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COMBINING ABILITY IN DIALLELE CROSS OF TORIA

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ABSTRACT

Combining ability in Toria (*Brassica compestris Linn.* Var. toria), was studied in a set of diallel cross (excluded the reciprocals) of 7 diverse genotypes for plant height, days of maturity, primary branches, seed/siliqua, siliqua/plant 1000 seed weight and seed yield/plant. Both additive and non-additive gene effects predominantly contributed towards the expression of the characters. Among the parent none was appeared to be good general combiner for all characters. T-151 was good combiner for seed yield and some yield contributing characters. The crosses T-151 x PT-303, T-151 x T-9, IB-1374 x PT-30 and IB 127 x IB 378 appeared to be good specific combiner for seed yield and its contributing characters. Both additive and non-additive gene effects might be exploited and recurrent might be practiced for exploiting the genetic variability.

Toria (*Brassica compestris Linn.* Var. toria) is a short duration crop, which can be accommodated as oil seed crop in rice-rice-mustard crop rotation in Manipur Valley. The superiority of parents may not depends so much on their actual performance as on their ability to combine well and throw trangressive segregates. But information regarding combining ability in toria is limited, hence breeding for high yielding varieties in the crop is greatly hindered. The present investigation aims to obtain information on combining ability for seed yield and its components in toria for breeding better varieties of this important oil seed crop in Manipur Valley.

MATERIALS AND METHODS

Seven diverse genotype viz. IB-127, T-151, IB-1374, Pt-303, IB-378, T-9 and PT-30 were crossed in diallel system without reciprocal during 1992-93. the parents were uniform after 3 years of mass selection. The seven parent and their 21 F1s were sown during winter 1994-95 at the experimental farm of college of Agriculture, Central Agricultural University, Imphal in a randomized block design with three replications. The parents and F1s were sown in two rows of 2 m length with spacing of 30 cm. Between the rows and 15 cm. Between the parents. Recommended agronomical practices and plant protection measures were followed in the experiment. Observations were taken on 10 competitive random plants each entry in a replication for the characters, plant height, days to maturity, primary branches, number of seed per siliqua, siliqua per plant, 1000 seed weight and seed yield per plant and their average were used in statistical analysis. The nature of gene action was worked out on the basis of their combinig ability (Model 1, Method II of Griffing 1956). The estimate of heritability in the narrow sense were computed as follows.

$$h^2 = \frac{2\sigma^2 g}{2\sigma^2 g + \sigma^2 s + \sigma^2 e}$$

RESULTS AND DISCUSSION

There were highly significant differences among genotypes for all the characters. Highly significant mean squares for both gca and sca (Table 1) indicated both additive and non-additive gene action. The gca mean squares were invariably higher for plant height, days to maturity, primary branches per plant and number of siliqua per plant whereas sca mean squares were higher for number of seed per siliqua, 1000 seed weight and seed yield per plant. Thus both additive and non-additive gene action seemed to be responsible for seed yield and its components in toria. But when the estimates of variance due to gca (s2 g2s) and sca (s2s) were computed and s2g / s2s was compared, the magnitude of s2s was higher than that of s2g for all the characters, indicating the preponderance of non-additive gene action. Apparently, gca/ sca may not always project the true picture of the gene action for a particular character because the ability of the parents to combine well would depend upon the complex interaction among the genes and genotype x environment interaction. Singh and Singh (1972)and Yadav et.al (1974) have reported the presence of non-additive gene action in toria and Lal and Singh (1974), Ram et.al. (1976) and Chauhan and Singh (1979) in Indian mustard.

Heritability in the narrow sense was highest for plant height (47.62 %), followed by days to maturity (36.09) and primary branches (23.83 %). The seed yield per plant had the lowest estimates of heritability (5.46 %). The estimates of gca effects showed that T-151 was the best general combiner for seed yield / plant, number of siliqua per plant, 1000 seed weight and primary branches. For plant height and days to maturity, IB-127 has the highest and significant negative gca effect and hence was a good combiner for these two traits. Genotypes PT-30 and IB-378 were tne best combiners for number of seeds per siliqua (Table 2).

T-151 x PT-303, T-151 x T-9, IB-1374 x PT-30 and IB -127 x IB 378 had high sca effect for seed yield per plant. High and significant sca effects were observed in the crosses T-151 x PT-303, T-151 x PT -303 for 1000 seed height. Significant sca effect for number seed siliqua were observed in the crosses PT -303 x PT-30, IB -1374 x IB-378 and IB -378 x T-9 . All the above crosses involved high x medium, high x low and low general combining ability. In other crosses for other characters no definite trend could be established between gca of the parents and sca of the resulting crosses (Table -3). Such results have been reported by Yadav et.al. (12974), and Jindal and Labana (1986) in Indian mustard and Labana et.al. in yellow seeded Indian colza.

When gca effects of the parents and sca effect of the crosses were analysed it could be noticed that T-151 and T-9 were good general combiners for seed yield per plant and number component characters studied whereas IB-127, IB-1374 and PT -303 were poor general combiners for these characters. This indicated that superior specific combination in the cross T-151 x PT-303 resulted due to high x low sca parents. The above cross that may be further exploited for future-breeding programme may release desirable transgressive segregates.

