

Combining Ability Analysis in Six Pearl Millet Inbreds*

R. SUBRAMANIAM¹ and M. RATHINAM²

Six inbred lines of pearl millet crossed in all possible combinations revealed higher *gca* variance than *sca* variance for the grain yield and its components studied. Estimates of *gca* effects indicated that the parents MS. 7625 and MS. 7373 were the best general combining ability estimates showed that the parents MS. 7625, MS. 7373 and J. 104 were in general superior specific combiners.

In the manifestation of hybrid vigour the combining ability of the parents plays a vital role. An evaluation of inbred lines for their genetic potentiality in this regard is necessary for isolating suitable parents for hybrid combination. Further, information on combining ability and its effects enables the breeder to classify the selected parental materials for their utility in the breeding programme. In pearl millet the grain yield and its component traits have been found to exert different *gca* and *sca* effects in manifesting heterosis (Phul *et al.*, 1973 and Tewari 1973).

MATERIAL AND METHODS

The details of the six inbreds studied for combining ability in the diallel cross analysis are presented in Table I. The 30 hybrid combinations (direct and reciprocals) were studied along with their parents in a randomised block design replicated four

times. A spacing of 45 × 15 cm was adopted. Data on plant height, number of productive tillers, peduncle length, panicle length, 1000 grain weight, primary panicle grain weight and grain yield per plant were recorded in five randomly chosen plants in each replication. General and specific combining abilities were estimated from the diallel cross by adopting Method I of Model (2) of Griffing (1956), which includes the parents and both the direct and the reciprocal combinations. For calculation of the *gca* and *sca*, the original mean values of the arrays were used. Standard errors were estimated by utilising their respective variances and tested for significance.

RESULTS AND DISCUSSION

The estimates of the variances for general and specific combining ability were made for the seven traits (Table II). The variance due to general

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1. School of Genetics and 2. Forestry Department, T. N. A. U., Coimbatore 641003.

TABLE I Details of the distinguishing features of the parents

Parents	Characters					
	Plant height (cm)	No of tillers	Panicle shape and length (cm)	Grain yield per plant (g)	Days to 50% bloom	Downy mildew disease resistance
MS. 7625	Medium tall (165)	Low (3)	Long, spindle (24)	40	45	Highly resistance
MS. 7373	Medium tall (150)	Low (3-4)	Medium, slightly spindle, (20)	40	45	Tolerant
PT. 1682	Medium (120)	Low (3)	Short, cylindrical (16)	12	35	Tolerant
PT. 866/2	Medium tall (160)	Medium (4-5)	Medium cylindrical (23)	30	40	Susceptible
J. 934	Short (65)	Medium (5)	Short, cylindrical (16)	10	35-40	Resistant
J. 104	Medium (100)	High (5-8)	Very short, conical (13-15)	13	32	Susceptible

combining ability and specific combining ability were highly significant for the traits, plant height, panicle length and grain weight of primary panicle. The estimates of general combining ability and specific combining ability effects for the seven traits under study are presented in Tables III and IV, respectively.

The parents 1, 2 and 4 exhibited high and significant *gca* effects for plant height. The cross combinations with high, positive and significant *sca* effect were in the order 5 X 6, 3 X 5, 1 X 5 and 3 X 6. Both *gca* and *sca* were indicated to be important. Badwal (1970) and Phul *et al.* (1973) have expressed a similar trend in pearl millet.

However, Gill *et al.* (1969) have found that *gca* was more significant than *sca*. The combinations involving the parents 5 and 6 were, in general, better in tillering habit for which highly significant estimates of *gca* were obtained in the parents. The cross 1 X 5 recorded the highest *sca* effect followed by 3 X 5 and 2 X 6. Both *gca* and *sca* were reported to be important for this trait (Phul *et al.* 1973 and Tewari 1973). The parents 5 (J. 934) and 6 (J. 104) may be utilized in the hybridization programme to obtain useful recombinations. The parents 3 (PT. 1682), 2 (MS. 7373) and 1 (MS. 7625) have exhibited high *gca* effect for peduncle length. Maximum positive *sca* effect

TABLE II Estimates of variance for general and specific combining ability for seven characters from analyses of diallel crosses.

Due to	D. F.	Plant height	No. of tillers	Peduncle length	Panicle length	1000 grain weight	Grain weight from the primary panicle	Grain yield per plant
General combining ability	5	633.49**	5.76**	15.44*	24.40**	4.40**	533.23**	54.93**
Specific combining ability	15	355.94**	0.89	12.30*	10.30**	1.95*	415.44**	10.16
Reciprocal effects	15	56.49	0.66	3.59	1.20	0.19	36.73	2.40
Error	105	77.66	2.36	6.07	2.57	0.94	65.95	6.27
G.C.A./S.C.A		1.78 : 1	6.45 : 1	1.25 : 1	2.36 : 1	2.26 : 1	1.29 : 1	5.40 : 1
Var. gi		0.2247	0.0068	0.0175	0.0089	0.0033	0.0181	0.1908
Var. sij		1.1685	0.0354	0.0913	0.0464	0.0172	0.0943	0.9923

** Significant at 1% level

* Significant at 5% level.

was noted in the cross 3 X 6 while the maximum negative effect was observed in 1 X 6. There seems to be a general dominance bias for longer peduncle as seen in 17 combinations. The parents 3 (P. T. 1682), 2 (7273) and 1 (MS. 7625) have exhibited high *gca* effect and these may find better utility in crop improvement programmes. For panicle length, the parents 1, 2 and 5 have recorded high positive estimates of *gca* effects. The cross 3 X 4 recorded the maximum *sca* (2.75) for panicle length followed by 5 X 6 (1.93). The importance of both *gca* and *sca* for this trait was indicated

by Phul *et al.* (1973). The parent 3 (PT. 1682) recorded the maximum and significant *gca* effects for 1000 grain weight. Four parents recorded significant *gca* effects. The combination 1 X 3 possessed the maximum positive *sca* (1.42). Most of the heterotic combination involving the parent 3 have recorded more *sca* than the parents 2 (MS. 7373) and 5 (J. 934). Both *gca* and *sca* were significant but the magnitude of *gca* was, however, higher than that of *sca*. Badwal (1970) has recorded that both *gca* and *sca* were important while Gill *et al.* (1969) have reported that *sca* alone was important for this

trait. The parents 1 (MS. 7625) and 2 (MS. 7373) possessed high *gca* for grain weight from the primary panicle. The combinations 1 X 2, 3 X 4, 5 X 1, 1 X 6 have recorded fairly high and significant *sca* effects for this trait. The parents 1 and 2 showed high *gca* for both grain yield from the primary panicle and grain yield per plant. The cross 1 X 6 exhibited the maximum *sca* effect for grain yield per plant (14.14) followed by 1 X 2, 3 X 4 and 2 X 5. A similar result of positive *sca* effect for grain yield has been recorded by Badwal (1970) in pearl millet. The parents 1 and 2 were seen to be consistently outstanding for five out of the seven characters studied.

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