GENETIC VARIABILITY WITH RESPECT TO SEED YIELD AND SOME GROWTH ATTRIBUTES IN INDIAN RAPE /*Brassica campestris* L. var. Toria/

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Introduction

The productivity of a crop community is dependent on its inherent capacity for photosynthesis, photosynthetic area developed and availability of photosynthetically active radiation within the canopy. Bingham /1972/ identified characters like sink capacity of the grains, photosynthetic capacity of the crop and pattern of assimilate distribution as important factor in breeding for higher yield in grain crops like wheat. Therefore, the genetic variations in productivity of a crop may be related to certain growth parameters like net assimilation rate /NAR/, crop growth rate /CGR/, leaf area ratio /LAR/ and partitioning of the total economic and non-economic sinks. Twenty genotypes of diverse origin were selected and evaluated.

Materials and methods

The material for the present study, comprising 20 genotypes of Indian rape /*Brassica campestris* var. toria/, was grown in a randomised block design consisting of three replications at the research farm of Haryana Agricultural University, Hisar.

Each genotype was represented by 10 rows plot of 6 meter length with a spacing of 30 x 10 cm between and within rows respectively. In order to estimate different physiological attributes, 10 competitive plants were uprooted at each of the following four stages viz. vegetative stage, pre-flowering stage, full bloom stage and post bloom stage.

In the present study the data from four stages were utilized to work out two phases, namely pre-flowering phase i.e. obtained by substracting vegetative stage /15 DAS/ from pre-flowering stage /30 DAS/ and post flowering phase i.e. obtained by substracting the full bloom stage /45 DAS/ from post bloom stage /60 DAS/. The physiological attributes, namely mean net assimilations rate /NAR/, mean leaf area index /LAI/, mean leaf area duration /LAD/, mean leaf area ratio /LAR/ and harvest index were calculated as per formulae suggested by Radford /1967/.

Results and discussion

The analysis of variance showed significant differences for all the physiological characters under study /Table 1/.

The mean values of different physiological traits contributing towards seed yield have been presented in table2.

The genotype TH63 was found to be the best in its yielding capacity /8.15 g/plant/ whereas TH-67 inherited lowest seed yield of 2.83 g/plant as against 5.37 g/plant of Sangam, the local check and 3.8 g/plant of T-9 the national check. Three other genotypes viz. GC-II /5.83 g/plant/ TH-37 /5.68 g/plant/, TL-5 /5.65 g/plant/ recorded higher seed yield than Sangam while twelve genotypes excelled T-9 in seed yield and the difference was statistically significant.

At the Ist phase, genotypes TCSU-2 and Ludh. K-2 possessed the highest value of NAR /1.20/ which was at par with T-9, the national check. Another variety, Sangam, exhibited /0.97/ NAR at the Ist phase.

Except Bardari /0.28/ all the genotypes surpassed standard variety Sangam /0.50/ for NAR at the 2nd phase. The national check T-9 /0.39/ surpassed only 2 genotypes namely TH-37 /0.87/ and Baradari /0.28/. The highest NAR value at the 2nd phase was observed for genotype PT-8 /3.30/.

Leaves of the standard variety T-9 remained functional for the maximum period at the Ist phase as it recorded the highest value for LAD /30.78 days/. On the other hand, Sangam /7.43 days/ had low LAD at this phase. Genotype YSM /4.33 days/ showed poorer performance than Sangam for this trait. At the 2nd phase both the standard varieties T-9 /76.99 days/ and Sangam /78.47 days/ were superior to all the genotypes except TCSU-2 /92.19 days/ and TH-37 /82.11 days/.

Further, while discussing the physiological causes of variations in crop yield, Watson /1947, 1958/ has indicated that variations in leaf area and leaf area duration are the main causes of difference in seed yield. However, the variation in net assimilation rate was observed to be of less importance.
Several workers have observed in different species of mungbeans that the excess of leaf area lowers NAR drastically and results in decreased dry matter accumulation /Donald 1961, Harper 1963, Rees 1963, Watson and French 1962/.

Crop growth rate was the highest /17.26/ for standard variety T-9, while the variety YSM was having the lowest CGR /1.53/ at the Ist phase as against the local check, Sangam /3.25/. Amongst the other genotypes TH-12 had maximum /15.77/ CFR value followed by BR-54 /14.72/ and TK-7 /14.01/. The data with respect to the 2nd phase revealed that genotypes TK-7 /112.16/ had the highest CFR followed by TCSU-2 /104.45/ and YSM /101.70/. The standard variety T-9 /45.61/ could surpass only five varieties. The local variety Sangam had the lowest CGR /25.35/ at the 2nd phase except Baradari /8.19/.

Genotype YSM exhibited the highest LAR /208.72/ at the Ist phase while both the standard varieties T-9 /152.71/ and Sangam /151.05/ could surpass only two genotypes, namely TH-37 /143.96/ and TL-5 /144.33/, whereas genotype TH-37 exhibited the highest LAR /67.37/ at the 2nd phase and TH-67 possessed the lowest LAR /20.22/ at the 2nd phase.

