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COMBINING ABILITY FOR SEED YIELD AND QUALITY PARAMETERS IN BITTER GOURD (*MOMORDICA CHARANTIA* L.)

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ABSTRACT

Combining ability analysis of seed yield and seed quality parameters in a 12 x 12 full diallel crossing programme indicated that MC 13 (Coimbatore Local) was a good general combiner for number of seeds/F_0 fruit and 100-seed weight and culture No. MC 84 for field emergence, seedling length and seedling dry weight. Considering the seed quality parameters and heterosis for yield, the combinations Co 1 x Coimbatore Long Green, KAU MC 84 x MC 13, and its reciprocal, MC 36 x Coimbatore Long Green, Priya x Co 1, and MC 13 x MC 36 were found to be promising.

Key words: Combining ability, seed, bitter gourd.

Efficiency of hybrid seed production is a factor to be considered in commercialising of any hybrid cultivar. Seed yield per crossed (F_0) fruit and seed quality parameters of the F_1 seeds are also of significance besides the field performance and better yield of the F_1 hybrids. Identification of good general combiner(s) and specific combiners for hybrid seed production becomes important in this context. Though many reports on combining ability and heterosis breeding are available in bitter gourd [1–4], information on identification of better parents for F_1 seed production is lacking.

MATERIALS AND METHODS

This experiment was conducted at the Horticulture College and Research Institute, Tamil Nadu Agricultural University, Coimbatore during 1991–92. Twelve diverse inbreds of bitter gourd were involved in a full diallel crossing programme. The parents were Pusa Do Mausami, MDU-1, MC 13, Priya, Arka Harit, MC 36, MC 41, Co 1, MC 78, Coimbatore Long Green, Kerala Agricultural University culture No. MC 84 and White Long. Seeds were

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extracted from the crossed fruits (66 direct crosses and 66 reciprocal crosses) and selfed fruits of the 12 parents and observations on quantitative traits (Tables 1 and 2) were recorded. Combining ability analysis was carried out as suggested by Griffing [5].

RESULTS AND DISCUSSION

Analysis of variance for the combining ability are furnished in Table 1. Though variance due to general and specific combining ability (direct and reciprocal) were significant,

Table 1. Analysis of variance (mean squares) for combining ability in bitter gourd

Source	d.f.	Seeds per F_0 fruit	100-seed weight	Field emergence	Seedling length	Vigour index	Seedling dry weight
Gca	11	49.0*	22.5*	417.9*	13.8**	365288.7**	0.2**
Sca	66	22.9	3.1*	126.8	6.6*	136699.6	0.0
Reciprocals	66	47.2**	14.1**	322.0*	18.7**	325662.5**	0.1**
Error	143	22.4	1.9	209.3	4.3	145320.4	0.0
Gca/sca ratio		2.1	7.2	3.3	2.1	2.7	3.8

additive gene action as indicated by a higher gca/sca ratio was predominant for all the characters studied. Such observations were reported in maize from a diallel analysis for seed vigour [6]. General combining ability (gca) effects of the parents for various seed parameters are presented in Table 2 and combinations with significant specific combining ability effects (sca) are listed in Table 3.

It was observed that MC 13 and Coimbatore Long Green were the best general combiners for number of seeds per F_0 fruits. For 100 seed weight MC 13, MC 78 and White Long were good combiners. KAU culture MC 84 was the best general combiner for field emergence. MC 41 and KAU culture MC 84 had significant gca effects for seedling length. MC 13 was found to be a good combiner for seeds per fruit and 100-seed weight; and KAU culture MC 84 had good gca effects for field emergence, seedling length, vigour index and seedling dry weight. Hence use of these two parents in crossing programmes would be ideal for hybrid seed production in bitter gourd. Arka Harit had negative gca effects for all the characters studied.

With respect to sca effects, MDU-1 x MC 36 and its reciprocal cross had significant positive sca values for seeds per F_0 fruit, in addition to Arka Harit x Priya. But performance of these combinations for yield was not satisfactory. In these crosses, no parents with high gca are involved, thus indicating the complementary gene action. For other characters also

Table 2. General combining ability effects of 12 bitter gourd genotypes

Parent	Number of seeds/F_0 fruit	100 seed weight	Field emergence (%)	Seedling length	Vigour index	Seedling dry weight
Pusa Do Mausami	0.37	-0.72**	3.94	0.29	85.05	-0.02
MDU-1	-0.71	0.32	-2.00	-1.36	-140.16	-0.06
MC 13	2.12*	1.11**	3.32	0.99*	104.55	-0.01
Priya	-0.18	-0.45	1.55	0.17	7.28	-0.03
Arka Harit	-0.83	-0.44	-4.91	-0.05	-126.30	-0.68*
MC 36	-0.66	-1.52**	3.73	-0.40	130.84	-0.11**
MC 41	1.36	0.18	-7.20*	0.92*	-208.76**	-0.05
Co 1	0.33	0.04	-2.41	-0.10	-81.61	-0.01
MC 78	0.04	1.86**	1.75	-0.30	35.20	0.09*
Coimbatore Long Green	2.77*	-0.79**	-2.62	-0.65	1.55	0.01
KAU Culture MC 84	-1.49	-0.67*	6.96*	1.29**	211.30**	0.08*
White Long	-2.62**	1.09**	-2.10	0.44	-18.95	0.16
t value (P = 0.05)	1.83	0.54	5.60	0.81	147.51	0.08

*,**Significant at 5% and 1% levels, respectively.

