

COMBINING ABILITY STUDIES IN *GLADIOLUS*. I.

C.C.PANT, S.D.LAL and DEEPAK SHAH

*HETC, Chaubattia (Ranikhet).263651,
Uttar Pradesh*

ABSTRACT

Combining ability analysis was looked out from 8 x 8 diallel for five important characters, viz. days to sprout, plant height, number of leaves/ plant, days to flower and floret size. Variances due to general combining ability exceeded the variances due to specific combining ability for all the characters except days to sprout, where the variances for SCA were twice the variances due to GCA. The variances due to GCA and SCA were significant for all the five characters. The higher values of GCA than SCA variances indicate that the inheritance of these characters was predominantly governed by additive and additive epistatic components of genetic variance. Oscar, Friendship and Apple Blossom were found to be good general combiners.

Key words : Diallel, combining ability, variance, epistatic

The concept of combining ability (Griffing, 1956 b) is especially useful in partitioning the total genetic variation into variances due to general combining ability (GCA) as a measure of additive genetic effects and specific combining ability (SCA) recognised as a measure of non-additive genetic effects. A knowledge of the relative magnitude of additive and non - additive genetic effects is very useful in designing any breeding programme. However, no such information is available with regard to gladiolus. Therefore, the present study was carried out, following the method I, model I suggested by Griffing (1956 a), to find out the proper breeding procedure to be employed for improvement of gladiolus in U.P. hill region.

MATERIALS AND METHODS

Eight gladiolus varieties which represent the different ecogeographical regions were used in the present investigation. Of these, Apple Blossom and Tropic Sea are American hybrids while others were Dutch hybrids. The varieties, viz. Apple Blossom (AB), Friendship (FS), King Lear (KL), Meria Geretti (MG), Oscar (OS), Snow White (SW), Tropic Sea (TS) and Vinks Glory (VG) ; along with 28 F₁ hybrids, were sown during the first week of March 1989 and 1990 at the Horticultural Experiments and Training Centre, Chaubattia (Almora) ; in a randomised block design with three replications. The parents and F₁ hybrids were planted in a single row comprising of 20

plants with a spacing of 50 cm between the rows and 15 cm between the plants. Five plants were selected randomly from each of the parents and F_1 s and data were recorded for five characters, viz. days to sprout, plant height, number of leaves per plant, days to flower and floret size and combining ability was analysed using method I, model I as suggested by Griffing (1956 b). Reciprocals will be dealt separately.

RESULTS AND DISCUSSION

Analysis of variance for combining ability indicated that both general and specific

combining ability were significant for all the traits. Variances due to reciprocal effects were also significant for all the traits as given in Table 1.

Days to sprout: The GCA exhibited poor effects in the varieties AB, OS, SW, and VG. Whereas, the varieties FS, KL, MG and TS had good GCA effects (Table 2). The SCA effects were significant and were twice the GCA effect. Negatively significant SCA effects were evident in the crosses AB X MG, FS X MG, FS X TS, FS X VG, KL X TS, MG X OS, MG X SW, MG X TS, OS X SW, OS X TS and TS X VG. The maximum positive

Table 1. Analysis of variance for combining ability for different characters in gladiolus

Source	d.f.	Days to sprout	Plant height	No. of leaves/plant	Days to flower	Floret size
gca	7	12.623	412.096**	0.506**	29.273**	3.777**
sca	28	32.457**	85.243**	0.246**	23.219**	0.632**
reciprocals	28	5.284**	58.291**	0.504**	37.690**	0.427**
error	126	0.268	6.346	0.068	5.683	0.104

* significant at 5% level

** significant at 1% level

Table 2. Estimates of general combining ability effects for different characters in gladiolus

Variety	Days to sprout	Plant height	No. of leaves per plant	Days to flower	Floret diameter (cm)
Apple Blossom	0.830**	0.410	0.015**	2.187**	0.164**
Friendship	-0.624**	6.566**	0.194**	-0.650*	0.165**
King Lear	-0.524**	-0.644	0.065**	0.049	0.043**
Meria Geretti	-1.333**	-3.060**	0.060**	-2.472**	-0.273**
Oscar	0.712**	7.784**	0.298**	0.128	1.035**
Snow White	0.855**	-5.026**	-0.160**	0.761*	-0.265**
Tropic Sea	-0.716**	-6.427**	-0.077**	-0.743*	-0.454**
Vinks Glory	0.800**	0.346	-0.233	-0.695*	-0.417**
SE + (gi)	0.015	0.347	0.004	0.311	0.005
C.D. 5%	0.029	0.680	0.007	0.609	0.010
C.D. 1%	0.038	0.895	0.009	0.802	0.014

