

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

D. K. PATEL¹, Y. RAVINDRABABU² AND C. J. PATEL³

Main Castor-Mustard Research Station,
S.D. Agricultural University, Sardarkrushinagar - 385 506 (Gujarat)

Received : 02 January, 2013

ABSTRACT

Forty seven castor germplasm and inbred lines were evaluated during Kharif-2009 for genetic variability and characters association in respect of ten characters studied. Analysis of variance revealed significant differences among the genotypes for all ten characters studied. High PCV, GCV, Heritability and Genetic advance as percentage of mean were observed for Plant height, length of primary raceme, number of capsule on primary raceme and seed yield per plant. Moderate heritability coupled with low to moderate genetic advance recorded by days to maturity of primary raceme and test weight. Days to flowering character was positive significantly correlated with days to maturity, number of node up to primary raceme and length of primary spike, while significantly negatively correlated with oil content. The trait 100 seed weight and oil content are negatively correlated. Days to maturity followed by number of effective spikes per plant recorded the highest positive direct effect on seed yield.

Key words : Genetic variability, characters association, GCV, PCV, genetic advance

Castor is important non-edible oilseed crop cultivated mainly for source of oil which has various industrial use. The success of any crop improvement programme essentially depend up on the nature and magnitude of genetic variability present in the crop. The knowledge of nature and magnitude of genetic variability is immense value to planning the efficient breeding programme to improve the yield potentiality of the genotype. The present investigation was carried out to gather information on variability, heritability and genetic advance in 47 castor genotypes for seed yield and its components characters in cross combination for seed yield and its components.

MATERIALS AND METHODS

The material for study comprised of 47 genotypes were selected from the germplasm bank. The

experiment was conducted at Main "Castor-Mustard" Research Station, S.D.Agricultural University, Sardarkrushinagar (Gujarat) during Kharif-2009 in randomized block design with two replications. Each genotype was sown in two rows of 6 mt. length at a distance of 120 cm. between the rows and 60cm. between the plants within the row. Five plants in each genotype and in each replication were selected randomly for recording the data of periodically observation for ten characters. Heritability in the broad sense was derived based on the formula given by Hanson *et.al* (1956) and genetic advance (GA) was obtained by the formula prescribed by Johnson *et.al* (1955). The method adopted by Burton and DeVane (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).

¹Assistant Research Scientist (Castor), ²Research Scientist, Center of Excellence for Research on Pulses

RESULTS AND DISCUSSION

The analysis of variance revealed significant differences among the genotypes for seed yield and 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 all the traits (Table 2). The genotypes showed high GCV, PCV, heritability and genetic advance as percentage of mean for plant height, length of primary raceme and seed yield per plant indicating lesser influence of environment in the expression of these traits and prevalence of additive gene action in its heritance, hence, amenable for simple selection. Similar results were reported by Bhatt & Reddy (1987). Moderate heritability estimate coupled with low to moderate genetic advance were recorded by days to maturity, 100 seed weight and oil content 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. Plant height and number of effective spikes per plant showed positive significant correlation with the seed yield per plant. The trait 100 seed weight was negatively correlated with oil content and number of nodes up to primary raceme, 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 plant height and number of effective spikes. Similar results were reported by Bidgoli *et.al* (2006). Path analysis (Table 4) revealed that days to maturity and number of effective spikes per plant recorded highest positive direct effect on seed yield resulting in positive association with this characters. Bidgoli *et.al* (2006) also reported similar findings indicating that number of days to maturity and number of effective spikes per plant are primary selection criteria for improving seed yield in castor.

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

Sr. No.	Source of variation	d.f.	Seed yield / plant	Days to 50 % Flowering	Days to Maturity	100 seed wt (g)	Oil content (%)	Plant height (cm)	Number of nodes up to primary raceme	Length of primary raceme (cm)	Number of Capsules on primary raceme	No. of effective spikes / plant
1.	Replications	1	135576**	1.532	11.585	5.210*	0.586	47.471*	0.225	83.888**	21.734*	0.310
2.	Genotypes	46	627502**	56.168**	35.715**	5.582**	6.956**	647.994**	5.561**	315.907**	207.24**	13.223**
3.	Error	46	211295	3.488	7.281	1.132	0.568	9.858	0.657	6.859	3.038	1.175
	Total	93	429467	29.524	21.391	3.337	0.646	325.9	3.078	160.55	104.24	

Table 2 Genetic parameters for ten quantitative characters in castor

Characters	PCV (%)	GCV (%)	h^2 (%)	GA	GA as % of mean
Days to 50 % Flowering	10.862	10.520	93.8	10.239	20.987
Days to Maturity	4.215	3.761	79.3	6.931	6.914
100seed wt (g)	5.928	5.293	797.0	2.744	9.735
Oil content (%)	1.109	0.199	3.2	0.036	0.073
Plant height (cm)	29.300	29.076	98.5	36.516	59.439
Number of nodes up to primary raceme	11.433	10.736	88.2	3.029	20.768
Length of primary raceme (cm)	19.653	19.439	97.8	25.328	39.606
Number of capsules on primary raceme	16.453	16.332	98.5	20.662	33.397
No. of effective spikes / plant	14.096	13.050	85.7	3.580	24.887
Seed Yield / plant (g)	20.818	16.955	66.3	765.338	28.445

