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THE COMBINING ABILITY IN CASTOR

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ABSTRACT

Combining ability of the three pistillate lines and eight testers was assessed by Line x Tester analysis. The variance components due to sca were higher than gca for five characters except for number of nodes upto the main spike indicating the predominance of non- additive gene action. The genotypes 262-1 and TMV 5 mutant 3 were the good general combiners. The hybrid combinations 240 x TMV 5 mutant 1, 240 x TMV 5 mutant 4 and 262 -1 x TMV 5 mutant 3 were good specific combiners. These materials can be profitably utilised in the exploitation of new hybrids in castor.

KEY WORDS : Castor,Line x Tester Analysis, Mutants of TMV 5, Non-Additive Gene Action, General Combiners, Specific Combiners.

Castor *(Ricinus communis* L) is an important non-edible vegetable oil with manifold industrial uses. After the introduction of hybrids in this crop, the area and production expanded considerably in the Gujarat state. The latest hybrid, GCH 4 is widely adaptable and it is becoming popular in southern states. However, it could not be introduced as intercrop in the existing cropping system due to its longer growing season. Further, the faster growth rate of it's male parent, 48-1, suppresses the growth of the pistillate line, VP 1, in the seed production plot. Hence. identification and isolation of new hybrids with diverse source of pistillate lines and male parents will be a boon to the caster growers. Knowledge on the combining ability of different parents and crosses is a must in such process. The present investigation aims at assessing the relative importance of general and specific combining effects and type of gene action for yield and its components through L X T analysis of some newly developed male and pistillate lines.

Table 1. Analysis of variance for combining ability

Source of variance	df	Nodes up to main spike	Effective No. of spike/plant	Length main spike	Effective leagth of main spike	No. of capsules	Seed yield
Replication	2	0.116	0.209	40.504	100.477	132.498	93.650
Genotypes	34	6.319**	3.487**	65.781**	128.149**	270.909**	143.090*
Parents	10	4.535**	6.893**	53.913*	93.988**	368.575*	84.699
Males	7	6.377**	7.979**	42.826	88.132**	278.518	100.835
Females	2	0.310	5.541	88.675	96.010	597.855	59.270
Male x Female	1	0.089	1.990	62.003	125.045	440.414	22.200
Parents Vs Crosses	1	8.409	2.855	238.681	323.472	190.805	597.371
Crosses	23	7.003**	2.033**	63.423**	135.062**	236.277**	148.724*
Lines	2	31.027**	1.851	44.688	278.792*	20.373	257.601
Testers	7	7.951**	2.894**	59.916*	132.418**	376.553	112.302
Lines x Tester	14	3.098**	1.629**	67.853**	115.851**	196.983	151.382*
Error	68	0.357	0.500	16.676	8.604	97.277	54.138
Variance components							
gca		0.993	0.045	10.367	5.439	0.089	2.035
sca		0.914	0.376	17.059	35.749	33.235	32.415
gca/sca		1.087	0.119	0.608	0.152	0.003	0.063

** Significant at 1% level; * Significant at 5% level.

Table 2. Estimates of gca effects of eleven (3+8) genotypes for six characters

Parents	Nodes up to main spike	Effective No. of spike	Effective No. of of spike	Effective length of main spike	No. of capsules	Seed yield
Female						
SKP 24	1.065	0.124	1.367	2.915*	0.333	-1.694**
240	0.132	0.194	0.004	0.832	-1.042**	-2.082**
262-1	-1.197	-0.318	-1.362	-3.747**	0.708**	3.776**
SE gca	1.122	0.144	0.834	0.599	2.013	1.502
Male						
TVC 30	1.172	-0.354	1.581	2.685**	1.208**	2.643**
TVC 31	0.817	-0.688	0.847	1.907*	-12.625**	1.168**
TVC 15	-1.549	0.024	-3.464**	-4.882**	1.708**	1.546**
TMV 5	-1.105	0.668	-2.653*	-4.771	6.042**	1.513**
Mut 1	-0.272	0.490	3.769**	1.463*	0.875**	5.443**
Mut 2	0.628	0.601	1.769*	2.585**	2.708**	0.257**
Mut 3	0.183	0.035	0.703	4.763**	6.542**	6.168**
Mut 4	0.128	-0.776	-2.553*	-3.749**	-6.458**	2.565**
SE gca	0.199	0.236	1.361	0.978	3.288	2.453