* significant at 5%

** significant at 1%

SCA effect was found in the cross FS X SW, followed by the crosses AB X SW, MG X VG and FS X KL. Noteworthy being the fact that at least one parent involved in these combinations possessed the high GCA effects for days to flower (Table 3), which may be attributed to the dominant genes present in the parentage.

Plant height : The GCA and SCA effects were significant. Poor GCA effects were observed in the varieties FS and OS, while, good GCA values were observed in varieties MG, SW and TS (Table 2). The variance due to SCA effects was found to be poor in the combinations AB X FS, AB X OS, FS X OS, FS X VG, KL X OS, OS X VG and SW X VG. Whereas, good SCA effects were found in the combinations AB X KL, AB X MG, AB X SW, AB X TS, FS X TS, KL X VG, MG X OS, MG X SW, MG X TS, MG X VG, TS X VG (Table 3). The cross TS X VG was indicative of notable SCA effect involving low x low combination in the parentage which may be attributed to a complementary gene action.

Number of leaves per plant : The GCA effects were poor in the varieties AB, FS, MG and OS. Whereas, the varieties KL, SW and TS had good GCA effects (Table 2). The SCA effects were also found following almost a similar trend. The combinations AB X FS, AB X OS and FS X OS were found dominant. Some other poor effects were also observed in the crosses FS X VG, OS X VG, SW X TS and SW X VG. Contrary to this, good SCA effects were evident in the combinations AB X KL, AB X MG, AB X SW, AB X TS, AB X VG, FS X KL, FS X MG, FS X SW, FS X TS, KL X MG, KL X OS, KL X TS, KL X VG, MG X SW, MG X VG, OS X SW and TS X VG. While, the comple-

mentary type of gene action is indicated in the cross KL X VG as both parents possessed low GCA values (Table 3).

Days to flower : The GCA effects were observed to be poor in the varieties AB, KL, and OS. Whereas, the varieties FS, MG, TS and VG exhibited negatively significant values of GCA (Table 2). The effects of SCA were observed to be highly positive in nature in only three combinations, viz. FS X SW, KL X OS and MG X OS, which were indicative of dominance involving higher x higher general combiners for this character. On the contrary, good SCA effects could be observed in the combinations AB X OS, FS X MG, FS X OS, MG X TS and SW X TS which may be attributed to complementary gene action involving a low x low combination (Table 3).

Floret size : The GCA effects exhibiting poor trend were found in the varieties AB, FS, KL and OS; while, good GCA effects in the varieties MG, SW, TS and VG (Table 2). The SCA effects showed poor combiner trend in the combinations AB X FS, AB X KL, AB X OS, FS X KL, FS X SW, KL X OS, KL X SW, KL X TS, OS X VG and SW X TS which was indicative of a dominant gene effect involving higher x higher general combiners. On the contrary, good SCA effects were evident from the combinations AB X MG, AB X SW, AB X TS, AB X VG, FS X MG, FS X SW, FS X TS, KL X MG, KL X VG, MG X OS, MG X SW, MG X VG, OS X SW, OS X TS, SW X VG and TS X VG. These good combiner SCA effects were the result of complementary gene effect involving low x low general combiners (Table 3).

