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Line x Tester Analysis of Combining Ability in Castor, *Ricinus communis L.*

M. KANDASWAMI[1]

An attempt has been made to assess the combining ability of castor inbred lines involving two pollen parents and a set of twelve exotic and Indian varieties as female parents, adopting line x tester analysis technique. The study revealed that the genetic variability is not predominantly additive for yield, number of branches, number of racemes, length of main raceme, length of pistillate region of raceme and total number of capsules. A large part of total genetic variation for seed yield and its components was associated with a significant general combining ability effect while specific combining ability had small effects on yield.

A large number of castor inbred lines are maintained at the Castor Research Station, Salem for utilising them in the hybridization programme for production of high yielding castor hybrids. Many workers advocated line x tester analysis as one of the successful tools for screening the lines with speed and reasonable confidence (Murthy *et al*., 1957, Rao *et al*., 1968). This technique has been used to assess the combining ability of castor inbred lines and presented in this paper.

MATERIALS AND METHODS

TMV 1 an improved strain and R. c. 539/1 (Egypt) an exotic variety well acclimatised to the local conditions were used as male parents and testers. Twelve inbred lines, viz., R.c. 1351 (Italy), R.c. 1175/1 (South Africa), R.c. 1193/1 (France), R.c. 1254 (Israel), R.c.1367 (Nigeria), R.c. 1301 (USSR), R. c. 1350 (F.W. Africa), R. c. 1196 (Kanpur), R.c. 1332 (Gujarat), R c. 1133 (IARI), R.c. 605 (Trichy) and R.c. 888 (Nagpur) were used as female parents in the present study. The resulting twentyfour hybrids were raised along with their parents for two years under rainfed conditions, adopting randomised block design with four replications at the Castor Research Station, Salem.

Six characters as shown in Table I were studied. Statistical analysis was done on the mean values of five plants per entry. Combining ability analysis was done based on the procedures developed by Kempthorne (1957).

RESULTS AND DISCUSSION

The mean squares due to the females are of a large magnitude (Table I) in comparison with those due to males or males x females indicating greater variability among females. The mean

1 : Castor Research Station, Tamil Nadu Agricultural University, Salem.
Present Address, Oil seeds Experiment Station, Tindivanam 604 001

TABLE I. Analysis of variance for combining ability in castor.

Source	d. f	Mean sum of squares					
		Yield	No. of branches	No. of racemes	Length of main raceme	Length of pistillate region of raceme	Total no. of capsule
Blocks	3	188.53	1.24	0.50	57.23	31.50	829.16
Hybrids	23	373.83**	0.94*	0.50**	71.93**	108.55**	601.75**
Female	11	486.34**	0.69	0.750**	72.77**	96.45**	599.85*
Male	1	135.08	1.04	0.070	2.10	17.00	364.25
Male x Female	11	270.19	0.97*	0.479**	56.54**	128.91**	625.230
Error	69	120.26	0.34	0.069	14.53	10.85	229.86
Gca		6.84	0.004	0.002	0.68	2.58	5.11
Sca		2.07	0.121	0.004	3.09	3.84	38.64
Gca/Sca		3.04	0.003	0.500	0.22	0.67	0.132

*, ** significant at P=0.05 and 0.01 level

squares due to females x males are not uniformly of higher or lower magnitude than that of males and females indicating that the hybrids are not uniform.

The analysis of variance for six characters revealed that female differences were significant for five attributes. The line x tester interaction was significant for number of branches, number of racemes, length of main raceme, length of pistillate region of raceme and total number of capsules. The hybrids differed significantly among themselves for most of the characters.

The estimates of general combining ability (gca) effects are given in Table II. None of the male parents had significant gca values for any attributes. With regard to ovule parents, two inbred lines R. c. 1196 and R. c. 1367 had significant gca value for yield. The lowest gca value for yield was expressed by R.c. 1301. The inbred line R.c. 1193/1 also had low gca value for total number of capsule and yield. R.c. 1196 had reduced length of main as well as pistillate region of raceme. R.c. 1367 had low gca value for number of racemes. R.c. 1301 had low gca value for length of main raceme, length of pistillate region of raceme and total number of capsule. R. c. 1351 was the only inbred line that recorded high value for number of branches and number of racemes. R. c. 888 had high gca effect for length of main raceme as well as length of pistillate region of raceme.

The estimates of specific combining ability (sca) effects are given in Table III. The sca effect was not significant in any of the crosses for yield. Number of branches, length of main raceme, and total number of capsule was significant in one cross each

