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Estimation of genetic diversity in *rabi* ridge gourd (*Luffa acutangula* L.)

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Abstract

The experiment was conducted at student research farm COH – Mojerla during *Rabi* season 2020, to estimate genetic diversity of Ridge gourd. 24 genotypes of ridge gourd were evaluated for sixteen characters in a randomized block design, to study the genetic divergence. D² statistic indicated that the genotypes studied were genetically diverse. The genotypes were grouped into five clusters. Cluster I contained 19 genotypes and cluster II, III, IV and V were solitary with one genotype. In overall, D² analysis suggested that the promising genotypes *viz.*, IC- 279347, IC- 262128, IC- 355974 and IC- 355959, with high yield component may be utilised as parents in further improvement studies through various breeding strategies.

Keywords: Genetic diversity, D² analysis, Clusters, germplasm

Introduction

Ridge gourd (*Luffa acutangula* L.), one of the most popular cucurbitaceous vegetable crops and grown extensively throughout the tropical and subtropical regions of the world. The fruits contain Vitamin A, C and iron. Its use is recommended for those who suffer from malaria and other seasonal fever for its easy digestibility and very appetizing quality (Yawalkar, 1985; Gautam *et al.*, 2017) [1, 2]. Information on genetic divergence among the plant material is vital to a plant breeder for efficient choice of parents for hybridization (Methela *et al.*, 2019). It is an established fact that genetically diverse parents are likely to contribute desirable segregants and/or to produce high heterotic crosses. More diverse the parents greater are the chances of obtaining high heterotic F₁ and broad spectrum of heritability in segregating generations (Murty and Arunachalam 1966) [7]. Precise information on the extent of genetic diversity among population is crucial in any crop improvement program, as selection of plants based on genetic diversity has become successful in several crops (Ananda and Rawat 1984; Manoj *et al.* 2018) [1, 5]. The parent's identified on the basis of divergence analysis would be more promising. The quantification of genetic diversity through biometrical procedures made it possible to choose the genetically diverse parents for a successful hybridization program (Jain *et al.* 1975) [3]. Cluster analysis and PCA (principal component analysis) are the important genetic diversity measuring tools employed for exhibiting relative genetic differences among the genotype collection of various crop species. In view of this, the present study was conducted to classify a set of ridge gourd genotypes that may be used for generating more heterotic cross combinations and finally superior useful hybrids.

Materials and Methods

The research work was carried out at student research farm on ridge gourd at COH, Mojerla During *Rabi* 2020. The experimental site was situated in the southern Telangana state. COH, Mojerla is situated at an altitude of 401m. above mean sea level on 77.966 east longitude and 16.366 North latitude with a soil PH 6.98 and the climate of Mojerla is semi-arid. The land was uniform topography and almost homogenous in respect to soil fertility. The material comprised of 24 genotype of ridge gourd (*Luffa acutangula* L) the experiment was laid out in randomized block design with three replications with distance of 2x1.5m² three plants was selected at random in each treatment to record the observations on number of primary branches, number of leaves per vine, sex ratio, leaf width (cm), leaf length (cm), internodal length (cm), days to first male flower appearance, days to first female flower appearance, vine length (cm) node number for first male flower appearance, node number for first female flower

appearance, average fruit weight (g), fruit length(cm), fruit diameter (cm), number of fruits per vine, fruit yield per vine. The data was subjected to mahalanobis D² statistics to

measure the genetic divergence as suggested by Rao (1952) ^[10].

Results and Discussion

Table 1: Average intra (bold) and inter-cluster D² values for 5 clusters in twenty four genotypes of ridge gourd

Cluster Distances					
	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
Cluster 1	72.18	149.88	137.72	158.42	400.43
Cluster 2	149.88	0.00	262.26	83.31	341.50
Cluster 3	137.72	262.26	0.00	316.97	285.73
Cluster 4	158.42	83.31	316.97	0.00	522.87
Cluster 5	400.43	341.50	285.73	522.87	77.81

Bold diagonal values indicate intra cluster distance, rest of the values show the inter cluster distances.