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Table 1. Analysis of variance for combining ability in 7x7 diallel cross in toria

		Mean squares						
Sources	df.	Plant height	Days to maturity	Primary branches	Seed/ siliqua	Siliqua/ plant	1000 seed weight	Seed yield/ plant
Progenies	27	426.156**	30.373**	1.789**	25.558**	11519.07**	0.3333**	6.082**
Error	54	72.851	7.147	0.575	3.267	3955.245	0.0827	1.1452
gca	6	355.742**	20.555**	0.906**	6.228**	3903.245*	0.109**	0.986*
sca	21	80.990**	7.148**	0.507**	9.174**	3821.532*	0.111**	2.327**
Error	54	27.280	2.382	0.192	0.089	1318.445	0.981	0.381
Gca/sca		4.392	2.875	1.786	0.678	1.021	0.981	0.427
$\sigma^2 g/\sigma^2 s$		0.657	0.423	0.251	0.71	0.114	0.108	0.034
h^2 %		47.62	36.09	23.828	11.07	13.06	14.02	5.46

P = 0.05, ** P = 0.01

Table 2 General combining ability effects and mean value of the parents in 7x7 diallel cross in toria.

Varieties	Plant height		Days of maturity		Primary Branches		Seed siliqua		Siliqua/ plant		1000 seed weight		Seed yield/plant	
	X	gi	X	gi	X	gi	X	gi	X	gi	X	gi	X	gi
IB-127	70.42	- 4.01*	109.10	- 1.82*	4.80	- 0.11	14.03	- 0.22	142.40	- 16.4	2.32	0.05	4.61	- 0.31
T-151	93.91	13.99**	118.10	2.92**	3.95	0.45*	20.97	- 1.42**	90.53	42.32*	2.49	0.18*	4.61	0.67*
IB-1374	71.45	- 2.93	112.70	- 0.30	4.72	0.03	14.27	- 0.22	161.15	- 621	1.92	- 0.09	4.40	- 0.25
PT-303	78.39	- 1.65	112.63	- 0.76	4.45	0.01	12.87	- 0.47	157.55	6.81	2.32	- 0.03	4.66	- 0.05
IB-378	83.43	- 0.90	114.87	0.05	5.27	0.34	15.40	0.77*	156.54	2.80	2.42	- 0.15	5.76	- 0.04
T-9	77.45	- 0.98	110.70	- 0.80	4.77	- 0.26	15.60	0.67	144.40	- 11.60	2.23	0.06	5.05	0.14
PT-30	74.68	- 3.52	115.73	0.72	4.23	- 0.46	15.17	0.88*	136.28	- 17.96	2.43	- 0.01	5.04	- 0.16
Se gi		1.520		0.684		0.135		0.322		11.203		0.084		0.33
Se (gi-gi)		2.321		1.045		0.206		0.412		17.108		0.129		0.50

* P = 0.05, ** P = 0.01

Table 3. Specific combining ability effects in 7x7 diallel cross in toria.

Crosses	Plant height	Days to maturity	Primary branches	No. of Seed/ Siliqua	No. of siliqua/ plant	1000 seed weight	Seed yield/ plant
IB -127 X T-151	7.60	0.08	5.18*	- 4.25*	- 0.40*	66.04*	- 1.92
X IB-1374	- 4.18	- 0.17	- 2.00	- 1.72	0.07	- 18.72	- 1.08
X PT-303	- 5.27	0.21	0.79	1.99*	- 0.18	- 20.35	- 0.08
X IB 378	7.15	- 0.24	- 2.02	2.02*	0.25	- 8.83	1.31
X T-9	- 3.00	0.22	2.17	0.19	0.20	- 0.72	0.64
X PT-30	11.23*	- 0.25	- 0.02	1.68	0.29	- 10.24	0.88
T-151 X IB 1374	11.19*	0.71*	- 2.41	- 2.01*	0.51*	- 3.12	0.55
X PT-303	15.27	1.26*	- 0.61	- 2.64	0.68*	134.32**	4.28*
X IB-378	10.18*	1.33*	6.24*	-2.87*	- 0.43*	67.50*	- 0.27
X T-9	4.83	0.76	- 1.91	3.57*	0.23	101.81	2.57
X PT-30	- 9.07*	0.34	- 1.43	- 3.42*	- 0.13	-21.77	-1.54
IB-1374 X PT 303	3.52	0.48	0.78	- 0.96	0.12	4.92	0.03
X IB-378	-3.91	- 038	0.14	2.30*	0.13	- 19.33	0.44
X T-9	9.99*	- 0.32	2.32	0.53	- 0.13	-6.52	- 0.23
X PT-30	- 085	0.25	4.13*	1.28	- 0.21	52.17	1.70
PT-303 X IB-378	-11.25*	- 0.03	- 0.74	- 0.76	- 0.23	- 23.05	- 2.07
XT-9	1.44	- 0.50	0.78	0.31	- 0.12	- 9.48	- 0.15
X PT-30	3.34	- 0.37	0.25	3.29*	- 0.37	- 17.66	- 0.30
IB-378 X T-9	- 3.12	- 0.56	- 0.03	3.04*	-0.18	-17.53	- 0.39
X PT-30	0.12	0.57	-3.56	-1.61	- 0.29	55.89	0.52
T-9 X PT-30	0.89	- 0.27	1.63	0.82	0.49*	-46.24	- 0.77
Se gi =	4.42	0.393	1.991	0.936	0.246	32.578	1.991