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Genetic Divergence Studies for Fibre Yield and It's Contributing Traits in Roselle (*Hibiscus sabdariffa* L.)

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Abstract

Genetic divergence in thirty genotypes of roselle was assessed utilizing Mahalanobis D^2 statistic and grouped into six Clusters based on D^2 values. Cluster I was the largest comprising of 11 genotypes followed by Cluster IV comprised of ten genotypes, Cluster III & V accommodated three genotypes each whereas Cluster II comprised two genotypes and Cluster VI included solitary genotype. Maximum inter Cluster distance was observed between Cluster II and III, followed by Cluster III and IV and Cluster V and VI, while minimum inter Cluster distance was observed between Cluster I and Cluster II. Days to 50 % flowering was contributed maximum to genetic diversity followed by fibre yield, fibre wood ratio, plant height, fibre length, basal diameter, bark thickness, internodal length, green weight and number of nodes per plant.

Keywords

Roselle; Genetic divergence; Mesta; Mahalanobis D^2; Cluster distance

Introduction

Mesta is the second most important fibre crop after jute. Mesta crop which grown for its bast fibre in India consisting of two species *viz.*, Roselle (*Hibiscus sabdariffa* L.) and Kenaf (*Hibiscus cannabinus* L.) out of which roselle leads in area and production in India for bast fibre, while kenaf cultivated in developed countries for its pulp. To improve such important fibre crop through breeding, study on genetic variability of important traits responsible for fibre yield. In the outset, is a pre-requisite which gives an idea for improvement of the crop. The present study has been outlined to estimate genetic diversity present in a set of roselle germplasms on the basis of ten morpho-economic characters including fibre yield, so that desirable parents could be identified for utilization in crop improvement programme to obtain maximum fibre yield.

Materials and Methods

The experimental material comprising of thirty genotypes of roselle, obtained from the Agricultural Research station, Amadalavalasa, Andhra Pradesh and Central Jute and Allied Fibre Research Institute, Barrackpore, West Bengal. The design adopted was Randomised Block Design with three replications. Each plot consisted of three rows of 3 meters length with a spacing of 30 × 10 cm. The fertilizer dose of 40:20:20 kg NPK/ha (50% N in + Full P & K at the time of sowing) was applied at the time of sowing seed and seeds were sown by hand dibbling. The remaining 50% N was applied after three weeks of sowing. Standard pest management measures were taken during the crop growth period as and when required. Observations were recorded on five plants 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. Mahalanobis D^2 statistic [1] was used to assess the diversity among genotypes and they were grouped into different Clusters using the Tocher's method as described by Rao [2].

Results and Discussion

Analysis of variance indicated the existence of significant variation in the genotypes studied for all the characters. Thirty genotypes were grouped into six Clusters (Table 1) based on D^2 values. Cluster I was the largest comprising of 11 genotypes followed by Cluster IV comprised of ten genotypes, Cluster III & V accommodated three genotypes each whereas remaining Cluster II comprised two genotypes and Cluster VI included solitary genotype indicating the distinctness from other genotypes for most of the characters studied.

The average intercluster D^2 values ranged from 33.632 to 556.733 (Table 2). The inter cluster distance between Cluster II and III (556.733) was highest followed by Cluster III and VI (454.196) and Cluster II and V (412.045) which supports that genotype belonging to these clusters were highly diverse than the other genotypes. The minimum intercluster D^2 value (33.632) was observed between Cluster I and VI, indicating close genetic relationship between the genotypes of these two Clusters. Cluster V which consists of three genotypes showed highest intra cluster D^2 value (167.580) followed by Cluster IV (85.669) having ten genotypes and Cluster I (43.355) with eleven genotypes, which suggested that the genotypes within Cluster V (AHS-162, AHS-172 and AMV-5) were highly diverse. Therefore, based on inter cluster distances the genotypes belonging to Cluster II, III, V and VI could be used as parents in hybridization programme for obtaining transgressive seggregants with high fibre yield.

Cluster means (Table 3) for different characters indicated that the mean values for number of nodes per plant, green plant weight, fibre length per plant, and fibre yield per plant were highest in Cluster V

Table 1: Grouping of thirty genotypes of roselle (*Hibiscus sabdariffa* L.) in different Clusters.

