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Research Article

GENETIC VARIABILITY IN CASTOR (*RICINUS COMMUNIS* L.) FOR YIELD AND ITS CONTRIBUTING TRAITS

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ABSTRACT
The present study was carried out in 52 castor genotypes to evaluate variability parameters like seed yield and its related characters. All the characters exhibited significant variability. Phenotypic Coefficient of Variation (PCV) was higher than Genotypic Coefficient of Variation (GCV) for all the characters studied indicating the role of environmental variance in the total variance. Heritability estimates were found to be high for all the characters. High heritability coupled with high genetic advance as % mean was observed for all traits except oil content and L/B ratio of seed indicating that most likely the heritability is due to additive gene effects and direct selection of these traits were effective.

Key Words: *Castor, GCV, PCV, Heritability, Genetic Advance, Variability*

ABSTRACT

Castor (*Ricinus communis* L.) is an important oil seed crop cultivated for its premier oil with manifold uses. Genetic variability is the most important feature of any population and variability present in the population are the pre requisite in response to selection for crop improvement programme. Selection of superior varieties will be possible only when adequate variability exists in the gene pool. Hence, the insight into the magnitude of variability present in a gene pool of a crop species is of utmost importance to plant breeder for starting a judicious plant breeding programme. The coefficient of variation expressed in phenotypic and genotypic levels are used to compare the variability observed among different characters. The heritability estimates aid in determining the relative amount of the heritable portion in variation and thus, helps the plant breeder in selecting the elite inbreds from diverse population. Therefore, the present study was undertaken for assessing the extent of genetic variability, heritability and genetic advance in castor genotypes.

MATERIALS AND METHODS

A field experiment was conducted with 52 castor genotypes grown in a randomized block design with two replications at Agricultural College Farm, Bapatla, Andhra Pradesh. Each genotype was sown in three rows of 5.0 m length by adopting 60 cm between rows and 30 cm between plants with in rows. Ten plants were selected from each genotype/replication for recording the observations on days to 50% flowering of primary raceme, stem length to primary raceme, number of nodes to primary raceme, total length of primary raceme, effective length of primary raceme, days to 80% maturity of primary raceme, secondary branches per plant, days to 50% flowering of secondary raceme, number of nodes to secondary raceme, stem length to secondary raceme, total length of secondary raceme, effective length of secondary raceme, days to 80% maturity of secondary raceme, number of tertiary branches per plant, days to 50% flowering of tertiary raceme, number of nodes to tertiary raceme, stem length to tertiary raceme, effective length of tertiary raceme, days to 80% maturity of tertiary raceme, 100 seed weight of primary raceme, 100 seed weight of secondary raceme, 100 seed weight of tertiary raceme, oil content, L/B ratio of seed, harvest index, seed yield per plant at 120 days, seed yield per plant up to 150 days and seed yield per plant up to 180 days. The data recorded for all the characters were subjected to analysis of variance technique on the basis of mean values (Cochran and Cox, 1950). The estimates of phenotypic and genotypic coefficient of variability were classified as given by Sivasubramanian and Menon (1973).

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RESULTS AND DISCUSSION

Table 1: Analysis of variance for yield and yield components in 52 genotypes of castor

Mean sum of squares

Source	df	Days to 50% Flowering of Primary Raceme	Stem Length to Primary Raceme (cm)	No. of Nodes to Primary Raceme	Total Length of Primary Raceme (cm)	Effective Length of Primary Raceme	Days to 80% maturity of Primary Raceme	No. of Secondary Branches/ Plant	Days to 50% Flowering of Secondary Raceme	No. of Nodes to Secondary Raceme	Stem Length to Secondary Raceme (cm)
Replication	1	0.0865	1.1890	0.0743	0.0558	0.7046	0.9615	0.0021	0.1538	0.1092	0.5561
Treatment	51	231.7200**	2338.9861**	30.3245**	185.0696**	198.0867**	230.4834**	0.5457**	244.9246**	7.0687**	1132.0123**
Error	51	1.0277	5.9505	2.2426	2.7065	6.0483	1.5302	0.0373	1.3499	0.2004	3.6737

