World Journal of Agricultural Sciences 6 (1): 110-114, 2010
ISSN 1817-3047

Correlation Studies on Yield and its Components in Glory Lily (*Gloriosa superba* L.)

R. Chitra and K. Rajamani

Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore-641 003

Abstract: Simple phenotypic and genotypic correlation coefficients were calculated from 18 genotypes of glory lily (*Gloriosa superba* L.) during two seasons (2007 and 2008). Experiment was laid out in a randomized block design with three replications at the Medicinal Plants Unit, Botanical Garden, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India. Positive phenotypic and genotypic correlations of dry seed yield were found with number of flowers per plant, number of pods per plant, pod length, fresh pod yield per plant and fresh seed yield per plant in the 1st and 2nd seasons and also in pooled analysis. These correlated yield components suggested that it may be good selection criteria to improve seed yield of glory lily crop.

Key words: *Gloriosa superba*, seed yield, Correlation coefficient

INTRODUCTION

Gloriosa superba (Liliaceae) is a perennial herbaceous climber growing up to 3.5 to 6.0 meters in length. *G. superba* is a native of tropical Africa and is found growing naturally in many countries of tropical Asia including Bangladesh, India, Sri Lanka, Malaysia and Myanmar. Seeds and tubers contain valuable alkaloids *viz*., colchicine and colchicoside as the major constituents, which are used to treat gout and rheumatism. Due to the action of colchicoside on spindle fibre formation during cell division, the plant has been identified as a potential anti-cancerous drug. In the Indian Systems of Medicine, the tubers are used as tonic, antiperiodic, antihelmenthic and also against snake bite [1].

Gloriosa was found in the wild on natural fences a decade back but now it has been domesticated for economic gain in as much as all parts of the plant find a diverse usage in Indian Systems of Medicine. Though *G. superba* has an extensive natural distribution and selective cultivation, the species has become endangered due to over exploitation of its tubers and poor germination per cent. The growing demand for the seeds of *G. superba* in the international market and the wider popularity it has gained among the farmers necessitates attempts to induce new variability with high yield, high colchicine content, dwarf stature and leaf blight resistant of the plant as well. Correlation studies give an idea about the contribution of different characters to seed yield [2]. Therefore, the present study was undertaken to assess the correlation coefficient of various desirable characters in 18 genotypes of glory lily, which will help in isolating promising lines for hybridization programmes and to explore yield potential of glory lily.

MATERIALS AND METHODS

The present study was carried out during two successive growth seasons of 2007 and 2008 at the Medicinal Plants Unit, Botanical Garden, Tamil Nadu Agricultural University, Coimbatore. 18 glory lily genotypes were collected from different places of Tamil Nadu and Andhra Pradesh and planted on August of 2007 and 2008 (Table 1). Randomized Block Design with three replications was used and each replicate had 3 lines. Agro-morphological observations were recorded on five randomly selected plants on each accession per replication for plant height (cm), stem girth (cm), number of leaves per plant, number of branches per plant, days to flowering, days to 50% flowering, number of flowers per plant, number of pods per plant, pod setting percentage, pod length (cm), pod girth (cm), number of seeds per pod, fresh pod weight (g), fresh seed weight per pod (g), fresh pod yield per plant (g), fresh seed yield per plant (g), fresh seed recovery (%), dry seed recovery (%), 100 fresh seed weight (g), 100 dry seed weight (g) dry seed yield per plant (g) and per cent disease index. Phenotypic and Genotypic correlation coefficients were computed according to Johnson *et al*. [3].

Corresponidgn Author: R. Chitra, Horticultural College and Research Institute,
Tamil Nadu Agricultural University, Coimbatore-641 003

