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Combining ability for yield and its components in F_3 generation of Pumpkin (*Cucurbita moschata* Duch.ex.poir)

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Abstract : Combining ability studies of 5 parent partial diallel cross in F_3 generation of pumpkin revealed the contribution of both additive and non-additive gene action controlling the expression of yield and its components. The estimates of component variances revealed predominance of non-additive gene action for all the characters. A close correspondence was observed between per se performance and combining ability effects for the characters studied. Among parents, CM-12 ranked as the best general combiner for yield and its components followed by CM-65 and CM-14. Most of the superior specific combinations involved high x low general combiners. When per se and *sca* effects were considered for all the characters including yield, the crosses CM-45 x CM-12, CM-12 x CM-64 and CM-12 x TPT Local were identified as best promising entries for yield.

Key words : Pumpkin, Combining ability, yield components, Cucurbita moschata Duch.ex.poir

Introduction

Pumpkin (*Cucurbita moschata* Duch.ex.poir) is a monoecious and cross pollinated Cucurbitaceous crop. Heterosis in cross-pollinated crops has been known to offer good potentialities for improvement of yield. Combining ability studies help to assess the prepotency of parents in hybrid combinations and also a powerful tool in selection of superior parents and superior cross combinations. For identifying these superiority in segregating progenies, estimation of *gca* of parents and *sca* of cross combinations was important. Hence, an attempt has been made to study the combining ability effects for yield and its components in F_3 generation of pumpkin.

Materials and Methods

The Ten F_3 crosses and five parents *viz.* CM-45, CM-14, CM-12, TPT-Local and CM-64 were evaluated in a randomized block design with three replications at S.V.Agricultural College, Tirupati during *rabi* 2002 - 2003. Twenty four plants for each cross and twelve plants for each parent were raised in each replication. Two healthy vigorous seedlings were maintained per pit with spacing of 2 m x 2 m. Recommended horticultural operations were followed throughout the cropping period. The observations were recorded on all the plants in each entry in each replication for fifteen characters *viz.*, vine length, number of branches per vine, node of first male flower appearance, node of first female flower appearance, days to first male flower opening, days to first female flower opening, sex ratio, number of fruits per vine, fruit weight, fruit length, fruit girth, fruit flesh thickness, yield per vine, number of seeds per fruit and hundred seed weight. Data were recorded and statistically analysed for the study according to the method 2 model 1 of Griffing (1956).

able 1. Analysis of variance for combining ability in 5 x 5 partial diallel of pumpkin

.No.	Character	Mean sum of squares					
		gca df = 4	gcadf=10	Error df=28	σ^2_{gi}	σ^2_{sij}	$\sigma^2_{gi}/\sigma^2_{sij}$
.	Vine length (m)	1.16950**	1.35420**	0.01811	0.00206	0.01379	0.14930
2.	Branches per vine	2.90917**	0.99008**	0.07217	0.00825	0.05499	0.15002
3.	Node at which first male flower appeared	0.20925**	0.24151**	0.00737	0.00084	0.00561	0.14954
4.	Node at which first female flower appeared	0.07100	0.56450**	0.04943	0.00564	0.03766	0.15000
5.	Days to first male flower opening	4.07780**	0.85009**	0.06606	0.00755	0.05032	0.15004
6.	Days to first female flower opening	2.35690**	0.45562*	0.10699	0.01228	0.08152	0.15063
7.	Sex ratio	0.00251	0.00588	0.00581	0.00066	0.00443	0.15011
8.	Fruits per vine	0.14889**	0.04373**	0.00761	0.00087	0.00580	0.14989
9.	Fruit weight (kg)	0.21500**	0.10009**	0.00125	0.00014	0.00095	0.14736
10.	Fruit length (cm)	10.64890**	2.20640**	0.14002	0.01600	0.10668	0.15000
11.	Fruit girth (cm)	5.04650**	3.76590**	0.07952	0.00908	0.06058	0.15001
12.	Fruit flesh thickness (cm)	0.02169**	0.08254**	0.00189	0.00216	0.00144	0.15000
13.	Yield per vine (kg)	6.80800**	2.53175**	0.04317	0.00493	0.03289	0.14998
14.	Number of seeds per fruit	11725.58500**	11500.40300**	274.00760	31.31516	208.76770	0.15000
15.	Hundred seed weight (g)	4.36770**	2.09240**	0.27371	0.03128	0.20854	0.14999