Source	df	Total Length of Secondary Raceme (cm)	Effective Length Secondary Raceme (cm)	Days to 80% maturity of Secondary Raceme	No. of Tertiary Branches / Plant	Days to 50% Flowering of Tertiary Raceme	No. of Nodes to Tertiary Raceme	Stem Length to Tertiary Raceme (cm)	Effective Length of Tertiary Raceme	Days to 80% maturity Of tertiary Raceme
Replication	1	1.5852	0.0936	0.4712	0.0770	0.4712	0.0625	0.0531	0.9965	0.9615
Treatment	51	76.5572**	75.6040**	242.9161**	1.1951**	279.5435**	4.0701**	535.9861**	46.8867**	299.1380**
Error	51	1.4449	1.0348	1.7064	0.1088	1.4908	0.1045	2.9756	3.5925	2.2753

Source	df	100 Seed Wt of Primary Raceme (gm)	100 Seed Wt of Secondary Raceme (gm)	100 Seed Wt of Tertiary Raceme (gm)	Oil Content (%)	L/B Ratio of Seed	harvest Index (%)	Seed Yield/ Plant At 120 Days (gm)	Seed Yield/ Plant up to 150 Days(gm)	Seed Yield/ Plant up to 180 Days (gm)
Replications	1	0.0102	0.7497	0.3102	0.2442	0.0004	0.8209	7.5008	47.2231	10.0192
Treatments	51	14.4737**	24.2571**	12.7811**	5.0807**	0.0092**	27.8411**	1925.5725**	1742.6244**	1772.4244**
Error	51	0.4771	0.8131	0.6716	0.9513	0.0003	2.6445	39.4790	120.2471	129.6415

***= significance at 1% level, *= significance at 5% level*

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Table 2: Mean, variability, heritability and genetic advance as per cent of mean for yield and yield components in castor

S. No.	Character	Mean	Range		GCV (%)	PCV (%)	Heritability (%) (broad sense)	Genetic advance as per cent of mean
			Minimum	Maximum				
1	Days to 50% Flowering of Pri Raceme	66.91	52.00	94.00	16.05	16.12	99.12	32.92
2	Stem Length to Pri Raceme (cm)	110.96	54.20	242.30	30.78	30.86	99.49	63.25
3	Nodes to Pri Raceme	20.07	14.20	28.75	18.67	20.10	86.23	35.71
4	Total Length of Pri Raceme (cm)	45.51	23.60	70.23	20.98	21.29	97.12	42.60
5	Effective Length of Pri Raceme (cm)	39.13	17.25	63.43	25.04	25.82	94.07	50.04
6	Days to 80%maturity of Pri Raceme	101.56	80.50	130.50	10.54	10.61	98.68	21.56
7	Secondary Branches/ Plant	2.76	2.00	5.45	18.30	19.60	87.19	35.20
8	Days to 50% Flowering of Sec Raceme	93.31	74.00	121.00	11.83	11.89	98.90	24.23
9	Nodes to Secondary Raceme	9.44	5.24	13.83	19.63	20.20	94.49	39.32
10.	Stem Length to Sec Raceme (cm)	78.70	39.13	121.25	30.18	30.28	99.35	61.97
11.	Total Length of Sec Raceme (cm)	34.03	23.90	46.47	18.01	18.35	96.30	36.41
12	Effective Length Sec Raceme (cm)	29.47	16.05	43.50	20.72	21.01	97.30	42.11
13.	Days to 80%maturity of Sec Raceme	126.16	98.50	151.50	8.70	8.77	98.60	17.81