Table 1: Genotypes details of *Gloriosa superba*

S.No.	Year of collection	Name of the Germplasm	Genotypes / treatment
1.	2007	Nallampalayam cultivated	GS 01
2.	2007	Kallimanthayam cultivated	GS 02
3.	2007	Sathyamangalam wild	GS 03
4.	2007	Aruppukotai wild	GS 04
5.	2007	Aruppukotai cultivated	GS 05
6.	2007	Kankayam cultivated	GS 06
7.	2007	Kallimanthayam wild	GS 07
8.	2007	Ottanchadram cultivated	GS 08
9.	2007	Moolanur cultivated	GS 09
10.	2007	Jeyankondam cultivated	GS 10
11.	2007	Udangudi cultivated	GS 11
12.	2007	Viralimalai cultivated	GS 12
13.	2007	Pudukottai cultivated	GS 13
14.	2007	Andhra cultivated – I	GS 14
15.	2007	Andhra wild	GS 15
16.	2007	Z-Melur cultivated	GS 16
17.	2007	Poondurai wild	GS 17
18.	2007	Andhra cultivated -II	GS 18

RESULTS AND DISSCUSION

Phenotypic and genotypic correlation was estimated on genotypes of 21 studied characters in pooled season between all possible pairs of studied characters (Table 2). The studies on correlation values indicate the intensity and direction of association of a character with yield. The interrelationship of component characters of yield provides the information about the likely consequences of selection for simultaneous improvement of desirable characters under selection.

Grafius [4] suggested that there might not be many genes for yield *per se*, but for its components [4]. Hence, the knowledge on interrelationship of plant characters with seed yield and among themselves is of paramount importance to the breeder for making improvement in complex characters like seed yield, for which direct selection is not much effective. Hence, the association analysis was undertaken to determine the direction of selection and the characters to be considered in improving the seed yield.

Table 2: Correlation among yield and yield influencing traits of 18 genotypes of *Gloriosa superba* (Pooled)

Characters		Plant height	Stem girth	No. of leaves /plant	No. of branches /plant	Days to flowering	Days for 50% flowering	No. of flowers /plant	No. of pods /plant	Pod setting %	Pod length	Pod girth	No. of seeds /pod	Fresh pod weight	Fresh seed weight / pod
Plant height	P	1.000	0.779**	0.952**	0.880**	-0.301	-0.779**	0.833**	0.818**	0.657**	0.882**	0.702**	0.732**	0.942**	0.931**
	G	1.000	0.780**	0.952**	0.881**	-0.305	-0.786**	0.834**	0.819**	0.668**	0.882**	0.748**	0.736**	0.944**	0.932**
Stem girth	P		1.000	0.718**	0.779**	-0.062	-0.443*	0.718**	0.714**	0.618**	0.831**	0.726**	0.649**	0.896**	0.903**
	G		1.000	0.719**	0.781**	-0.064	-0.447*	0.720**	0.716**	0.629**	0.833**	0.764**	0.652**	0.898**	0.905**
No. of leaves / plant	P			1.000	0.905**	-0.343	-0.809**	0.937**	0.924**	0.666**	0.868**	0.732**	0.793**	0.878**	0.891**
	G			1.000	0.906**	-0.347	-0.816**	0.937**	0.924**	0.677**	0.869**	0.780**	0.797**	0.879**	0.892**
No. of branches / plant	P				1.000	-0.262	-0.638**	0.876**	0.898**	0.831**	0.925**	0.686**	0.632**	0.892**	0.904**
	G				1.000	-0.267	-0.646**	0.877**	0.899**	0.844**	0.927**	0.729**	0.635**	0.893**	0.907**
Days to flowering	P					1.000	0.458*	-0.335	-0.323	-0.113	-0.124	-0.124	-0.194	-0.180	-0.146
	G					1.000	0.471*	-0.339	-0.327	-0.117	-0.125	-0.140	-0.202	-0.184	-0.149
Days taken for 50% flowering	P						1.000	-0.689**	-0.684**	-0.521*	-0.508	-0.457	-0.668**	-0.599	-0.580**
	G						1.000	-0.695**	-0.690**	-0.538**	-0.512	-0.502	-0.678**	-0.605**	-0.585**
No. of flowers / plant	P							1.000	0.994**	0.699**	0.854**	0.756**	0.839**	0.826**	0.854**
	G							1.000	0.995**	0.710**	0.855**	0.806**	0.843**	0.827**	0.856**
No. of pods / plant	P								1.000	0.762**	0.861**	0.749**	0.819**	0.817**	0.847**
	G								1.000	0.769**	0.862**	0.799**	0.823**	0.819**	0.849**
Pod setting percentage	P									1.000	0.756**	0.588**	0.540**	0.681**	0.691**
	G									1.000	0.767**	0.637**	0.550**	0.694**	0.704**
Pod length	P										1.000	0.695**	0.720**	0.949**	0.961**
	G										1.000	0.742**	0.723**	0.950**	0.963**
Pod girth	P											1.000	0.682**	0.700**	0.747**
	G											1.000	0.727**	0.741**	0.793**
No. of seeds / pod	P												1.000	0.737**	0.755**
	G												1.000	0.739**	0.760**
Fresh pod weight	P													1.000	0.994**
	G													1.000	0.996**
Fresh seed weight / pod	P														1.000
	G														1.000

