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RESEARCH ARTICLE

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Genotype x environmental interaction and stability parameters for yield and component characters in castor (*Ricinus communis* L.)

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ABSTRACT

The stability parameters were studied for eleven characters with 10 inbred lines with 45 hybrids developed through crossing in diallel fashion using four created environment during the crop season of the year 2007-08 and 2008-09. The value of mean square due to genotypes x environments were significant for all the characters except number of branches per plant. The linear component (G x E) was high for days to 50% flowering, days to 80% maturity, stem length, number of nodes on main stem, effective raceme length, number of capsules on primary raceme and seed yield per plant. Among the parents, 48-1 and SKI 291 were found to be stable for seed yield as well as wilt resistance. The hybrids DCS 89 x PCS 124, 48-1 x SKI 281 and SKI 291 x SKI 215 registered as stable for seed yield. On the other hand SKI 291 x SKI 281, PCS 124 x SKI 291 and SKI 281 x SKI 215 were stable and responsive to favourable environments. None of the hybrids was stable for all the characters in the same environment

KEY WORDS : Genotype, Environment, Inbred line, Castor, Stability

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INTRODUCTION

The interplay of genes and environment is of vital significance in the expression of a character. Castor crop is more sensitive to environmental variations particularly differences for fertility status of soil, temperature during growth period and moisture availability. The sensitivity of castor genotypes / hybrids to environmental variations suggested the need of using array of environments instead of single environment to study the nature of gene effect controlling the inheritance of components of adaptation. In view of this, 10 parents and their 45 F_1 crosses developed by using diallel mating design excluding reciprocals were evaluated to study response of genotypes for seed yield and other matricate characters over four varying environments created through date of sowing (normal and late) and plot selection (normal plot and wiltsick plot)

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MATERIALS AND METHODS

The material for study comprised of 10 inbred lines selected from the germplasm were crossed in diallel mating design. The seeds of parents and 45 $F1^s$ were sown on (1) August 2, 2007 in normal plot (2) August 2, 2007 in wiltsick plot (3) July 30, 2008 in normal plot and (4) July 30, 2008 in wiltsick plot The experiment was conducted at Main Castor-Mustard Research Station, S.D. Agricultural University, Sardarkrushinagar (Gujarat) during *Kharif-2007* and *Kharif-2008* in the randomized block design with three replications. Each genotype was sown in one row of 6 mt length at a distance of 120 cm between the rows and 60cm between the plants with in the row. Five plants in each genotype were selected randomly and the data on the characters were recorded for 11 characters. The statistical analysis for G x E interaction and stability parameters were carried out according to the method of Eberhart and Russell (1966).

RESULTS AND DISCUSSION

The pooled analysis of variance for stability (Table 1) revealed that genotype as well as environments were quite different from each other. Genotypes interacted significantly in different environments for all the traits except number of branches per plant. The environment

Table 1 : Analysis of variances for stability parameter with regards to different characters in castor

Sr. No.	Source of variation	d.f.	Days to 50 per cent flowering (Primary raceme)	Days to 80% maturity (Primary raceme)	Stem length (cm)	Number of nodes on main stem	Effective raceme length (cm)	Number of capsules on primary raceme	Number of branches per plant	Seed yield per plant (g)	100 seed weight (g)	Oil content (%)	Wilt incidence (%)
1.	Genotype	54	55.16**	58.16**	655.77**	5.57**	228.93**	590.64**	3.52**	3309.03**	15.89**	4.73**	137.11**
2.	Environment	3	13.73**	141.15**	4167.79**	48.66**	2934.06**	3676.32**	3.42**	2074.44**	3.87**	17.48**	529.06**
3.	Genotype x Environment	162	7.51**	25.72**	102.99**	1.46**	50.84**	274.14**	1.39**	281.07**	0.325*	0.763**	1.65
4.	Environment (Linear)	1	41.12**	421.45**	12503.4**	146.05**	880.23**	11029.4**	10.29**	6223.56**	11.51**	52.81**	1587.20**
5.	Genotype x Environment (Linear)	54	10.31**	65.55**	293.46**	2.93**	121.38**	421.14**	0.0136	55.12**	0.159	0.192	0.201
6.	Pooled deviation	110	6.00**	5.81**	7.63	0.709**	15.29**	197.00**	0.0138	73.58**	0.400**	1.03**	2.33**
7.	Pooled error	432	0.760	4.38	10.79	0.32	5.51	128.35	0.0579	51.82	0.077	0.084	0.631

* and ** indicate significance of values at P 0.05 and 0.01, respectively

(linear) component were highly significant for the characters days to 50 per cent flowering , days to 80% maturity, stem length (cm), number of nodes on main stem, effective raceme length (cm), number of capsules on primary raceme, seed yield per plant (g). For remaining characters *viz.,* number of branches per plant, 100 seed weight, oil content and wilt incidence non-linear component was greater indicating that the differences over the environment were real. These results are in general in agreement with those of Hira chand *et al.* (1982), Patel *et al.* (1984), Dangaria *et al.* (1986) and Tank *et al.* (2003). All these workers also indicate that both linear and non-linear components played an important role in building up total Genotype x Environment interaction.