14.	Tertiary Branches/ Plant	2.65	1.40	5.90	27.78	30.44	83.30	52.23
15.	Days to 50% Flowering of Ter Raceme	118.66	94.00	147.00	9.94	9.99	98.94	20.36
16.	Nodes to Tertiary Racemes	7.90	5.15	12.10	17.82	18.29	94.99	35.79
17.	Stem Length to Ter Raceme (cm)	46.37	18.45	87.70	35.21	35.40	98.90	72.12
18.	Effective Length of Ter Raceme (cm)	17.24	9.14	30.00	26.99	29.14	85.77	51.49
19.	Days to 80%maturity of Ter Raceme	147.60	119.50	174.50	8.25	8.32	98.49	16.88
20.	100 Seed Wt of Primary Raceme (gm)	25.25	17.83	30.58	10.48	10.83	93.62	20.88
21.	100 Seed Wt of Secondary Raceme (gm)	27.06	19.30	38.51	12.65	13.08	93.51	25.21
22.	100 Seed Wt of Tertiary Raceme (gm)	25.63	18.57	29.50	9.60	10.12	90.02	18.76
23.	Oil Content (%)	47.87	43.34	51.35	3.00	3.63	68.46	5.12
24.	L/B Ratio of Seed	1.47	1.34	1.63	4.52	4.69	93.15	8.99
25.	Harvest Index (%)	35.13	28.95	45.15	10.10	11.11	82.65	18.92
26.	Seed Yield/ Plant At 120 Days (gm)	62.13	0.00	156.30	49.43	50.45	95.98	99.75
27.	Seed Yield/ Plant At 150 Days (gm)	123.67	70.20	183.06	23.03	24.68	87.09	44.27
28.	Seed Yield/ Plant At 180 Days (gm)	140.37	76.71	219.74	20.42	21.97	86.37	39.09

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The analysis of variance revealed highly significant differences among 52 genotypes for all the characters (Table 1) indicating the presence of sufficient genetic variability. Different genetic parameters such as mean, variability, heritability and genetic advance are presented in Table 2.

Phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation for all the characters studied indicating the influence of environment towards the total variance. Higher magnitudes of GCV and PCV for seed yield upto 120 days (49.4 and 50.4), stem length to tertiary raceme (35.2 and 35.4), stem length to primary raceme (30.7 and 30.8)stem length to secondary raceme (30.1 and 30.2) and effective length of tertiary raceme (26.9 and 29.1) indicate the presence of high amount of variability. However, low values were obtained for oil content, L/B ratio, days to maturity of secondary raceme and days to maturity of tertiary raceme. Similar results were observed by Reddy *et al.,* (1999), Golakia *et al.*, (2007), Patel *et al.*, (2010), Najan *et al.*, (2010) and Ramesh *et al.,* (2012).

However, high variance values alone are not the determining factors of the expected progress that could be made in quantitative traits (Falconer, 1981). It was suggested that the GCV together with the high h^2 estimates would give a better picture of the extent of genetic gain to be expected under selection.

In the present investigation, all the characters expressed high heritability ranging from 68.4 to 99.4 %. All the characters except oil content and L/B ratio showed high genetic advance as percent of mean. High heritability coupled with high genetic advance as % mean were noticed for the characters viz. Stem length to primary raceme, stem length to secondary raceme, stem length to tertiary raceme, seed yield at 120 days, seed yield at 150 days, effective length to primary raceme, effective length to secondary raceme, effective length to tertiary raceme and total length to primary raceme suggesting the presence of additive gene action in the inheritance of these traits and improvement of these characters is possible through simple selection. The higher estimates of heritability and lower estimates of genetic advance as % mean for oil content (%), and L/B ratio may be attributed to non additive gene effects and further improvement of these characters would be possible through heterosis breeding. Similar results have also been reported by Najan *et al.,* (2010), Kaushik *et al.,* (2007), Patel *et al.,* (2010) and On the bases of genetic parameters estimated, it can be concluded that selection would be worthwhile for seed yield and associated traits to bring out improvement in castor.

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