* Significant at 5% level ** Significant at 1% level

G – Genotypic correlation P – Phenotypic correlation

Table 2: Continued

Characters		Fresh pod yield / plant	Fresh seed yield/ plant	Fresh seed recovery	Dry seed recovery	100 fresh seed weight	100 dry seed weight	Dry seed yield / plant
Plant height	P	0.819**	0.806**	0.845**	-0.257	0.934**	0.916**	0.813**
	G	0.819**	0.806**	0.873**	-0.268	0.955**	0.916**	0.814**
Stem girth	P	0.761**	0.762**	0.833**	-0.480*	0.817**	0.824**	0.734**
	G	0.762**	0.764**	0.865**	-0.503*	0.835**	0.826**	0.737**
No. of leaves / plant	P	0.914**	0.905**	0.854**	-0.218	0.942**	0.955**	0.918**
	G	0.914**	0.905**	0.883**	-0.227	0.963**	0.955**	0.920**
No. of branches / plant	P	0.911**	0.902**	0.840**	-0.426*	0.855**	0.935**	0.895**
	G	0.912**	0.903**	0.872**	-0.439*	0.875**	0.937**	0.898**
Days to flowering	P	-0.284	-0.269	-0.033	-0.503*	-0.295	-0.307	-0.318
	G	-0.288	-0.273	-0.030	-0.536**	-0.307	-0.311	-0.321
Days taken for 50% flowering	P	-0.649**	-0.634**	-0.475*	-0.212	-0.701**	-0.700**	-0.674**
	G	-0.654**	-0.639**	-0.496*	-0.216	-0.724**	-0.706**	-0.679**
No. of flowers / plant	P	0.985**	0.981**	0.839**	-0.290	0.894**	0.948**	0.989**
	G	0.985**	0.982**	0.867**	-0.300	0.914**	0.949**	0.990**
No. of pods / plant	P	0.992**	0.988**	0.828**	-0.314	0.878**	0.948**	0.995**
	G	0.992**	0.988**	0.857**	-0.325	0.900**	0.949**	0.995**
Pod setting percentage	P	0.750**	0.737**	0.661**	-0.479*	0.651**	0.729**	0.736**
	G	0.758**	0.746**	0.692**	-0.495*	0.683**	0.742**	0.746**
Pod length	P	0.884**	0.877**	0.909**	-0.506*	0.889**	0.943**	0.864**
	G	0.885**	0.877**	0.942**	-0.524*	0.908**	0.943**	0.865**
Pod girth	P	0.757**	0.764**	0.846**	-0.502*	0.730**	0.740**	0.751**
	G	0.806**	0.814**	0.935**	-0.543**	0.774**	0.789**	0.805**
No. of seeds / pod	P	0.809**	0.806**	0.752**	-0.224	0.820**	0.807**	0.817**
	G	0.812**	0.810**	0.793**	-0.237	0.836**	0.811**	0.822**
Fresh pod weight	P	0.847**	0.840**	0.893**	-0.415*	0.918**	0.924**	0.825**
	G	0.848**	0.841**	0.929**	-0.430*	0.937**	0.925**	0.828**
Fresh seed weight / pod	P	0.877**	0.873**	0.933**	-0.453*	0.927**	0.938**	0.857**
	G	0.879**	0.874**	0.955**	-0.463*	0.949**	0.939**	0.860**
Fresh pod yield / plant	P	1.000	0.999**	0.843**	-0.351	0.883**	0.959**	0.997**
	G	1.000	0.999**	0.872**	-0.364	0.904**	0.960**	0.998**
Fresh seed yield/ plant	P		1.000	0.844**	-0.357	0.877**	0.952**	0.996**
	G		1.000	0.870**	-0.369	0.898**	0.953**	0.997**
Fresh seed recovery	P			1.000	-0.545**	0.886**	0.876**	0.831**
	G			1.000	-0.553**	0.940**	0.905**	0.860**
Dry seed recovery	P				1.000	-0.273	-0.315	-0.300
	G				1.000	-0.291	-0.326	-0.315
100 fresh seed weight	P					1.000	0.943**	0.884**
	G					1.000	0.964**	0.907**
100 dry seed weight	P						1.000	0.953**
	G						1.000	0.955**
Dry seed yield / plant	P							1.000
	G							1.000