* Significant at P = 0.05%

** Significant at P = 0.01%

Table 2. General combining ability effects of 5 parents for 15 characters in pumpkin

Entires	1 Vine length (m)	2 Branches per vine	3 Node at which first male flower appeared	4 Node at which first female flower appeared	5 Days to male flower appearance	6 Days to female flower appearance	7 Sex ratio	8 Fruits per vine	9 Fruit weight (kg)	10 Fruit length (cm)	11 Fruit girth (cm)	12 Fruit flesh thickness (cm)	13 Yield per vine (kg)	14 Number of seeds per fruit	15 Hundred seed weight (g)
CM-45	0.22**	-0.40**	0.07	0.02**	0.63**	0.86**	-0.01**	-0.17**	-0.24**	-0.57**	-0.43**	-0.01	-0.10	-65.55**	-0.97**
CM-14	0.33	-0.26**	0.19	-0.15*	1.00**	0.14**	-0.02*	0.09**	0.05**	0.08**	0.30**	-0.03	-0.85	28.76**	0.70**
CM-12	-0.65**	1.01**	0.07	0.01**	-0.42**	-0.74**	-0.01*	0.20**	0.19**	0.04**	1.17**	0.10	1.28	34.18**	0.74**
TPT-Local	-0.15**	-0.59**	-0.06	0.13*	-0.73**	-0.15**	0.02*	-0.09**	-0.12**	-1.46**	0.08**	-0.01	-1.02	-12.91**	-0.69**
CM-64	0.35**	0.24**	-0.26	-0.02**	-0.48**	-0.11**	0.02*	-0.04**	0.12**	1.90**	-1.12**	-0.04	0.69	15.53**	0.22**
SE (gi)	0.045	0.091	0.290	0.075	0.087	0.111	0.026	0.030	0.120	0.127	0.095	0.015	0.702	5.596	0.177
CD at P=0.05	0.092	0.186	0.593	0.154	0.178	0.227	0.053	0.061	0.246	0.260	0.195	0.307	1.438	11.461	0.362
CD at P=0.01	0.124	0.251	0.801	0.207	0.240	0.307	0.718	0.082	0.331	0.351	0.262	0.414	1.940	15.462	0.489

* Significant at P = 0.05%
** Significant at P = 0.01%

Results and Discussion

The analysis of variance for combining ability revealed that the mean squares due to general *(gca)* and specific combining ability *(sca)* effects were significant for all the characters except sex ratio and node of first male flower appearance indicating the importance of both additive and non-additive genetic variance in their inheritance (Table 1). These results are in relevance with Doijode *et al.* (1982) for vine length, Mohanty (2001) for node of first female flower appearance, Mohanty (2000) for fruit flesh thickness and yield per vine in pumpkin.

The estimates of *gca* effects (Table 2) showed that the parental line, CM-12 recorded highest gca effects as well as high mean performance for vine length (in negative direction), fruits per vine, fruit weight, fruit girth, fruit flesh thickness, yield per vine, number of seeds per fruit and hundred seed weight. Similarly CM-14 showed greater potentiality as a good general combiner for node at which first male flower.

