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Studies on Genetic Variability, Heritability and Genetic Advance Estimates in Roselle (*Hibiscus sabdariffa*L.)

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ABSTRACT

An investigation was carried out during *kharif*, 2013 to assess the variability, heritability and genetic advance for tenquantitative characters *viz.,* days to 50% flowering, plant height, basal stem diameter, bark thickness, number of nodes per plant, internodal length per plant, green plant weight, fibre length per plant, fibre wood ratio and fibre yield per plant in 30 genotypes of Roselle in three different environments. The analysis of variance indicated significant differences among the 30 genotypes for all the characters studied. The genotypic coefficients of variation for all the characters studied were lesser than the phenotypic coefficients of variation indicating the interaction of genotypes with environment. High heritability coupled with high genetic advance was observed for fibre wood ratio (in environment IIÉ) and fibre yield per plant (in environment II) indicating the importance of additive gene action in governing the inheritance of these traits. Hence, direct selection is useful with respect to these traits.

Key words : Genetic advance, Heritability, Mesta, Variability.

Roselle (*Hibiscus sabdariffa* L.) is a second most important bast fibre crop next to jute. It is an annual or perennial tropical plant. Improvement in any quantitative character depends solely on the amount of variability present in the base material for that trait. Hence, insight into the magnitude of genetic variability present in a population is of paramount importance to a plant breeder for starting a judicious breeding programme. Knowledge on heritability and genetic advance of the character indicate the scope for the improvement of a trait through selection. Heritability estimates along with genetic advance are also helpful in predicting the gain under selection (Johnson *et al.,* 1955). Hence, the present study was carried out to have knowledge on genetic variability, heritability and genetic advance as per cent of mean present in the available genetic material over environments.

MATERIAL AND METHODS

The experimental material comprising of thirty genotypes of roselle, were grown in three environments (different dates of sowing with twenty one days interval) during *kharif,* 2013 at the Agricultural Research Station Farm, Amadalavalasa, Andhra Pradesh, India. The design adopted was RBD with three replications. Each plot consisted of three rows of 3 meters length with a spacing of 30 x 10 cm. Observations were recorded for ten quantitative characters *viz.,*days to 50% flowering, plant height, basal stem diameter, bark thickness, number of nodes per plant, internodal length per plant, green plant weight, fibre length per plant, fibre wood ratio and fibre yield per plant. The data were subjected to statistical analysis and various genetic parameters such as genotypic and phenotypic coefficients of variation were calculated according to the method suggested by Burton (1952) and heritability estimates were obtained following the method of Allard (1960). The genetic advance as per cent of mean was calculated by the formula given by Johnson *et al.* (1955).

RESULTS AND DISCUSSION

The analysis of variance revealed significant differences among all the 30 genotypes for all the characters studied indicating the presence of sufficient genetic variability in the studied material (Table 1). In any successful crop improvement programme, the availability of adequate variability in basic genetic stocks and their proper utilization through various breeding program for building up

Table 1. Analysis of variance (mean sum of squares) for tenquantitative characters inthreedifferent environments (dates of sowing) for 30 genotypes of Roselle.

Source of variations	d.f.	Environ-ments	Days to 50% flowering	Plant height	Basal stem diameter	Bark thick-ness	Number of nodes per plant	Internodal length per plant	Green plant weight	Fibre length per plant	Fibre wood ratio	Fibre yield per plant
Replications	2	E_1	0.84	1377.43	0.20	0.35	18.07	0.65	17112.87	38.46	0.00	1.52
		E_2	0.40	1528.51	4.22	0.99	77.70	0.91	666.17	5217.86	0.01	5.02
		E_3	0.03	831.63	3.56	0.87	23.75	0.62	2124.14	2506.73	0.00	4.49
Genotypes	29	E_1	87.43**	2294.39**	8.91	0.74*	99.43**	0.47**	17379.21**	2997.75**	0.00	91.26**
		E_2	40.67**	2439.62**	7.68**	0.61**	55.95**	0.33**	7420.36**	2442.87**	0.01**	18.30**
		E_3	35.34**	741.54*	2.32	0.26**	19.66	0.59*	2609.69**	845.30	0.06**	7.83**
Error	58	E_1	0.47	761.08	6.03	0.36	38.52	0.12	5959.00	933.48	0.00	19.20
		E_2	0.20	496.17	2.81	0.28	26.08	0.14	1611.85	1110.90	0.00	2.51
		E_3	0.14	374.83	1.82	0.12	16.13	0.34	988.08	555.20	0.00	3.37

*Significant at 5% level **Significant at 1% level

E_1 – Environment I (DOS: 18-06-2013) E_2 – Environment II (DOS: 10-07-2013) E_3 – Environment III (DOS: 31-07-2013)

DOS- Date of Sowing.

