IJPS INTERNATIONAL JOURNAL OF PLANT SCIENCES
Volume 9 | Issue 2 | July, 2014 | 385-388
e ISSN-0976-593X | Visit us - *www.researchjournal.co.in*

RESEARCH ARTICLE

Genetic variability, heritability and genetic advance for yield and yield components in castor (*Ricinus communis* L.) genotypes

■ J.K. PATEL AND P.C. PATEL

SUMMARY

The present investigation was carried out in 43 castor (*Ricinus communis* L.) genotypes. The material for investigation consistded of 36 hybrids, two inbreds, one released variety and four checks (GCH 4, GCH 5, GCH 6 and GCH 7) were grown in a Randomized Block Design in three replications at Regional Research Station, Anand. Variability parameters were estimated for seed yield (g/plant) and yield component characters. Seed yield at 120 days after planting recorded highest phenotypic co-efficient of variability (PCV)value (33.53%). The highest genotypic co-efficient of variability (GCV) value was recorded for seed yield at 120 days after sowing (28.12%). The highest heritability was recorded by seed specific gravity (90.35%) followed by number of nodes up to primary spike (82.23%), plant height up to primary spike (76.32%), number of capsules on primary spike per plant (70.84%) and seed yield at 120 days after sowing (70.32%). The genetic advance as per cent of mean was highest for seed yield at 210 days after sowing (114.63%) followed by seed yield at 180 days after sowing (78.05%), seed yield at 150 days after sowing (50.96%), number of capsules on primary spike (40.14%) and seed yield at 120 days after sowing (34.11%). The character seed yield revealed high variability, heritability and genetic advance as per cent mean.

Key Words : Castor, Genetic advance, Heritability, Variability

How to cite this article : Patel, J.K. and Patel, P.C. (2014). Genetic variability, heritability and genetic advance for yield and yield components in castor (*Ricinuscommunis* L.) genotypes. *Internat. J. Plant Sci.*, **9** (2): 385-388.

Article chronicle : Received : 27.01.2014; **Revised :** 22.05.2014; **Accepted :** 05.06.2014

Castor (*Ricinus communis* L.) with 2n=20, an important industrial non-edible oil seed crop belongs to the family Euphorbiaceae, indigenous to Eastern Africa. It is grown in arid and semi-arid regions. Castor seed oil and its by-products have wide genetic variability is the most important feature of any population and variability present in the population is the prerequisite in response to selection for any crop improvement programme. Selection of superior varieties or populations will be possible only when adequate variability exists in the genepool. Hence, the insight into magnitude of variability present in a gene pool of a crop species is of utmost importance to plant breeder for initiating a judicious plant breeding programme. The co-efficient of variation expressed in phenotypic and genotypic levels are used to compare the variability observed among different characters. Hence, knowledge about the variability using parameters like genotypic co-efficient of variation (GCV) and phenotypic co-efficient of variation (PCV) is of paramounted importance for an efficient breeding programme in crops like castor. It is not possible to identify a genotype with higher performance for all the characters implied that it is advisable to improve the individual trait in the order of economic importance and requirement. The heritability estimates aid in determination the relative amount of heritable portion in variation and thus, helps the plant breeder in selecting the elite genotypes from a diverse population. Therefore, the present study was undertaken assessing the extent of genetic variability, heritability and genetic advance in castor germplasm lines.

MEMBERS OF THE RESEARCH FORUM

Author to be contacted :
J.K. PATEL, Agricultural Research Station (A.A.U.) Sansoli, KHEDA (GUJARAT) INDIA
Email: jitendranathpatel@gmail.com

Address of the Co-authors:
P.C. PATEL, Agricultural Research Station (A.A.U.) Sansoli, KHEDA (GUJARAT) INDIA

MATERIAL AND METHODS

The present study was conducted during the rainy season of 2012 at the Agricultural Research Station, Anand Agricultural University, Sansoli, Dist. Kheda.The experimental site is located at an altitude of $22^0$85'75.09" N latitude and $72^0$75'25.21" E longitude. The experimental material for the present study, comprised of 36 hybrids, two inbreds, one released variety and four hybrid checks (GCH 4, GCH 5, GCH 6 and GCH 7) available at the centre. Each genotype was sown in one row of 6.0 m length with a spacing of 120 cm x 60 cm and recommended package of practices was adopted to grow a healthy crop. Five plants in each plot and in each replication were selected at random and single plant observation was recorded for plant height upto primary raceme (cm), number of nodes upto primary raceme, total length of main spike (cm), effective length of main spike (cm), number of capsules on main spike, total number of branches per plant, effective number of branches per plant, 100 capsule weight (g), 100 seed weight (g), seed specific gravity, seed yield (g/plant) at 120, 150, 180 and 210 days after sowing and oil content (%). The phenotypic and genotypic co-efficient of variation, heritability and genetic advance as per cent of mean were calculated following standard methods. The data were subjected to analysis of variance for the character estimated on the basis of mean values (Panse and Sukhatme, 1985). The estimates of PCV and GCV were classified as given by Sivasubramanian and Madhavamenon (1973). The phenotypic and genotypic co-efficient of variability were calculated as Burton and De Vane (1953). Heritability estimates in broad sense for yield components of castor genotypes was estimated and the heritability estimates were categorized as suggested by Robinson *et al*. (1949), while genetic advance was worked out as per Johnson *et al*. (1955).