It was observed that the parents which performed well were also good general combiners for the respective characters. It can be inferred

Table 3. Specific combining ability effects of 10 F3 hybrid progenies in pumpkin

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Characters F₁'s	Vine length (m)	Branches per vine	Node at which first male flower appeared	Node at which first female flower appeared	Days to male flower appearance	Days to female flower appearance	Sex ratio	Fruits per vine	Fruit weight (kg)	Fruit length (cm)	Fruit girth (cm)	Fruit flesh thickness (cm)	Yield per vine (kg)	Number of seeds per fruit	Hundred seed weight (g)
CM-45xCM-4	-0.63**	-0.11**	-0.10**	0.53**	-1.48**	0.38**	0.01	-0.03*	0.08**	1.34**	0.83**	0.07**	1.96**	223.29**	1.08**
CM-45xCM-12	0.12**	0.62**	-0.52**	0.84**	0.26**	0.33**	0.00	-0.14*	0.04**	-1.48**	2.71**	0.17**	2.48**	14.90**	0.90**
CM-45xTPT local	0.81**	1.56**	0.08**	0.28**	0.21**	-0.33**	-0.03	0.18*	0.18**	0.09**	1.84**	0.57**	0.49**	-50.94**	-0.40**
CM-45xCM-64	0.35**	0.46**	-0.75**	-0.37**	0.26**	-0.91**	-0.03	0.09*	0.49**	-0.06**	0.07**	0.03*	1.40**	65.69**	2.81**
CM-14xCM-12	0.41**	0.24**	-0.23**	0.58**	-0.47**	0.92**	0.01	0.33	0.38**	0.20**	1.26**	-0.18**	-0.86**	26.72**	-0.03**
CM-14xTPt local	-1.40**	0.61**	0.00**	0.09**	-0.76**	-0.31**	-0.02	-0.25	0.05**	-0.82**	2.24**	-0.02**	0.16**	22.20**	0.60**
CM-14xCM-64	-1.16**	0.77**	-0.23**	-0.80**	-0.07**	-0.35**	-0.02	-0.06*	0.18**	-0.49**	0.04**	0.23**	-0.07**	19.37**	0.12**
CM-12xTPT local	-0.17**	-1.22**	0.69**	-0.70**	1.26**	0.21**	-0.01	-0.33	-0.20**	1.95**	-0.90**	-0.14**	-0.22**	8.83**	-0.20**
CM-12 x CM-64	1.29**	0.47**	0.09**	1.22**	0.38**	-1.00**	-0.02	-0.17*	0.17**	2.06**	-1.36**	-0.27**	0.33**	83.59**	0.34**
TPT local x CM-64	1.73**	0.48**	-0.28**	0.26**	0.55**	0.54**	0.21	0.15*	-0.06**	1.65**	0.61**	-0.22**	0.26**	4.94**	0.68**
SE (Sij)	0.117	0.233	0.743	0.193	0.223	0.283	0.661	0.756	0.306	0.324	0.244	0.376	0.180	13.340	0.453
CD at P = 0.05	0.240	0.477	1.522	0.395	0.457	0.580	1.354	1.548	0.627	0.664	0.500	0.770	0.369	29.368	0.928
CD at P = 0.01	0.323	0.644	2.053	0.533	0.616	0.781	1.826	2.089	0.845	0.895	0.674	1.039	0.497	39.621	1.252

* Significant at P = 0.05%, ** Significant at P = 0.01%

that the potential parents for breeding to improve the yield and its components in pumpkin may be judged on the basis of their per se performance. Out offen crosses studied, CM-45 x CM-12 showed highest *sca* and per se performance for fruit girth and yield per vine, CM-45 x CM-14 for number of seeds per fruit. CM-45 x TPT local for branches per vine, sex ratio (in negative direction), fruit weight and hundred seed weight and the cross CM-45 x CM-12 showed highest *sca* for days to first female flower appearance and fruits per vine, CM-14 x TPT - Local for vine length, CM-12 x TPT- Local for node at which first male flower appeared and days to first male flower appearance and CM-12 x CM-64 for node at which first female flower appeared (Table 3).

As the estimates of component variances revealed that *sca* effects were higher than the *gca* effects for all the characters studied indicating the predominance of non-additive gene action in their inheritance. Hence, reciprocal recurrent selection may be effective for improvement of these traits. These are in conformity with Gopalakrishnan *et al.* (1980) and Ajitha (2001) for number of node at which first male and female flower appeared in pumpkin respectively.