.23	9.09	33.25	1.31	24.49	3.55	1.15	0.06
Sylvia	1.30	1.47	-0.02	10.62	0.21	2.38	32.85	0.95	-13.27	3.67	1.13	-0.01
Punjab Glance	1.66	3.70	0.00	41.52	3.40	16.34	52.25	1.57	61.56	4.25	0.61	0.02
Red Advance	1.08	0.62	-0.02	14.07	1.16	0.25	34.66	0.66	-10.30	4.22	0.88	-0.02
Jacksonville Gold	1.34	0.16	-0.17	8.81	0.04	21.89	39.58	0.75	1.53	4.05	0.89	-0.00
Rose Supreme	1.99	0.15	0.02	12.58	1.04	3.52	102.70	0.14	-7.08	5.66	1.98	0.05
Suchitra	1.70	1.19	0.45	5.19	-0.01	1.06	79.38	0.98	-7.44	4.05	0.59	-0.01
Mean	1.55	-	-	14.92	-	-	47.72	-	-	4.01	-	-
C.D. (p = 0.05)	0.11	-	-	0.95	-	-	4.70	-	-	0.21	-	-

0.545), no. of florets per spike (0.614 and 0.501), duration of flowering (0.431 and 0.247) and weight of spike (0.317 and 0.383) as these characters were positively associated with number of cormels per plant at both genotypic and phenotypic level, respectively. Bharathi*et al*. (2014) reported positive significant correlation for flower yield with number of flowers per plant and flower size in marigold. Weight of corms per plant showed positive significant association only with vase life at genotypic (0.789) and phenotypic (0.597) level. Days taken from bud initiation to flowering, duration of flowering, weight of spike and number of corms per plant showed positive significant correlation with weight of corm per plant,

weight of spike, no. of florets opened at one time and size of corms at phenotypic level (0.663, 0.565, 0.564 and 0.909,respectively). Negative significant association were observed for days taken to sprouting, bud initiation, spike length and vase life at genotypic level (-0.983, -0.682, -0.565 and -0.641, respectively), while for days taken to sprouting at phenotypic level (-0.537) with respect to number of cormels per plant. Weight of spike showed positive significant genotypic association with no. of florets opened at one time and no. of corms per plant (0.817 and 1.139). No. of florets opened at one time had positive significant association with no. of corms per plant (1.144 and 0.760), while negative significant association with vase life (-0.815 and -0.618) at both genotypic and phenotypic level.

Days taken to sprouting had significantpositive correlation with days to bud initiation, plant height, spike length and vase life. Days taken to bud initiation had significantpositive correlation with plant height and spike length. Maitra and Satya (2004) reported that days to flower bud initiation exhibited high negative correlation with number of florets spike.

Days taken from bud initiation to flowering had significant positive genotypic correlation with weight of corm per plant and vase life while, significant positive phenotypic correlation with weight of corm per plant. Floret size showed significantpositive genotypic correlation with no. of florets per spike, corms and cormelsper plant,duration of flowering, weight of spike, no. of florets opened at one time, while, significant positive phenotypic correlation with no. of florets per spike, cormels per plant andweight of spike. The results find support from findings of Katwate*et al*. (2002).No. of florets per spike showed significant positive genotypic and phenotypic correlation with weight of spike, no. of florets opened at one time and no. of cormels per plant. These results are in conformity with Kumar *et al*.(2010). Plant height had significant positive correlation with spike length while significantnegative correlation with weight of spike and no. of florets opened at one time. These results are in accordance with Choudhary(2011),Neeraj and Jha (2001), Pattanaik*et al*.(2015). Spike length had positive significant phenotypic and genotypic correlation with vase life (Misra and Saini, 1990). Duration of flowering had significantpositive phenotypic and genotypic correlation with weight of spike.

Phenotypic stability

The estimates of stability parameters (mean, regression coefficient bi and deviation mean squares S^2di) for twelve gladiolus genotypes for six floral traits are given in Table III. An ideal genotype according to Eberhart and Russel would be one with high mean, unit regression coefficient ($bi = 1$) and low deviation mean squares ($S^2di = 0$). They further pointed out that the varieties exhibiting high regression coefficient ($bi > 1$) could be considered as below average stable varieties. Such varieties will do well only in favorable environments and their performance will be poor in poor environments. The varieties with low regression coefficient ($bi < 1$) have above average stability and are adapted specifically to poor environments.

Regression coefficient ranged from -4.00 to 4.12 for various traits in twelve gladiolus genotypes. Cv. Punjab Glance and Punjab Pink Elegance exhibited high performance for days taken to sprouting of corms (7.95 and 8.45 days) but had average stability. Rose Supreme perform best for days for bud initiation, duration of flowering, florets open at one time and vase life and has the above average stability ($bi < 1$), thus perform better under poor environment and is insensitive to environment changes. Red Advance showed the highest performance for days taken from bud initiation to flowering followed by CPG, and exhibited average stability. Punjab Pink Elegance showed the highest performance for number of florets per spike and show average stability. Punjab Flame is best regarding weight of spike and weight of corms and exhibit average stability. For number of corms per plant, Punjab Lemon Delight is considered as best and exhibit above average stability. Punjab Glance performs better for number of cormels per plant and exhibit above average stability. Rose supreme performs well for size of corms but only in productive environment and is sensitive to environment changes.

Cultivar Red Beauty is regarded as good performer in respect to duration of flowering (11.67 days) and size of corms (4.59) with regression coefficient of 0.99 and 1.006 and S^2di approaching zero. Thus it could be considered widely adapted and stable; it had the ability to express its potential in a range of environmental conditions. Punjab Glance is widely adapted and stable in respect to days taken to sprouting of corms (7.95 days) with bi of 0.918. These results are in line with the findings of Arora and Sharma (1991) who reported differential stability by different varieties planted under different environments.

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APPLICATION FORM

NATIONAL ENVIRONMENTALISTS ASSOCIATION (N.E.A.)

To,
The Secretary,
National Environmentalists Association,
D-13, H.H.Colony,
Ranchi - 834 002, Jharkhand, India

Sir,
I wish to become an Annual / Life member and Fellow* of the association and will abide by the rules and regulations of the association

Name _____

Mailing Address _____

_____

Official Address _____

_____

E-mail _____Ph. No._____(R)_____(O)

Date of Birth _____ Mobile No. _____

Qualification _____

Field of specialization & research _____

Extension work (if done) _____

_____

Please find enclosed a D/D of Rs..... No. ..... Dated ..... as an *Annual / Life membership fee*.

*Attach **Bio-data and some recent publications along with the application form when applying for the Fellowship of the association.**

Correspondance for membership and/ or Fellowship should be done on the following address :

SECRETARY,
National Environmentalists Association,
D-13, H.H.Colony,
Ranchi - 834002
Jharkhand, India
E-mails : m_psinha@yahoo.com Cell : 9431360645
dr.mp.sinha@gmail.com Ph. : 0651-2244071