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Variability and character association analysis in Castor (*Ricinus communis* L.)

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SUMMARY

Ten castor inbred lines were evaluated for genetic diversity in respect of eleven characters during *Kharif*-2008. Analysis of variance revealed significant differences among genotypes for all the characters. High GCV, PCV, heritability and genetic advance as percentage of mean were observed for seed yield per plant (g), stem length, wilt incidence (%) and number of branches per plant. Moderate heritability coupled with low to moderate genetic advance recorded by number of capsule on primary spike and effective raceme length (cm). Days to 50% flowering was positive significantly correlated with days to 80% maturity and positive non significantly with oil content (%), wilt incidence (%) and stem length (cm), while negatively correlated with 100 seed weight and number of capsules on primary spike. 100 seed weight (g) and oil content (%) are negatively correlated. Number of branches per plant followed by effective raceme length (cm) and number of capsule on primary spike recorded highest positive direct effect on seed yield. Wilt incidence had a highest significant negative direct effect on seed yield.

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Key words : Genetic variability, Characters association, GCV, PCV, Castor

Castor is a important non-edible oilseed crop cultivated mainly for source of oil which has tremendous industrial use. The success of any crop improvement programme essentially depend upon the nature and presence of genetic magnitude of variability in the crop . The knowledge of nature and magnitude of genetic variability is of immense value to planning the efficient breeding programme to improve the yield potentiality of the genotype. The present investigation was carried out to collect information on variability, heritability and genetic advance in 10 inbred lines for eleven characters.

MATERIALS AND METHODS

The material comprised of 10 inbred lines selected from the germplasm for study. The experiment was conducted at Main Castor-Mustard Research Station, S.D.Agricultural University, Sardarkrushinagar (Gujarat) during *Kharif* 2008 in the Randomized Block Design with three replications. Each genotype was sown in one row with 6 m. length at a distance of 120 cm. between the rows and 60cm. within the row. Five plants in each genotype were selected randomly for study and the data of all characters were recorded. Heritability in the broad sense was derived based on the formula given by Hanson *et al.* (1956). Genetic advance (GA) was obtained by the formula prescribed by Johnson *et al.* (1955). The method adopted by Burton (1953) was used to calculate phenotypic and genotypic coefficients of variation. The phenotypic and genotypic correlation coefficients were worked out by Al-Jibouri *et al.* (1958) and path coefficient analysis as suggested by Dewey and Lu (1959).

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RESULTS AND DISCUSSION

The analysis of variance revealed significant differences among the genotypes for seed yield and its component characters indicating considerable amount of genetic variation in the material (Table 1). The phenotypic coefficient of variation (PCV) was greater than the genotypic coefficient of variation (GCV) for all the traits indicating the effect of environment on the expression of the traits (Table 2). The genotypes showed high GCV, PCV, heritability and genetic advance as percentage of mean for seed yield per plant (g), stem length and wilt incidence (%) indicating lesser influence of environment in the expression of these traits and prevalence of additive gene action for its in heritance, hence enable to simple selection. Similar results were reported by Bhatt and Reddy

Table 1 : Analysis of variance for seed yield and its components in castor

Sr. No.	Source of variation	d.f.	Seed yield per plant (g)	Days to 50 % flowering	Days to 80% maturity	100-seed weight (g)	Oil content (%)	Stem length (cm)	Number of nodes on main stem	Effective raceme length (cm)	Number of capsules on pri. raceme	Number of branches /plant	Wilt incidence (%)
1.	Replications	2	547.65	5.82	12.19	0.285	0.345	3.93	0.20	3.42	28.52	0.109	9.82**
2.	Genotypes	9	524.31**	53.22**	55.28**	8.132**	1.731**	1062.3**	6.11**	204.19**	336.43**	4.03**	145.55**
3.	Error	18	203.86	3.03	6.57	0.185	0.144	15.35	0.38	9.17	21.02	0.163	1.85
	Total	29	438.21	29.524	21.391	3.337	0.646	325.9	3.078	60.55	104.24	1.845	132.34

** indicates significance of value P=0.01

Table 2 : Genetic parameters for eleven quantitative characters in castor

Characters	GCV (%)	PCV (%)	h^2 (%)	GA	GA as % of mean
Days to 50 % flowering	6.7167	6.7588	0.9876	7.5557	13.7502
Days to 80% maturity	2.7674	3.0340	0.8320	6.5325	5.2001
100seed wt (g)	6.6368	6.6478	0.9967	4.0919	13.6492
Oil content (%)	2.2179	2.2390	0.9813	2.200	4.5258
Stem length (cm)	17.3872	17.5543	0.9810	25.8822	35.4765
Number of nodes on main stem	6.1018	6.3541	0.9222	2.2376	12.0707
Effective raceme length (cm)	12.6024	12.7712	0.9737	15.1984	25.6178
Number of capsules on primary spike	17.6567	19.8897	0.7881	19.7614	25.3253
Number of branches / plant	18.4914	18.6531	0.9827	1.8982	37.7619
Wilt incidence (%)	33.0540	33.2807	0.9864	11.8971	67.6274
Seed yield / plant (g)	22.4899	22.9753	0.9582	56.7833	45.3504

GCV : Genetic coefficient of variation PCV : Phenotypic coefficient of variation GA : Genetic advance h^2 : Heritability

Table 3 : Genotypic and phenotypic correlation coefficients between seed yield and its components in castor