Sr. No.	Cluster No.	Total No. of genotypes	Name of genotypes
1.	I	11	ER-1, ER-10, ER-38, ER-58, ER-63, AR-12, AR-71, AR-72, R-28, R-93, AS-80-31
2	II	2	JRR-9, JRRM-9-1
3.	III	3	R-78, AMV-4, HS-4288
4.	IV	10	R-134, R-200, R-83, AS-80-29, AS-80-31, AS-80-19, CRIJAFR-2, CRIJAFR-8, AHS-160, AHS-161, AHS-152
5.	V	3	AHS-162, AHS-172, AMV-5
6.	VI	1	AHS-179

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Table 2: Average Intra-Cluster and inter-Cluster D^2 values among thirty genotypes of roselle.

Cluster	I	II	III	IV	V	VI
I	**43.355 (6.584)**	43.722 (6.612)	400.361 (20.009)	64.675 (8.042)	296.671 (17.224)	33.632 (5.799)
II		**4.959 (2.227)**	556.733 (23.595)	86.853 (9.319)	412.045 (20.299)	38.877 (6.235)
III			**12.528 (3.539)**	344.261 (18.554)	84.527 (9.194)	454.196 (21.312)
IV				**85.669 (9.256)**	258.297 (16.072)	66.707 (8.167)
V					**167.580 (12.945)**	339.979 (18.439)
VI						**0.000 (0.000)**

Table 3: Cluster mean values for ten characters in roselle.

Characters	Cluster I	Cluster II	Cluster III	Cluster IV	Cluster V	Cluster VI
Days to 50% flowering	144.30	147.00	131.89	142.77	134.67	145.00
Plant height (cm)	306.84	339.62	338.29	319.76	336.76	240.12
Basal Diameter (cm)	19.88	20.58	21.68	20.35	22.27	15.68
Bark Thickness (cm)	3.81	4.51	3.53	3.55	3.87	2.83
No.of nodes per plant	62.63	67.20	68.91	66.86	70.39	45.47
Internodal length (cm)	5.35	5.37	5.01	5.31	4.90	5.62
Green plant weight (gm)	434.55	497.66	474.38	479.23	550.69	272.43
Fibre length (cm)	314.32	352.33	347.16	318.68	367.51	247.08
Fibre wood ratio	0.35	0.28	0.36	0.38	0.36	0.39
Fibre yield / plant (gm)	21.97	25.34	26.21	25.40	30.22	19.39

Table 4: Contribution of different characters towards divergence in roselle.

Sr. No.	Characters	Times ranked 1st	Per cent contribution
1.	Days to 50% flowering	232	53.33
2.	Plant height (cm)	16	3.68
3.	Basal Diameter (cm)	14	3.22
4.	Bark Thickness (cm)	10	2.30
5.	No.of nodes per plant	1	0.23
6.	Internodal length (cm)	10	2.30
7.	Green plant weight (gm)	3	0.69
8.	Fibre length (cm)	15	3.45
9.	Fibre wood ratio	16	3.68
10.	Fibre yield / plant (gm)	118	27.13
	TOTAL	435	100

(AHS-162, AHS-172, AMV-5); days to 50% flowering, plant height, bark thickness were highest in Cluster II (JRR-9, JRRM-9-1); Cluster VI (AHS-179) exhibited highest values for internodal length per plant, fibre wood ratio. Cluster III (R-78, AMV-4, HS-4288) had higher values for basal stem diameter.

Days to 50 % flowering (53.33%) contributed maximum towards total divergence (Table 4) followed by fibre yield (27.12%), fibre wood ratio (3.68%), plant height (3.68%), fibre length (3.45%), and basal diameter (3.22%). These results were in confirmation with the findings of Shobha and Dharmatti [3] in vegetable Mesta, Hariram Kumar [4] in Roselle and Dudhane [5] in tossa jute.

Conclusion

Based on inter cluster D^2 values and cluster mean values the genotypes *viz.*, JRR-9, JRRM-9-1, R-78, AMV-4, HS-4288, AHS-162, AHS-172, AMV-5 and AHS-179 may be utilized in future breeding programmes for quality high fibre yielding lines thereby increasing the productivity of the crop which gives higher returns to the farming community.

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