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TRIPLE TEST CROSS ANALYSIS FOR SOME PHYSIO-MORPHOLOGICAL TRAITS IN OILSEED RAPE (*BRASSICA NAPUS*)

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ABSTRACT

The triple test cross (TTC) analysis of Jinks and Perkins was applied to study the additive (D), dominance (H), and epistatic components of genetic variation for different physio-morphological traits, viz., seed yield/plant, primary branches, secondary branches, pod length and plant height in two crosses of *Brassica napus*. The results revealed that epistasis was of major importance for seed yield and primary branches in cross Bronowski × Topa and for primary branches and plant height in cross CSL-1 × Nikalis. The [j & l] type of epistasis was prevalent in both the crosses, Bronowski × Topa and CSL-1 × Nikalis.

Key words : *Brassica napus*, physio-morphological traits, triple test cross analysis, components of genetic variation.

The exploitation of genetic variation depends on the extent of fixable and nonfixable variation, and the genetic model used. Most genetic models of second degree statistics have been developed to estimate the components of continuous variation in the absence of epistasis. The present study aims to obtain unbiased estimates of additive (D) and dominance (H) components in the absence of epistasis by triple test cross design [1].

MATERIALS AND METHODS

Twenty and 16 plants were randomly chosen from each of the two F_2 of crosses GSL-1 × Nikalis and Bronowski × Topa. Each of these plants was crossed as male to both its parents (P_1 and P_2) and F_1 ($P_1 \times P_2$) to produce L_{1i}, L_{2i} and L_{3i} families of each of these two crosses thus produced were raised in complete randomized block design with three replications. Observations were recorded on five competitive plants from each family for seed yield per plant, primary branches, secondary branches, pod length and plant height.

Data recorded on the above characters were utilized for statistical analysis according to Jinks and Perkins [1].

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RESULTS AND DISCUSSION

The test of epistasis for various physio-morphological traits is presented in Table 1. Significant epistasis was observed for seed yield per plant and primary branches in cross Bronowski × Topa; and for primary branches and plant height in cross GSL-1 × Nikalis. This indicated the significant role played by epistasis in the control of these characters. However, the partitioning of epistasis into overall epistasis [i] and [j & l] type revealed that additive × additive [i] interaction was nonsignificant for all the characters in both crosses, i.e. GSL-1 × Nikalis and Bronowski × Topa. The [j & l] type epistasis was significant for all those characters in which epistasis was present. Singh and Singh [2] also obtained similar results in two crosses of wheat..

Table 1. Analysis of variance for epistasis in two triple test crosses, 1 (Bronowski × Topa) and 2 (GSL-1 × Nikalis), for physio-morphological traits

Source of variation	Cross No.	d.f.	M. S. S.				
			seed yield per plant	primary branches	secondary branches	pod length	plant height
Epistasis	1	16	23.6**	3.9**	18.6	0.20	128.52
	2	20	10.0	2.5**	7.0	0.33	242.42**
Overall [i] epistasis	1	1	72.5	12.0**	110.9	0.27	74.41
	2	1	19.2	30.7	41.9	1.14	1593.90
[j & l] type epistasis	1	15	20.4**	3.3**	12.4	0.20	132.13
	2	19	9.6	1.0**	5.1	0.34	169.71**
Epistasis × replications	1	32	12.0**	2.1**	17.9**	0.13**	83.87**
	2	40	11.4**	1.2**	5.09**	0.31**	134.99**
Overall epistasis × replications	1	2	54.6**	20.0**	124.8**	0.24**	212.23**
	2	2	51.0**	19.8**	28.6**	1.86**	1199.99**
[j & l] type epistasis × replications	1	30	9.1	1.1	10.8**	0.12**	75.31**
	2	38	11.9**	0.2	3.7**	0.24**	78.95**
Within family	1	576	6.5	0.8	1.7	0.04	14.85
	2	720	6.5	0.5	0.9	0.12	12.38

**Significant at 1% level.

The additive component was significant for primary branches, whereas dominance component was significant for seed yield per plant, primary branches, and plant height in cross Bronowski × Topa (Table 2). In cross GSL-1 × Nikalis, the additive and dominance components were significant only for seed yield per plant, whereas for primary branches and pod length only additive component was significant. Epistasis was absent for secondary branches, pod length and plant height in cross Bronowski × Topa; and for seed yield, secondary branches and pod length in cross GSL-1 × Nikalis. Because of the unbiased estimate obtained in the absence of epistasis, it becomes easy to draw conclusion about the importance of genetic components of variation.

As *Brassica napus* is a self-pollinated crop, where production of commercial hybrids is still in its infancy, this type of epistasis is of little use. However, the epistatic component cannot be ignored when one is formulating breeding plans to improve the population for economic traits.

Table 2. Analysis of variance for sums (addition) and differences (dominance) in two triple test crosses for different physio-morphological traits

Source of variation	d.f.	M. S. S.				
		seed yield per plant	primary branches	secondary branches	pod length	plant height
TTC-1 (Bronowski × Topa)						
(a) *Analysis of sums*						
Sums (additive)	15	9.1	2.7**	10.7	0.10	176.0
Sums × replications	30	12.9**	1.2*	8.4**	0.23**	121.0**
Within family	575	6.5	0.8	1.7	0.04	14.8
σ_d^2		—	0.2	—	—	—
D		—	1.7	—	—	—
(b) *Analysis of difference*						
Difference (dominance)	15	29.1*	3.0**	10.8	0.14	85.4**
Differences × replications	30	13.8**	1.0**	12.7**	0.11**	33.7**
Within family	384	5.9	0.3	0.7	0.03	4.9
σ_d^2		2.5	2.6	—	—	8.6
H		20.3	20.7	—	—	69.4
TTC-2 (CSL-1 × Nikalis)						
(a) *Analysis of sums*						
Sums (additive)	19	32.3**	0.9**	8.5	0.16**	170.4
Sums × replications	38	16.9**	0.7	6.3**	0.15	173.9**
Within family	720	6.4	0.5	0.9	0.10	12.4
σ_d^2		1.4	—	—	0.001	—
D		11.0	0.2	—	0.008	—
(b) *Analysis of difference*						
Differences (dominance)	19	25.5**	1.7	6.8	0.13	113.3
Differences × replications	38	17.1**	1.1**	8.4**	0.61**	103.9**
Within family	480	7.0	0.5	0.8	0.001	13.1**
σ_d^2		1.4	—	—	—	—
H		11.2	—	—	—	—

**Significant at 1% level.

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