Character	Days to 50 % flowering	Days to 80% maturity	100seed wt (g)	Oil content (%)	Stem length (cm)	Number of nodes on main stem	Effective raceme length (cm)	Number of capsules on pri. spike	Number of branches / plant	Wilt incidence (%)
Days to 50 % flowering	1.000	0.9545* (0.9617)*	-0.4688 (-0.6143)	0.5578* (0.5674)*	0.0514 (0.0642)	0.1050 (0.6175)*	0.2644 (0.2948)	-0.4628 (0.3146)	0.0436 (0.0559)	0.4058 (0.4259)
Days to 80% maturity		1.000	-0.5164* (0.5302)*	0.3173** (1.4995)**	-0.0002 (0.1655)	0.1113 (0.5511)*	0.4395 (0.4570)	-0.3168 (0.3832)	-0.0899 (0.0151)	0.2664 (0.3151)
100seed wt (g)			1.000	-0.1816 (-0.0355)	-0.0854 (0.2484)	0.1643 (0.1704)	0.1249 (0.3988)*	-0.0219 (0.4254)*	0.2732* (0.361)*	-0.2172* (0.361)*
Oil content (%)				1.000	-0.2140 (0.1932)	-0.3424* (-0.3307)*	-0.3608* (0.7197)**	-0.6793** (1.5941)**	-0.0220 (-0.0184)	0.2766 (0.2984)
Stem length (cm)					1.000	0.8355** (0.8526)**	0.2156 (0.3042)	0.3606 (0.4753)	0.0927 (0.5143)*	-0.2341 (0.5143)*
Number of nodes on main stem						1.000	0.5627* (0.6058)*	0.6106* (0.6046)*	0.3424 (0.3516)	-0.4289 (0.1016)
Effective raceme length (cm)							1.000	0.4423* (0.5739)*	-0.0987 (0.1010)	-0.2247 (0.1010)
Number of capsules on pri. spike								1.000	-0.1009 (-0.1354)	-0.4966* (-0.1354)
Number of branches / plant									1.000	-0.5223* (-0.2354)
Wilt incidence (%)										1.000
Seed yield/plant (g)	-0.0548	0.0798	-0.0225	-0.9987*	0.6339*	0.0326	0.3266	0.1811	0.7639*	0.7639*

Figures in parenthesis shows genotype correlations * and ** indicating significance of values at P=0.05 and 0.01, respectively

Table 4 : Direct and indirect effect of eleven characters in castor

Characters	Days to 50 % flowering	Days to 80% maturity	100seed wt (g)	Oil content (%)	Stem length (cm)	Number of nodes on main stems	Effective raceme length (cm)	Number of capsules on pri. spike	Number of branches / plant	Wilt incidence (%)
Days to 50 % flowering	-1.0251	-0.9785	0.4806	-0.5718	-0.0527	-0.1076	-0.2710	0.4744	-0.0449	-0.4159
Days to 80% maturity	-0.9830	-1.0298	0.5317	-0.3268	0.0002	-0.1146	-0.4526	0.3262	0.0925	-0.2949
100seed wt (g)	0.6197	0.6825	-1.3218	0.2400	0.1129	-0.2172	-0.1651	0.0290	-0.3611	0.2870
Oil content (%)	0.2724	0.1549	-0.0887	0.4882	-0.1045	-0.1672	-0.1761	-0.3316	-0.0107	0.1350
Stem length (cm)	0.0029	0.0000	-0.0048	-0.0120	0.0560	0.0468	0.0121	0.0202	0.0052	-0.0131
Number of nodes on main stem	0.4333	0.7203	0.2047	-0.5912	0.3533	-0.3928	-0.2210	0.7249	-0.1617	-0.3683
Effective raceme length (cm)	-0.0412	-0.0437	-0.0645	0.1345	-0.3282	0.9221	1.6328	-0.2399	-0.1345	0.1685
Number of capsules on pri. spike	0.2989	0.2046	0.0142	0.4387	-0.2329	-0.3944	-0.2857	0.6459	0.0652	0.3208
Number of branches / plant	0.0418	-0.0858	0.2607	-0.0210	0.0885	0.3267	-0.0942	-0.0963	0.9543	-0.4984
Wilt incidence (%)	-0.0560	-0.0395	0.0300	-0.0382	0.0323	0.0592	0.0310	0.0685	0.0721	-0.1380
Seed yield / plant (g)	-0.4364	-0.4150	0.0421	-0.2594	-0.0751	-0.0390	0.0161	0.3294	0.4763	-0.8173

(1987) . Moderate heritability estimate coupled with low to moderate genetic advance were recorded by number of capsules on primary spike and effective raceme length (cm) indicating the predominance of non-additive gene action in the expression of these traits. Genotypic correlation in general was higher than the phenotypic correlation (Table 3) indicating less influence of environmental factors. Number of branches per plant, stem length (cm) and wilt incidence (%) showed positive significant correlation with the seed yield per plant. 100 seed weight (g) was negatively correlated with days to 50% flowering, days to 80% maturity, oil content (%), wilt incidence (%) and stem length, while rest of all characters were positively correlated with the 100 seed weight. Similar results were reported by Dalvi *et al.* (2005). The result of this study indicated that improvement of seed yield could be achieved by selection of number of branches per plant, effective raceme length (cm), wilt incidence (%), stem length (cm) and number of capsule on primary spike. Similar results were reported by Bidgoli *et al.* (2006). Path analysis revealed that effective raceme length (cm), number of branches per plant and number of capsules on primary spike recorded highest positive direct effect on seed yield resulting in positive association with this characters (Table 4). Bidgoli *et al.* (2006) also reported similar findings indicating that effective raceme length (cm), number of effective branches per plant and number of capsules on primary spike are primary selection criteria for improving seed yield in castor.

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