TABLE II. Effects of general combining ability in castor

Source	No. of branches	No. of racemes	Length of main raceme	Length of pistillate region of raceme	Total no. of capsules	yield
Male						
R. c. 539/1	0.10	0.02	0.14	—0.43	—1.95	—0.60
TMV. 1	—0.10	—0.02	—0.15	0.43	1.95	0.60
S. E. (gi)	±0.08	±0.037	±0.55	±0.47	±2.18	±1.58
Females						
R. c. 1351	0.83**	0.52**	—1.48	—2.12	3.64	—2.52
R. c. 1175/1	0.20	0.40**	0.77	—0.49	9.89	4.48
R. c. 1193/1	—0.17	—0.10	—1.48	—2.24	—13.34*	—9.14*
R. c. 1254	—0.04	—0.23*	—1.86	—1.62	0.01	—3.65
R. c. 1196	—0.04	—0.10	+4.73**	+2.49*	10.64*	11.60**
R. c. 1367	—0.04	0.23*	0.27	2.34*	12.26*	13.85**
R. c. 1332	—0.04	0.02	3.65**	1.76	7.89	— 4.40
R. c. 1301	—0.17	0.02	—3.98**	—5.24**	—13.49**	—13.64**
R. c. 1360	—0.29	—0.60**	1.39	—1.36	—12.49*	1.48
R. c. 133	—0.17	0.14	—0.49	—0.62	0.64	2.48
R. c. 605	—0.17	0.27**	2.15	7.01**	8.39	2.02
R. c. 888	0.08	—0.10	5.77**	5.26**	— 0.99	1.48
SE (gi)	±0.206	±0.093	±1.34	±1.17	± 5.36	±3.17

*, ** Significant at P=0.05 and 0.01 level

whereas number of racemes and pistillate region of raceme was significant in three crosses each.

The present study revealed that for number of branches, number of racemes, length of main raceme, length of pistillate region of raceme, total number of capsule and yield, the genetic variability is not predominantly additive as gene interactions were highly significant (Table I) and Sca effects were lower than the gca effects. Two lines R.c. 1196 and R.c. 1367 had significant gca effect for yield as well as for length of pistillate region of raceme and total number of capsule. It is suggested that these lines could be chosen as one of the parents in the hybrid breeding programme. In the case of tester it is difficult to arrive at any definite conclusion since the gca effect was not significant for any of the characters. The significant line x tester effect for number of branches, number of recemes, length of main raceme, length of pistillate region of raceme and total number of capsules in this study indicated that different testers produce markedly different combining ability effects. The present study brought out that a large part of

TABLE III. Effects of specific combining ability in castor

Character	Line	Tester											
		R. c. 1351	R. c. 1175/1	R. c. 1193	R. c. 1254	R. c. 1196	R. c. 1367	R. c. 1332	R. c. 1301	R. c. 1360	R. c. 1133	R. c. 605	R. c. 868
No. of branches	R. c. 539/1	0.65*	—0.22	—0.37	—0.23	—0.48	0.27	0.02	—0.10	0.23	0.40	—0.10	0.50
	TMV .1	—0.64*	0.23	0.35	0.23	0.48	—0.27	—0.02	0.10	0.23	—0.40	0.10	—0.40
No. of racemes	R. c. 539/1	0.48**	—0.07	0.10	0.23	—0.40**	—0.02	0.23	—0.21	—0.15	—0.14	—0.02	0.10
	TMV. 1	—0.48**	0.14	—0.11	—0.23	0.39**	0.02	—0.23	0.27*	0.14	0.15	0.02	—0.11
Length of main raceme	R. c. 539/1	—2.14	2.61	—0.89	5.98**	0.14	0.11	2.73	—2.89	—0.52	—2.89	—2.27	0.36
	TMV. 1	2.15	—2.60	0.90	—5.98**	0.15	—0.10	—2.73	2.90	0.52	2.90	2.27	—0.35
Length of pistillate region of raceme	R.c. 539/1	—1.95	2.18	—0.07	+3.80*	—0.03	4.05*	1.93	—0.47	—1.07	—3.45*	—4.32*	—1.07
	TMV. 1	1.95	—2.18	0.07	—3.80*	+0.07	—4.05*	—1.93	1.07	1.07	3.45*	4.32	1.03
Total no. of capsules	R. c. 539/1	4.82	11.07	0.80	13.20	—11.18	5.70	6.32	—6.30	—0.80	—7.43	—15.68*	—1.05
	TMV. 1	—4.82	—11.07	—0.85	—13.20	11.18	5.70	6.32	6.30	0.80	7.43	15.68*	0.55
Yield	R. c. 539/1	—2.15	7.85	0.47	10.48	—5.79	—2.85	2.73	—6.53	+5.85	0.10	—5.40	—2.40
	TMN. 1	2.15	—7.85	—0.48	—10.48	5.76	2.70	—2.72	6.52	—5.85	—0.10	5.40	2.40

S. e. for number of branches = ±0.29. *, ** Significant at P=0.05 and P=0.01

total genetic variation for seed yield and its components viz., length of main raceme, length of pistillate region of raceme and total number of capsules was associated with a significant general combining ability effect while specific combining ability had small effects on seed yield. To realise high seed yield in castor, exploitation of hybrid vigour in F1 hybrids appeas to be more useful.

REFERENCES

KAMPTHORNE, O. 1957. *An Introduction to Genetical Statistics*. John Willy and Sons, Inc., New York.

MURTHY, B. R., J. L. TIWARI and G. HARINARAYANA. 1967. Line tester analysis of combining ability and heterosis for yield factors in *Pennisetum typhoides*. *Indian J. Genet.* 27 : 238-45.

RAO N. G. P., V. K. S. RANA and D. P. TRIPATHI. 1968. Line x tester analysis of combining ability in Sorghum. *Indian J. Genet.* 28 : 23-18.