Twenty three hybrids in respect of seed yield per plant displayed higher mean yield than that of grand mean yield *i.e.* 125.21 g. Among parents all the parents were found stable over environments but 48-1 (86.42) and SKI 291 (85.83) had higher mean values as compared to other parents. The three best hybrids among them with high mean and stable for this trait were DCS 89 x PCS 124 (166.08 g), 48-1 x SKI 281 (158.25 g) and SKI 291 x SKI 215 (158.08 g) and therefore, they were classified as stable genotypes . The performance of hybrid DCS 89 x DCS 9 was unpredictable over environments due to its significant deviations (s^2di).

The summarized account of the out standing F1 hybrids along with their performance , bi value and s^2di value are presented in Table 2. From this table it could be seen that, the hybrids, SKI 291 x SKI 281, PCS 124 x SKI 291 and SKI 281 x SKI 215 manifested high mean with least deviations from regression accompanied by significant bi value there by suggested that these hybrids were found better under better management for higher yield. Hybrid SKI 321 x DCS 9, DCS 89 x DCS 9, PCS 124 x DCS 9 and JI 321 x DCS 9 had early flowering along with stability, while the hybrid SKI 291 x SKI 281 had stability under favorable environments. The top ranking hybrid DCS 89 x PCS 124 recorded stability for seed yield per plant (g) and number of capsules on primary raceme , while second ranking hybrid SKI 291 x SKI 215 had a stability for seed yield per plant (g) and 100-seed weight (g). The hybrids SKI 321 x DCS 9 and DCS 89 x DCS 9 were stable for days to 50 per cent flowering and days to 80 % maturity. Among 45 hybrids, the hybrid SKI 291 x SKI 281 was found stable for seed yield per plant under better environment condition (Table 2). This hybrid registered stability for number of nodes on main stem and number of capsules on primary raceme. The hybrid SKI 291 x SKI 215 had a stability for lower wilt incidence it meant it is a wilt resistance under any environment. It

Table 2 : Out standing hybrids with their mean performance, b_i and S^2di values

Characters	Hybrids	Mean performance	b_i value	S^2di value
Days to 50 per cent flowering	SKI 321 x DCS 9	47.00	-0.59	-0.34
(Primary raceme)	DCS 89 x DCS 9	47.24	-0.94	-0.27
	PCS 124 x DCS 9	48.17	-1.87	-0.67
Days to 80% maturity	JI 321 x DCS 9	118.75	0.89	-4.73
(Primary raceme)	SKI 321 x DCS 9	119.83	0.79	-1.22
	DCS 89 x DCS 9	121.0	-0.35	-3.65
Stem length (cm)	SKI 314 x JI 321	53.42	-0.26	-3.80
	48-1 x SKI 291	56.23	0.30	-9.56
	48-1 x PCS 124	58.60	-0.07	-6.05
Number of nodes on main stem	SKI 321 x SKI 215	15.63	-0.45	0.79
	PCS 124 x SKI 291	16.22	-0.67	1.47
	SKI 314 x JI 321	16.33	-0.83	1.76
Effective raceme Length (cm)	48-1 x JI 321	64.11	0.58	0.67
	DCS 89 x SKI 291	60.80	-0.23	0.00
	SKI 314 x SKI 291	58.71	-0.08	-5.50
Number of capsules on primary	DCS 89 x PCS 124	77.68	1.66	-120.52
raceme	JI 321 x SKI 291	77.33	1.17	-119.43
	SKI 321 x DCS 89	75.97	1.65	-122.92
Total number of branches per	PCS 124 x SKI 215	6.44	1.33**	-0.05
plant	PCS 124 x DCS 9	6.42	1.26**	-0.05
	DCS 89 x SKI 215	6.38	1.21**	-0.03
Seed yield per plant (g)	SKI 291 x SKI 281	171.58	1.12*	78.70
	DCS 89 x PCS 124	166.08	0.90	-40.70
	48-1 x SKI 281	158.25	0.86	-51.83
100-seed weight (g)	JI 321 x SKI 291	32.76	2.14	0.01
	PCS 124 x SKI 291	32.63	1.71	0.04
	SKI 291 x SKI 215	32.37	0.95	1.21
Oil content (%)	SKI 321 x SKI 281	50.18	0.75	0.30
	JI 321 x DCS 9	49.93	1.10	-0.07
	48-1 x SKI 291	49.71	1.15	-0.03
Wilt incidence (%)	SKI 291 x SKI 215	8.73	0.54	0.07
	48-1 x SKI 291	10.0	0.54	0.03
	48-1 x SKI 215	13.13	0.53	0.10

also registered stability for days to 80% maturity (Primary raceme), number of capsules on primary raceme, seed yield per plant (g), 100-seed weight (g) and oil content (%). The hybrids SKI 321 x SKI 281, JI 321 x DCS 9 and 48-1 x SKI 291 had stability for oil content and the performance of nine hybrids with high oil content was unpredictable due to their significant deviations from regression. The hybrids PCS 124 x SKI 215 , PCS 124 x DCS 9 and DCS 89 x SKI 215 registered stability for number of branches per plant and hybrids DCS 89 x PCS 124 , JI 321 x SKI 291 and SKI 321 x DCS 89 registered stability for number of capsules on primary raceme. The hybrids, 48-1 x JI 321, DCS 89 x SKI 291 and SKI 314 x SKI 291 manifested high mean with least deviations from regression accompanied by non-significant bi value there by suggested that these hybrids were found stable over environments for effective raceme length (cm).

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