improved strains are very important. Fibre yield is quantitatively inherited and influenced by genetic factors and environments. Knowledge on the nature of magnitude for genotypic and phenotypic variability present plays a role in selection for evolving superior cultivars. In the present study, the variation among genotypes was estimated as coefficient of variation and the phenotypic coefficient of variance (PCV) was slightly higher in magnitude than genotypic coefficient of variance (GCV) for all the characters studied indicating the interaction of genotypes with environment (Table 2). High PCV and GCV were recorded for fibre wood ratio in environment ÉÉÉ, fibre yield per plant in environment É indicating sufficient variation among the genotypes studied. Moderate PCV and GCV were recorded for green plant weight in all environments, fibre wood ratio in environment ÉÉ and fibre yield per plant in environment ÉÉ and ÉÉÉ while days to 50% flowering, plant height, basal stem diameter, bark thickness, number of nodes per plant, internodal length per plant and fibre length per plant exhibited low PCV and GCV in all environments.

Heritability estimates will be helpful in knowing the transmission of characters from generation to generation. The consistency of the performance of selection in succeeding generations depends on the magnitude of heritable variation present in relation to the observed variation. In the present study, heritability estimates were high for days to 50% flowering in all environments, fibre wood ratio in environment ÉÉÉ and fibre yield per plant in environment ÉÉ. Moderate heritability was recorded for plant height in environment É and ÉÉ, basal stem diameter in environment ÉÉ, number of nodes per plant in environment É, internodal length per plant in environment É and ÉÉ, green plant

Table 2. Estimates of genetic variability parameters of yield component attributes in three different environments (dates of sowing) of Roselle.

S.No.	Character	Genotypic coefficient of variation (%)			Phenotypic coefficient of variation (%)			Heritability (%) (broad sense)			Genetic advance			Genetic advance as per cent of mean		
		E_1	E_2	E_3	E_1	E_2	E_3	E_1	E_2	E_3	E_1	E_2	E_3	E_1	E_2	E_3
1.	Days to 50% flowering	3.80	3.02	3.35	3.83	3.05	3.37	98.40	98.50	98.80	11.00	7.51	7.01	7.76	6.18	6.85
2.	Plant height	7.13	9.31	4.85	11.24	12.37	9.79	40.20	56.60	24.60	29.52	39.46	11.29	9.31	14.42	4.96
3.	Basal stem diameter	4.81	7.81	3.18	12.99	12.91	11.01	13.70	36.60	08.30	0.75	1.59	0.24	3.68	9.73	1.89
4.	Bark thickness	9.57	11.82	9.27	18.86	22.58	17.99	25.80	27.40	26.60	0.37	0.36	0.23	10.01	12.75	9.85
5.	No. of nodes / plant	6.91	5.98	2.67	11.77	11.38	10.25	34.50	27.60	06.80	5.45	3.42	0.58	8.37	6.47	1.44
6.	Internodal length / plant	6.49	4.54	4.97	9.28	8.15	11.20	48.90	31.00	19.70	0.49	0.29	0.27	9.35	5.21	4.54
7.	Green plant weight	13.30	14.75	13.64	21.31	19.97	22.88	39.00	54.60	35.40	79.35	66.69	28.84	17.11	22.45	16.67
8.	Fibre length / plant	8.08	7.69	4.25	12.40	14.39	11.04	42.40	28.60	14.80	35.20	23.20	7.80	10.84	8.46	3.37
9.	Fibre-wood ratio	6.55	16.06	29.92	19.44	23.80	32.27	11.40	45.50	85.90	0.02	0.07	0.28	4.55	22.38	57.12
10.	Fibre yield / plant	20.00	18.03	12.25	26.83	21.92	22.15	55.60	67.60	30.60	7.52	3.89	1.39	30.72	30.53	13.95

E_1 = Environment I (18-06-2013) E_2 = Environment II (10-07-2013) E_3 = Environment III (31-07-2013)

weight in environment É and ÉÉÉ, fibre length per plant in environment É, fibre wood ratio in environment ÉÉ and fibre yield per plant in environment É and ÉÉÉ. The maximum value for heritability was recorded by days to 50% flowering (98.80%) and minimum was recorded by number of nodes per plant (6.80%).

High heritability alone is not sufficient enough to exercise selection unless the information is accompanied with substantial amount of genetic advance. Genetic advance for any quantitative character can be predicted with the help of heritability. The estimates of heritability and genetic advance as per cent of mean were high for fibre wood ratio in environment ÉÉÉ and fibre yield per plant in environment ÉÉ. Moderate heritability coupled with low genetic advance as per cent of mean was observed for plant height in environment É, basal stem diameter in environment ÉÉ, number of nodes per plant in environment É and internodal length per plant in environment É and ÉÉ indicating the role of non-additive gene action and can be improved by hybridization followed by selection. These results were in accordance with the findings of Hari Ram Kumar *et al.* (2012), Ibrahim and Hussein (2006), Pulli Bai *et al.* (2005), Rama Kumar *et al.* (2000).

Thus, the characters*viz.,* fibre wood ratio and fibre yield per plant having high heritability and genetic advance as per cent of mean can be exploited in the breeding programmes by using simple selection.

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