Table 3. Specific combining ability effects for F_1 seed yield and quality parameters of bitter gourd

Character	Crosses with significant positive sca			
	direct cross	sca	reciprocal	sca
Number of seeds per F_0 fruit	MDU 1 x MC 36	8.38	Arka Harit x Priya	10.55
			MC 36 x MDU 1	7.60
100-seed weight	Pusa Do Mausami x MC 78	2.50	KAU.MC 84 x MC 13	2.20
	Co 1 x Coimbatore Long Green	2.40	MC 36 x Priya	2.95
	MC 41 x White Long	2.50	White Long x MC 41	2.33
Field emergence (%)	MDU 1 x MC 13	21.89	—	—
Seedling length	MDU 1 x MC 78	4.83	MC 36 x Priya	4.80
	MC 13 x KAU. MC 84	3.16	White Long x Arka Harit	3.95
	MC 41 x White Long	3.04	Coimbatore Long Green x MC 78	4.68
Vigour index	MDU 1 x MC 13	499.26	Coimbatore Long Green x MC 36	1237.00
	MC 36 x Coimbatore Long Green	1210.26	Coimbatore Long Green x MC 78	558.50
Seedling dry weight	MC 13 x MC 36	0.35	Co 1 x Priya	0.42
	Priya x Co 1	0.30	Coimbatore Long Green x MC 78	0.44
	MC 41 x MC 78	0.40		

this type of complementary gene action was observed. MC 41 x White Long and its reciprocal, Pusa Do Mausami x MC 78, Co 1 x Coimbatore Long Green and MC 36 x Priya had good sca effects for 100-seed weight besides KAU. MC 84 x MC 13. Its reciprocal MC 13 x KAU. MC 84 exhibited significant sca effects for seedling length; both parents viz. MC 13 and KAU. MC 84 had good general combining ability also, thus indicating additive x additive type of epistatic gene action. For vigour index MC 36 x Coimbatore Long Green and its reciprocal; MDU 1 x MC 13 and Coimbatore Long Green x MC 78 exhibited significant sca effects. Co 1 x Priya and its reciprocal, MC 13 x MC 36, MC 41 x MC 78 and Coimbatore Long Green x MC 78 had significant sca effects for seedling dry weight. Additive gene effects and nonadditive, epistatic gene effects were reported by Barlaszabo et al. [6] for seed vigour from a diallel analysis in maize. Out of these combinations, Co 1 x Coimbatore Long Green, KAU. MC 84 x MC 13, MC 13 x KAU. MC 84, MC 36 x Coimbatore Long Green, Priya x Co 1 and MC 13 x MC 36 exhibited high degree of heterosis for total yield and number of fruits also (Table 4), indicating better planting value of these hybrid seeds coupled with better field performance of the progenies.

Table 4. Percentage of relative heterosis (di), heterosis over better parent (dii) and standard heterosis (diii) for yield and number of fruits in certain hybrid combinations of bitter gourd exhibiting high sca for seed quality parameters

Seed quality parameter	Hybrids with high sca values	Heterosis for yield			Heterosis for fruit number		
		di	dii	diii	di	dii	diii
Seeds/F_0 fruit	MDU-1 x MC 36	5.14	0.15	1.44	3.70	- 14.11	- 4.11
	MC 36 x MDU-1	13.43	8.06	9.44	- 14.70	- 28.83	- 20.55
	Arka Harit x Priya	- 36.02	- 50.86	- 52.24	- 20.75	- 35.38	- 42.47
100-seed weight	MC 41 x White Long	- 17.01	- 28.69	- 16.48	- 16.18	- 32.87	- 0.68
	White Long x MC 41	- 38.47	- 47.13	- 38.08	- 44.51	- 55.56	- 34.25
	Pusa Do Mausami x MC 78	2.04	- 9.57	- 0.20	10.57	- 15.00	- 6.85
	Co 1 x Coimbatore Long Green	11.75	- 2.04	30.08	70.12	40.41	40.41
	MC 36 x Priya	- 2.16	- 2.96	- 9.60	11.95	0.61	12.33
	KAU. MC 84 x MC 13	0.78	- 5.79	35.20	72.58	14.44	46.58
Seedling length	MC 13 x KAU. MC 84	50.98	41.14	102.56	131.45	53.46	96.58
Vigour index	MC 36 x Coimbatore Long Green	45.97	23.37	63.84	94.57	53.99	71.92
	Coimbatore Long Green x MC 36	- 4.06	- 18.92	7.68	44.96	14.72	28.08
	MDU-1 x MC 13	- 15.03	- 27.54	4.00	3.40	- 18.72	4.11
	Coimbatore Long Green x MC 78	- 33.83	- 44.82	- 26.72	- 8.24	- 26.86	- 19.86
Seedling dry weight	Co 1 x Priya	14.66	10.72	10.72	15.22	8.90	8.90
	Priya x Co 1	27.59	23.20	23.20	47.83	39.73	39.73
	MC 13 x MC 36	69.93	39.24	99.84	73.71	62.57	108.22
	MC 41 x MC 78	- 53.34	- 59.01	- 52.00	- 55.32	- 61.11	- 42.47
	Coimbatore Long Green x MC 78	- 33.82	- 44.82	- 26.72	- 8.24	- 26.86	- 19.86

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