RESULTS AND DISCUSSION

The analysis of variance indicated high and significant variation for all characters under study (Table 1). The range of variation was maximum for seed yield at 210 days after sowing (202-548g/plant) followed by seed yield at 180 days after sowing (170-432 g/plant), seed yield at 150 days after sowing (117-283g/plant), number of capsules on primary spike (92.3-191.7), seed yield at 120 days after sowing (39-133 g/plant) and plant height up to primary raceme (67.7-113.7 cm) (Table 2). The higher mean was associated with high range, indicating the scope of improvement through simple selection procedure. A perusal of phenotypic co-efficient of variability was greater than genotypic co-efficient of variability for all the characters studied showing the environmental effect for all the characters (Table 2). It is evident that using co-efficients of variation as a measure, the magnitude of PCV and GCV were highest for seed yield at 120 days after sowing, followed by seed yield at 210 days after sowing, number of capsules on primary spike, seed yield at 180 and 150 days after sowing, number of total branches

Table 1: Analysis of variance for seed yield and yield attributes of castor

Characters	Mean sum of squares		
	Replications	Treatments	Error
Days to 50% flowering	3.54	23.79**	3.07
Days to maturity	18.51	55.31**	8.01
Number of nodes up to primary raceme	0.44	14.37**	0.97
Plant height up to primary raceme (cm)	1.42	291.68**	27.33
Total length of primary spike (cm)	87.47	229.53**	39.11
Effective length of primary spike (cm)	100.07	215.19**	40.82
Number of capsules on primary spike per plant	383.50	1828.96**	220.71
Number of total branches per plant	1.17	8.63**	1.87
Number of effective branches per plant	2.08	5.72**	1.27
100 capsule weight (g)	21.51	325.49**	46.68
100 seed weight (g)	5.49	16.51**	2.58
Shelling per cent (%)	3.10	18.77**	7.19
Seed specific gravity	9.11	89.33**	3.07
Seed yield (g)/plant			
120 days after sowing	612.72*	1333.98**	164.53
150 days after sowing	1837.31	4297.91**	933.48
180 days after sowing	4649.80	9726.42**	2024.51
210 days after sowing	7159.08	18039.09**	3058.89
Oil content (%)	0.53	2.81**	0.63

and number of effective branches per plant (Table 2). While, medium GCV and PCV was revealed for number of nodes up to primary raceme, effective and total length of primary spike and plant height. Similar findings were reported by Ayalneh *et al*. (2012). Low variability was observed for oil content shelling per cent and days to maturity.

However, high variance values alone are not the determining factors of the expected progress that could be made quantitative traits (Falconer, 1981). It was suggested that the GCV together with the high heritability (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 estimates ranging from 34.95 to 90.35 per cent. High heritability (broad sense) estimated were observed for all the traits indicated that the dependence of phenotypic expression reflect the genotypic ability to transmit the genes to their off spring. These results are in accordance with the results of Solanki and Gupta (2000). High genetic advances as per cent of mean was highest for seed yield at 210 and 180 days after sowing followed by seed yield at 150 days after sowing and number of capsules on primary spike per plant. While, seed yield at 120 days after sowing, plant height up to primary raceme,100 capsule weight, total length of primary spike and effective length of primary spike characters recorded medium genetic advance as per cent of mean. Oil content, number of effective branches per plant, number of total branches per plant shelling per cent,100 seed weight and number of nodes up to primary spike observed low genetic advance as per cent of mean.