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

Table 3. Specific combining ability effects of 24 crosses

Crosses	Nodes up to main spike	Effective No. of spike/plant	Length of main spike	Effective length of main spike	No. of capsules	Seed yield
SKP 24 x TVC 30	-0.243	-0.312	0.045	1.941	-0.833*	2.104**
SKP 24 x TVC 31	0.346	0.126	4.278	5.719*	2.001**	-1.907**
SKP 24 x TVC 15	-0.187	0.115	2.789	0.508	10.167**	-1.284**
SKP 24 x TMV 5	-0.432	-0.535	-5.222*	-4.903*	-5.664**	-1.117*
SKP 24 x TMV 5 Mutant 1	1.201	-0.491	2.222	3.663*	3.499**	-1.461**
SKP 24 x TMV 5 Mutant 2	1.001	0.532	-1.578	1.107	0.833**	4.439**
SKP 24 x TMV 5 Mutant 3	-0.921	0.265	-1.012	-1.571	8.834**	-1.906**
SKP 24 x TMV 5 Mutant 4	-0.765	0.309	-1.522	-6.460**	-2.166**	1.127*
240 x TVC 30	0.889	0.717	4.116	3.890*	5.042**	-1.974**
240 x TVC 31	0.580	-0.049	-3.485	-5.998**	-3.124	2.481**
240 x TVC 15	-0.754	-1.161	-4.974	7.543**	-10.458**	-2.262**
240 x TMV 5	-0.199	-0.605	-4.151	-2.954	-1.291**	-0.163**
240 x TMV 5 Mutant 1	-0.532	0.239	0.627	0.946	8.876**	8.927**
240 x TMV 5 Mutant 2	0.435	0.128	3.293	0.990	6.042**	0.793
240 x TMV 5 Mutant 3	0.213	0.394	5.159*	3.146**	-12.291**	-13.218**
240 x TMV 5 Mutant 4	-0.632	0.339	-0.585	2.523	7.209**	5.4115**
262-1 x TVC 30	-0.647	-0.403	-4.159	-5.831*	-4.208**	-0.132
262-1 x TVC 31	-0.925	-0.071	-0.793	0.281	1.126*	-0.577
262-1 x TVC 15	0.941	1.052	2.185	7.036**	0.292	3.546**
262-1 x TMV 5	0.631	1.139	9.374**	7.859**	6.959**	1.279*
262-1 x TMV 5 Mutant 1	-0.669	0.251	-2.849	-4.609*	-5.374**	-7.465**
262-1 x TMV 5 Mutant 2	-1.436	-0.659	-1.715	-2.097	2.792**	-5.231**
262-1 x TMV 5 Mutant 3	0.708	-0.659	-4.149	6.575**	3.459**	15.125**
262-1 x TMV 5 Mutant 4	1.397	-0.649	2.108	3.936	-4.333**	-6.542**
SE (sca)	0.345	0.408	2.358	1.694	5.694	4.248

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

MATERIALS AND METHODS

Three pistillate lines (SKP 24, 240, 262-1) and eight pollen parents (mostly the advanced breeding lines) were selected (Table 2). The resulting 24 hybrids along with 11 parents were raised in a randomised block design with three replications at the Oilseeds Research Station, Tamil Nadu Agricultural University, Tindivanam, during *Kharif* '92, season. Each plot consisted of 60 plants having an inter-and intra row spacing of 90 x 30 cm. Observations were recorded in ten randomly selected plants for six characters *viz.*, number of nodes upto main spike, effective number of spikes/plants, length of main spike (cm), effective length of main spike (cm), number of capsules/plant and seed yield/plant (g). Estimates of general and specific combining ability effects were computed (Kempthrone, 1957).

RESULTS AND DISCUSSION

Analysis of variance (Table 1) revealed significant differences for genotypes and crosses for all the characters. The line x tester interaction was significant for all the characters except for the number of capsules/plant. The variance components due to gca is higher than sca only for number of nodes upto the main spike. Whereas, the variance due to sca is higher than gca for all the other characters. This revealed the fact that non-additive type of gene action is predominant for yield and some of the yield attributing traits in the present materials. Such type of non- additive gene actions were also reported in castor by Singh and Yadava (1981), Singh and Srivastva (1982) and Dangeria *et al.*, (1987).

Among the pistillate lines, 262-1 was the best general combiner for number of capsules/plant and seed yield/plant (Table 2). Among the pollen parents, TMV 5 mutant 3 (stabilised mutant derived from 30kr of gamma rays in TMV 5 was the best general combiner for effective spike length, number of capsules per plant and seed yield. Similarly, TVC 15 and TMV 5 were also good combiners for number of capsuless/plant and seed yield.

The specific combining ability effects are presented in Table 3. None of the combinations was significant for the characters, number of nodes upto the main spike and effective number of spikes/plant. In castor, the number of nodes upto main spike is used as an index for measuring duration. The lesser the number of nodes the shorter the duration will be. However, in the present material, none of the combinations was superior in this respect. Similarly, the number of effective spikes/plant is directly related to branching. There was no indication of better combination in this respect too.

The combinations, 262-1 x TMV 5 and 240 x TMV 5 mutant 3 were the good specific combiners for the length of main spike. The hybrid between 262-1 x TMV 5 was the superior combination for spike length, number or capsules per plant and seed yield. In respect of number of capsules and seed yield, the crosses *viz.*, 240 x TMV 5 mutant 1, 240 x TMV 5 mutant 4 and 262-1 x TMV 5 mutant 3 were good specific combiners. Hence, it is clear that there is good scope for evolving hybrids with diverse source of pistillate lines with the advanced breeding lines of gamma ray induced mutants of TMV 5 in castor.

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