* Significant at 5% level ** Significant at 1% level
G – Genotypic correlation P – Phenotypic correlation

The phenotypic and genotypic correlation coefficients were worked out based on the data for two seasons and also based on pooled data on pooled environments in the present investigation. This type of study over seasons is needed to confirm the character association with seed yield so as to fix some of the positively associated characters with seed yield as selection criteria for the improvement of seed yield. Clark [5] opined that this type of study was necessary, because, the correlations do depend on the season and genotype x season interactions, which affect genetic correlations [5].

In the present investigation, mostly the genotypic correlation coefficients were slightly higher than the phenotypic correlation coefficients. This may be due to effect of environment in modifying the total expression of genotypes, thus altering the phenotypic expression. This was conformed by the previous findings of Shanmugasundaram [6] in turmeric [6]; Ramaprasad *et al.*[7] in *Phaseolus vulgaris* [7] and Ashok Kumar Singh *et al.* [8] in Safed musli [8]. This a pparent negative association at genetic level would have arisen from repulsion linkage of gene(s) controlling the direct and indirect effects. Conversely the positive correlation was due to the coupling phase of linkage [9, 10].

In the present study, dry seed yield exhibited highly positive significant correlation both at phenotypic and genotypic levels for all 19 traits. The remaining

two characters *viz*., days to flowering and per cent recovery of dry seed showed negative and non-significant association with dry seed yield per plant. The correlation analysis made in this study revealed positive and highly significant association of traits *viz*., number of leaves per plant, number of branches per plant, number of flowers per plant, number of pods per plant, pod length, fresh pod weight, fresh seed weight per pod, fresh seed recovery percentage per plant, hundred fresh seed weight and hundred dry seed weight with dry seed yield per plant in the 1st and 2nd both in I and II seasons. Hence, it may be concluded that these traits may be considered as the most important yield contributing attributes in *G. superba*. These results coincide with the findings of Dayal *et al*. [11] in potato [11]; Data *et al*. [12] in fenugreek [12] and Golani *et al.* [13] in hyacinth bean [13].

Therefore, while exercising selection, emphasis must be laid on the yield components, which had significant correlation with seed yield. However, the information about the association with seed yield and yield attributes alone is not sufficient. The interrelationship between these component characters themselves may affect the overall influence of the characters on yield. Hence, Doku [14] suggested that selection based on the yield components would be effective in improving yield, provided the components are highly heritable and genotypic correlations among them are not negative [14].

Regarding interrelation of the yield components, most of the traits had highly significant positive correlation with each other. The characters *viz*., plant height, stem girth, number of leaves per plant and number of branches per plant had negative and non-significant association with days to flowering and also had highly significant positive correlation with rest of the characters. Regarding association with percentage recovery of dry seed, six characters showed negative and non-significant association, ten characters had negative and significant association and one character such as days to fifty per cent flowering had positive and non-significant association.

Days to flowering had negative correlation with all characters. Days to fifty per cent flowering had negative highly significant association with other characters. The percentage recovery of dry seed had negative and non-significant association with hundred fresh seed weight. However, percentage recovery of dry seed had negative and significant association with hundred dry seed weight and dry seed yield.