High heritability with high genetic advance as per cent of mean was observed for number of capsules on primary spike and seed yield at 210. High heritability coupled with high genetic advance, which indicated the presence of high additive gene effects (Panse, 1957) suggesting that direct selection for those traits would be fruitful. Similar results also recorded by Kaushik *et al*. (2007) and Patel *et al*. (2010). High heritability coupled with moderate genetic advance observed for plant height up to primary raceme, total length of primary spike, 100 capsule weight and seed yield at 120 days after sowing. High heritability coupled with moderate genetic advance in the character indicates that the variability was due to both additive and non-additive interaction of genes. The characters exhibited low heritability with moderate genetic advances indicates a non-additive gene effect in governing these characters. Selection of genotypes on the basis of these characters makes less effective in further breeding programme. It was observed that seed yield recorded high heritability coupled with high genetic advance as per cent of mean indicating the improvement of seed yield can be achieved by adopting simple selection procedures with which additive genes can be pyramided and will be gaining in the selection process. The character with high genotypic variance and high heritability coupled with high genetic gain would be effective for selection in improvement of the crop. Hence, the selection may be made in the desirable direction based on phenotypic performance. The expression of traits is

Table 2: Magnitude of variability, heritability and genetic advance for seed yield and yield attributes of castor

Characters	Range		Co-efficient of variation		Heritability in broad sense (%)	GA as per cent mean
	Minimum	Maximum	GCV (%)	PCV (%)		
Days to 50% flowering	46	57	5.06	6.08	69.20	4.50
Days to maturity	108	122	3.45	4.24	66.28	6.66
Number of nodes up to primary raceme	12	19	13.25	14.61	82.23	3.95
Plant height up to primary raceme (cm)	67.7	113.7	10.57	12.10	76.33	16.89
Total length of primary spike (cm)	51.3	86.0	11.14	14.16	61.88	12.91
Effective length of primary spike (cm)	49.0	82.3	11.36	14.82	58.74	12.04
Number of capsules on primary spike per plant	92.3	191.7	17.55	20.85	70.84	40.14
Number of total branches per plant	6.0	13.0	15.72	21.26	54.68	2.29
Number of effective branches per plant	4.7	10.8	15.61	21.27	53.90	1.84
100 capsule weight (g)	125.7	182.2	6.71	8.21	66.92	16.26
100 seed weight (g)	30.21	42.88	6.28	7.83	64.33	3.56
Shelling per cent (%)	60.29	72.49	2.99	5.05	34.95	2.39
Seed specific gravity	78.08	98.76	5.84	6.14	90.35	10.50
Seed yield (g/plant)						
120 days after sowing	39	133	28.12	33.53	70.32	34.11
150 days after sowing	117	283	16.77	22.70	54.57	50.96
180 days after sowing	170	432	16.99	22.72	55.91	78.05
210 days after sowing	202	548	20.15	25.59	62.03	114.63
Oil content (%)	43.60	49.66	1.82	2.50	53.36	1.28

unstable. Hence, breeder should not rely on the estimates of heritability.

REFERENCES

Ayalneh, T., Habtamu, Z. and Amsalu, A. (2012). Genetic variability, heritability and genetic advance in tef [*Eragrostistef* (Zucc.)Trotter] lines at Sinana and Adaba. *Internat. J. Plant Breed. & Genet.*, **6**(1): 40-46.

Burton, G. W. and De, Vane E. W. (1953). Estimating haritability in tall fescue (*Fescuta arudinaceae*) from replicated clonal material. *Agron. J.*, **45**: 478-481.

Falconer, D.S. (1981). *Introduction to quantitative genetics*. (2nd Edn.). ELBS. Longman. pp. 14-169.

Johnson, H.W., Robinson, H.F. and Comstock, R. E. (1955). Estimates of genetic and environmental variability in soybeans. *Agron. J.*, **47**: 314-318.

Kaushik, N., Kumar, Krishnan, Kumar, S. and Roy, S. (2007). Genetic variability and divergence studies in seed traits and oil content of jatropha (*Jatrofa carcus* L.) accessions. *Biomass & Bioener.*, **31**(7): 497-502.

Panse, V. G. (1957). The application of genetics to plant breeding. The inheritance of qualitative characters and plant breeding. *Indian J. Genet.*, **40**: 282-302.

Panse, V.G. and Sukhatme, P.V. (1985). *Statistical methods for agricultural workers*. Indian Council of Agricultural Research Publication, New Delhi pp. 87-89.

Patel, J. R., Saiyed, M.P., Patel, C. G., Bhatt, R.K. and Bhatt, J.P. (2010). Genetic variability and correlation studies in castor (*Ricinus communis* L.). *Internat. J. agric. Sci.*, **6**(1): 129-131.

Robinson, H. F., Comstock, R. E. and Harvey, P. H. (1949). Estimation of heritability and degree of dominance in corn. *Agron. J.*, **41**: 353-359.

Sivasubramanian, S. and Madhavamenon, P. (1973). Genotypic and phenotypic variability in rice. *Madras agric. J.*, **60**: 1093-1096.

Solanki, Z.J. and Gupta, Deepak (2000). Correlation and path analysis for oil yield in sesame (*Sesamum indicum* L.). *J. Oilseed Res.*, **17**: 51-53.