Some of the combinations in F_1 s are non-significant also. It would have been possible

Table 3. Estimates of sca effects in different characters in gladiolus

S.No	Crosses	Days to sprout F1	Plant height (cm.) F1	No. of leaves/plant F1	Days to flower F1	Floret size (cm) F1
1.	AB x FS	-0.188	8.121**	1.373**	3.280	0.480**
2.	AB x KL	0.312**	-6.616**	-0.494**	-0.520	0.130**
3.	AB x MG	-0.288**	-16.536**	-0.193**	-0.320	-1.070**
4.	AB x OS	0.179	10.474**	0.473**	-4.920**	1.580**
5.	AB x SW	2.345**	-16.826**	-0.494**	2.647	-0.710**
6.	AB x TS	1.112**	-19.816**	-0.760**	3.013	-1.013**
7.	AB x VG	0.145	-4.766	-0.394**	-0.820	-0.400**
8.	FS x KL	1.500**	1.317	-0.077**	1.618	0.174
9.	FS x MG	-0.334**	-2.872	-0.110**	-7.682**	-0.626**
10.	FS x OS	0.466**	9.955**	0.123**	-5.949**	1.024**
11.	FS x SW	3.200**	-4.368	-0.210**	5.784**	-0.423**
12.	FS x TS	-2.134**	-11.561**	-0.077**	0.851	-0.972**
13.	FS x VG	-0.367**	9.695**	0.323**	0.417	-0.013
14.	KL x MG	1.541**	3.605	-0.411**	2.618	-0.201**
15.	KL x OS	2.141**	5.905*	-0.011	5.318*	0.742**
16.	KL x SW	0.907**	2.598	0.623	1.251	0.322**
17.	KL x TS	-1.926**	1.049	-0.244**	0.184	0.202**
18.	KL x VG	0.607**	-9.012**	-0.444**	0.951	-1.454**
19.	MG x OS	-0.463**	-6.966**	-0.073**	6.138**	-0.137**
20.	MG x SW	-1.730**	-12.400**	-0.206**	1.705	-0.887**
21.	MG x TS	-3.497**	-7.950**	-0.040	-6.562**	-1.094
22.	MG x VG	1.970**	-5.190*	-0.540**	-0.512	-1.447**
23.	OS x SW	-1.184**	-3.937	-0.285**	-1.662	-0.933**
24.	OS x TS	-0.984**	0.243	0.681**	-0.528	-0.229**
25.	OS x VG	0.383**	16.583**	0.319**	0.839	1.331**
26.	SW x TS	1.179**	1.327	0.056*	-4.357*	0.392
27.	SW x VG	1.545**	10.874**	0.056*	4.210	-0.080*
28.	TS x VG	-1.668**	-6.469**	-0.469**	-1.390	-0.467**
SE - Sij +		0.104	2.479	0.027	2.220	0.040
CD 5%		0.205	4.859	0.052	4.351	0.079
CD 1%		0.270	6.395	0.069	5.727	0.104

* significant at 5%, ** significant at 1%

that epistasis may play a role during segregation if selfing in these F_1 s is to be made, but is only an expectation. Since, there is an indication of high GCA effect for almost all the characters, it will be possible to improve the gladiolus crop by selection among the hybrids.

We can infer from the present study that Oscar is the best combiner regarding traits like plant height, number of leaves per plant and floret size. Another variety Friendship is also a good general combiner for plant height, number of leaves/plant and floret size. While, the variety Apple Blossom was found to be

the best general combiner for days to flower and good combiner for days to sprout, number of leaves/plant and floret size. Therefore, all the yield contributing factors are controlled by both additive and non-additive gene action.

The significant general and specific combining ability estimates during the study revealed both types of gene action, which can be exploited by simple recurrent selection in the given population. Importance of additive and non-additive variances, presence of sufficient genetic variation are indicative of individual genetic (genotypic) efficacy for selection among varieties under

the present study and the varieties could be improved through simple recurrent selection methods. Griffing (1956a, b) has also opined that for a more predominant role of additive and additive x additive epistatic components of genetic variances, it is better to adopt recurrent selection for rapid improvement.

REFERENCES

- Griffing, B. (1956a). A generalised treatment of the use of diallel cross in quantitative inheritance. *Heredity*, 10 : 31-50.
- Griffing, B. (1956b). Concept of general and specific combining ability in relation to diallel crossing system. *Austr. J. Biol. Sci.*, 9 : 463-493.

Best Compliments From

SUNPAK

Manufacturers of Agro Shade Net

496/A,1, Sankaran Kovil Road,
Rajapalayam-626117, Tamil Nadu, India.

Ph. : 91-4563-31320, 91-4563-20735

Fax : 91-4563-30320