The harvest index ranged between 14.82 per cent to 32.08 per cent. The improvement in plant type must be reflected as improved sink capacity, and therefore, in increased harvest index. Donald /1968/ and others have discussed the value of high harvest index in improving the productivity of crop plants. Genotype TH-63 which gave the highest yield had 30.39 per cent harvest index. Improved harvest index represents increased physiological capacity to mobilize photosynthates and translocate them to the organs of high economic value /Wallace et al, 1972/.

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Table 1 : Analysis of variance for certain physiological characters in *toria*

Source of variation	d.f.	Mean Squares								
		NAR		LAD		CGR		LAR		Harvest Index
		Ist phase	2nd phase	Ist phase	2nd phase	Ist phase	2nd phase	Ist phase	2nd phase	
Blocks	2	0.01	0.00	2.14	0.23	0.06	0.99	7.60	4.01	0.55
Treatments (Genotypes)	19	0.05*	1.85*	252.00*	745.44*	75.21*	2390.68*	1240.38*	479.62*	59.50*
Error	38	0.00	0.01	0.72	1.56	0.35	0.96	4.81	1.39	0.39

*Denotes significance at P = 0.05

Table 2: Mean performance of certain physiological characters in *toria*

Sr.No.	Genotypes	Seed yield (g)	NAR (g cm^{-2} day^{-1}) Ist phase	NAR 2nd phase	LAD (Days) Ist phase	LAD 2nd phase	CGR (gm^{-2} day^{-1}) Ist phase	CGR 2nd phase	LAR (cm^2 g^{-1}) Ist phase	LAR 2nd phase	Harvest index
		1	2	3	4	5	6	7	8	9	10
1.	TK-7	2.10	0.99	2.53	26.75	63.15	14.01	112.16	185.57	32.04	19.65
2.	TH-67	2.83	0.98	2.60	17.75	37.77	10.23	56.72	154.44	20.22	14.82
3.	PT-8	4.20	0.99	3.30	26.70	45.67	13.52	104.47	167.25	25.73	25.07
4.	T1-5	5.65	1.10	2.00	7.38	51.23	2.37	65.23	144.38	35.23	24.70
5.	BR-54	3.67	0.99	1.27	22.54	40.56	14.72	34.24	152.86	28.16	29.86
6.	TK-1	4.15	0.83	1.60	24.21	44.47	10.37	43.87	169.04	29.96	23.20
7.	TH-37	5.68	1.03	0.87	6.58	82.11	3.83	47.85	143.96	67.67	32.08
8.	TH-12	4.55	1.02	2.60	27.50	45.33	15.77	65.73	157.97	31.40	29.94
9.	TH-66	3.22	0.78	1.90	26.94	45.11	11.42	53.37	207.85	38.23	21.15
10.	Bardari	3.70	0.87	0.28	16.56	50.61	7.57	8.19	174.55	37.21	25.54
11.	PT-10	5.12	0.93	1.60	5.55	64.74	2.56	64.40	156.68	60.45	20.02
12.	GC-II	5.83	0.97	1.53	5.72	57.98	2.35	69.94	167.71	45.92	21.16
13.	YSM	4.60	0.86	2.13	4.33	75.21	1.53	101.70	208.72	49.24	18.04
14.	TH-63	8.15	0.78	0.89	26.63	65.06	10.01	39.45	197.95	60.68	30.45
15.	TH-8	3.42	0.99	0.99	27.52	54.21	12.28	34.36	182.35	34.25	19.90
16.	TCSU-2	4.92	1.20	1.67	21.85	92.19	10.49	104.45	198.86	43.75	18.84
17.	Ludh K-2	5.02	1.20	1.30	16.82	59.42	9.71	50.61	167.77	46.30	20.78
18.	TH-34	4.92	1.07	1.03	23.28	65.85	11.98	45.61	176.15	43.71	27.58
19.	T-9	3.80	1.20	0.89	30.78	76.99	17.26	45.21	152.71	54.23	21.93
20.	Sangam	5.37	0.97	0.50	7.43	78.47	3.25	25.37	151.05	46.60	20.14
	Grand mean S.E.	4.60 ±0.11	0.99 ±0.04	1.57 ±0.08	18.64 ±0.07	60.16 ±0.10	9.24 ±0.49	58.75 ±0.80	170.89 ±1.79	41.55 ±0.96	22.74 ±0.51
	C.D. at 5%	0.23	0.09	0.15	1.40	0.21	0.98	1.61	3.61	1.94	1.02
	Range	2.83 to 8.15	0.78 to 1.20	0.28 to 3.30	4.33 to 30.78	37.77 to 92.19	1.53 to 17.26	8.19 to 112.16	143.96 to 208.72	20.22 to 67.67	14.82 to 32.08