The characters *viz*., plant height, stem girth, number of leaves per plant and number of branches per plant had highly significant positive correlation with most of the characters except days to flowering. The inter correlation between various yield traits were studied by several authors *viz*., Singh *et al*.[15] in *Mentha arvensis* [15]; Ram *et al.* [16] in *Silybum marianum* [16]; Panesar and Jadeja [17] in cumin [17] and Jotshi *et al.*[18] in *Abrus precatorius* [18]. Their conclusions generally are in agreement with the results of the present study. This suggests that productive seed yield is the most important selection criterion for improving the glory lily productivity.

REFERENCES

1. Gupta, L.M., R.C. Rana, R. Raina and Meenakshi Gupta, 2005. Colchicine content in *Gloriosa superba* L. J. of Res., SKUAST-J, 4: 238-241.
2. Vandana and D.K. Dubey, 1993. Path analysis in Faba bean. FABIS News Lett., 32: 23-24.
3. Johnson, H.W., W.E. Robinson and R.F. Comstock, 1955. Genotypic and phenotypic correlations in soyabeans and their implication in selection. Agron. J., 47: 447-483.
4. Grafius, J.E., 1959. Heterosis in barley. Agron. J., 51: 515-518.
5. Clark, A.G., 1987. Senescence and genetic correlation hangup. Ame. Nat., 129: 932-940.
6. Shanmugasundaram, K.A., 1998. Evaluation and selection for certain quantitative and qualitative characters in turmeric (*Curcuma domestica* Vel.). M. Sc.. (Hort.) Thesis submitted to Tamil Nadu Agricultural University, Coimbatore.
7. Ramaprasad, E., P.J.M. Rao, P.V. Rama Kumar and V. Srinivasa Rao, 2007. Character association and path analysis in frenchbean (*Phaseolus vulgaris* L.). The Andhra agric J., 54: 28-30.
8. Ashok Kumar Singh, Hemendra Pratap Singh, Surendra Pratap Singh and Alok Kalra, 2008. Genetic variability and correlation studies for selection criteria in Safed Musli (*Chlorophytum borivilianum*, Santapau). Communications in Biometry and Crop Science, 3: 67-71.
9. Lal, S.D., A. Shah and K.P.S. Phogat, 1986. Path analysis of productivity in turmeric. Prog. Hort., 18(1-2): 101-103.
10. Geetha, V. and P.V. Prabhakaran, 1987. Genotypic variability, correlation and path coefficient analysis in turmeric. Agric. Res. J. Kerala, 25(2): 249-254.

11. Dayal, T.R., M.D. Upadhya and S.N. Chaturvedi, 1983. Correlation studies on 1000-true-seed weight, tuber yield and other morphological traits in potato (*Solanum tuberosum* L.) Potato Research, 27: 185-188.
12. Data, S., R. Chatterjee and S. Mukherji, 2005. Variability, heritability and path analysis studies in fenugreek. Indian J. Hort., 62(1): 96-98.
13. Golani, I.J., D.R. Mehta, M.V. Naliyadhara, R.K. Patel and M.V. Kanzariya, 2007. Genetic variability, correlation and path analysis for green pod yield and its characters in hyancinth bean. The Orissa J. Hort., 35: 71-75.
14. Doku, J.L., 1970. Variability in local and exotic varieties of cowpea (*Vigna unguiculata* (L.) walp) in Ghana. Ghana J. Agric. Sci., 3: 139-143.
15. Singh, S.P., R.K. Tiwari and T. Dubey, 2000. Studies on selection parameters in *Mentha arvensis*. J. Med. Arom. Plant Sci., 22: 443-446.
16. Ram, G., M.K. Bhan, K.K.Gupta, Thaker Brijesh, U. Jamwal and S. Pal, 2005. Variability pattern and correlation studies in *Silybum marianum* Gaertn. Fitoterapia, 76: 143-147.
17. Panesar, B. and G.C. Jadeja, 2008. Correlation studies and path analysis for agro-morphological traits in cumin (*Cuminum cyminum* L.). Crop Res., 35: 140-144.
18. Jotshi, P.N., M.K. Bhan, Kanti Rekha and Pooja Mengi, 2008. Variability and correlation studies in *Abrus precatorius* for plant improvement. J. Trop. Med. Plants, 8: 31-35.