REFERENCES

- Al-Jibouri, H.A., Miller, P.A. and Robinson, H.F. 1958. Genotypic and environmental variances in upland cotton cross of interspecific origin, *Agronomy Journal*, **50** : 633-636.
- Burton, G.W. and DeVane, E.W. 1953. Estimating heritability in tall Fescue (*Festuca arundinacea*) from replicated clonal material, *Agronomy Journal*, **45** : 478-481.
- Bhatt, D. and Reddy, T.P. 1987. Genetic divergence and heterosis in castor. *Indian journal of Botany*, **10** : 21-26
- Bidgoli, A.M., Akbari, G.A., Mirhadi, M.J., Zand, E. and Soufizadeh, S. 2006. Path analysis of the relationships between seed yield and some morphological and phenological traits in safflower. *Euphytica*. **148** : 261-266
- Dalvi, V.A., Madrap, L.A. and Phad, D.S. 2005. Correlation and path analysis study in safflower. *Journal of Maharashtra Agricultural Universities*, **30** : 232-234
- Dewey, D.H. and Lu, K.H. 1959. A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agronomy Journal*, **51** : 515-518
- Hanson, C.H., Robinson, H.F. and Comstock, R.E. 1956. Biometrical studies of yield in segregating populations of Korean Lespedeza. *Agronomy Journal*, **48** : 268-272
- Johnson, H.W., Robinson, H.F. and Comstock, R.E. 1955. Estimation of genetic and environmental variability in Soybeans. *Agronomy Journal*, **47** : 314-318

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

Character	Days to 50 % Flowering	Days to Maturity	100seed wt (g)	Oil content (%)	Plant height (cm)	Number of nodes up to primary raceme	Length of primary raceme (cm)	Number of Capsules on primary raceme	No. of effective spikes / plant
Days to 50 % Flowering	1.000	0.8879* (0.9317)*	-0.0058 (-0.0134)	-1.7479** (-1.1922)**	0.0344 (0.0442)	0.6133* (0.6175)*	0.1979** (0.1948)**	0.2870 (0.3146)	0.0057 (0.0059)
Days to Maturity	1.000	1.000	0.1105 (0.0502)	-2.2432** (-1.4995)**	0.2150 (0.1655)	0.5557 (0.5511)	0.2862 (0.3170)	0.4193 (0.3832)	0.0267 (0.0151)
100 seed wt (g)			1.000	-0.4618 (-0.3355)	0.2759 (0.2484)	-0.0283 (-0.0504)	0.3666 (0.3988)	0.4197 (0.4254)	0.0414 (0.361)
Oil content (%)				1.000	0.1913 (0.1932)	-1.4897** (-0.9407)*	1.1111** (0.7197)*	2.0782** (1.5941)	-1.3451** (-0.7984)*
Plant height(cm)					1.000	0.3659 (0.3526)	0.5775 (0.6042)	0.5009 (0.4753)	0.5138 (0.5143)
Number of nodes up to pri. raceme						1.000	0.5952* (0.6058)*	0.3078 (0.2946)	0.1021 (0.1016)
Length of primary raceme (cm)							1.000	0.5387 (0.5739)	0.0987 (0.1010)
Number of capsules on pri. raceme								1.000	-0.1204 (-0.1354)
No. of effective spikes/plant									1.000
Seed Yield / plant (g)	-0.0548	0.0798	-0.0225	-0.9987*	0.6339*	0.0326	0.3266	0.1811	0.7639*

Figures in parenthesis are genotype estimates
*Significance at P = 0.05 levels. **Significance at P = 0.01 levels

Table 4 Direct and indirect effect of ten characters in castor

Character	Days to 50 % Flowering	Days to Maturity	100seed wt (g)	Oil content (%)	Plant height(cm)	Number of nodes up to primary raceme	Length of primary raceme (cm)	Number of capsules on primary raceme	No. of effective spikes / plant
Days to 50 % Flowering	-0.3931	-0.3663	0.0053	0.4687	-0.0174	-0.2428	-0.0766	-0.1237	-0.0023
Days to Maturity	0.5152	0.5529	0.0278	-0.8291	0.0915	0.5047	0.1753	0.2119	0.0084
100 seed wt (g)	0.0026	-0.0096	-0.1920	0.0644	-0.0477	0.0097	-0.0766	-0.0817	-0.0069
Oil content (%)	-0.0607	-0.0764	-0.0171	0.0510	0.0098	-0.0479	0.0367	0.0812	-0.0407
Plant height(cm)	0.0061	0.0227	0.0341	0.0265	0.1372	0.0484	0.0829	0.0652	0.0706
Number of nodes up to pri. raceme	-0.1741	-0.1554	0.0142	0.2653	-0.0995	-0.2820	-0.1709	-0.0831	-0.0287
Length of primary raceme (cm)	0.0501	0.0815	0.1025	0.1850	0.1553	0.1557	0.2571	0.1475	0.0260
Number of capsules on pri. raceme	0.0119	0.0145	0.0161	0.0602	0.0180	0.0111	0.0217	0.0378	-0.0051
No. of effective spikes / plant	0.0044	0.0114	0.0272	-0.6028	0.3883	0.0767	0.0762	-0.1022	0.7750
Seed Yield / plant (g)	-0.0378	0.0753	0.0181	-0.3108	0.6356	0.0336	0.3258	0.1529	0.7762