Table 2: Clustering pattern of twenty four genotypes of ridge gourd by Tocher’s method

Cluster No.	Number of genotypes	S. No.	Genotype
1 Cluster	19	2	IC - 262245
		19	IC - 355967
		8	IC - 265026
		23	IC - 392535
		6	IC - 264908
		7	IC - 264971
		24	IC - 392535
		9	IC - 278358
		15	IC - 355952
		14	IC - 341161
		12	IC - 341116
		13	IC - 341122
		17	IC - 355961
		22	IC - 392534
		3	IC - 262245
		21	IC - 391465
		5	IC - 264830
		10	IC - 279347
		4	IC - 262265
2 Cluster	1	1	IC - 262128
3 Cluster	1	18	IC - 355967
4 Cluster	1	20	IC - 356037
5 Cluster	1	11	IC - 355951

Table 3: Mean values of clusters for ten characters in twenty four genotypes

	Number of primary branches	Number of leaves per vine	Sex ratio	Leaf width (cm)	Leaf length (cm)	Internodal length (cm)	Days to first male flower appearance	Days to first female flower appearance	Vine length	Node number for first male flower appearance	Node number for first female flower appearance	Average fruit weight (g)	Fruit length (g)	Fruit diameter (cm)	Number of fruits per vine	Fruit yield per vine
Cluster 1	12.94	93.33	2.22	17.6	11.38	19.43	44.91	45.14	4.01	4.27	8.11	110.62	21.81	3.51	3.28	1097.66
Cluster 2	14.44	120.56	2.68	15.35	13.08	18.97	42.33	43.78	3.85	2.66	8.77	105.22	20.55	3.55	6	1892.99
Cluster 3	9.44	67.33	3.26	17.5	12.11	23.05	45.67	47.56	3.91	4.89	7.55	110.22	14.98	5.45	2.55	843.97
Cluster 4	14.47	83.44	1.52	18.35	10.78	17.51	42.89	43.45	3.87	3.44	6.88	86.22	19.94	3.6	6.11	1576.72
Cluster 5	14	98.11	6.27	18.61	11.63	20.11	40.78	46.5	3.35	4.05	9.44	110.83	20.16	3.76	4.28	1399.81

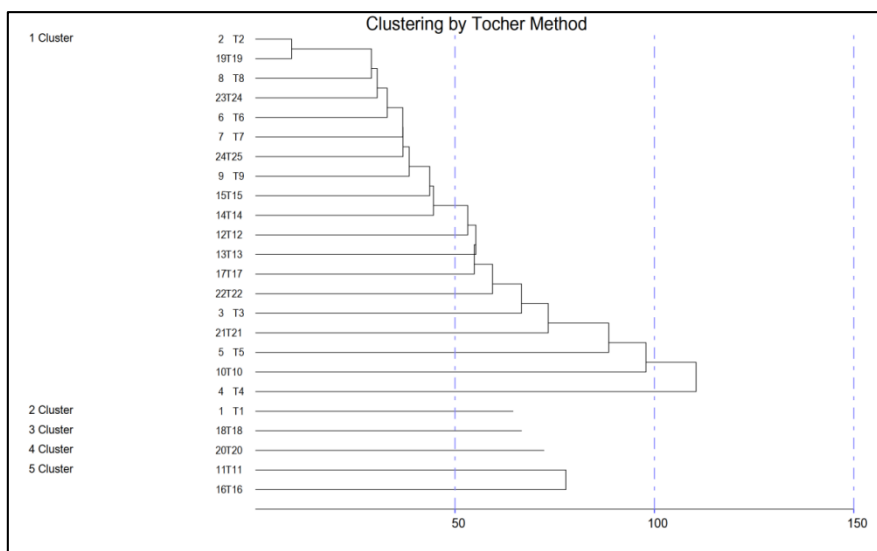


Fig 1: Dendrogram showing clustering pattern for divergence of ridge gourd genotypes

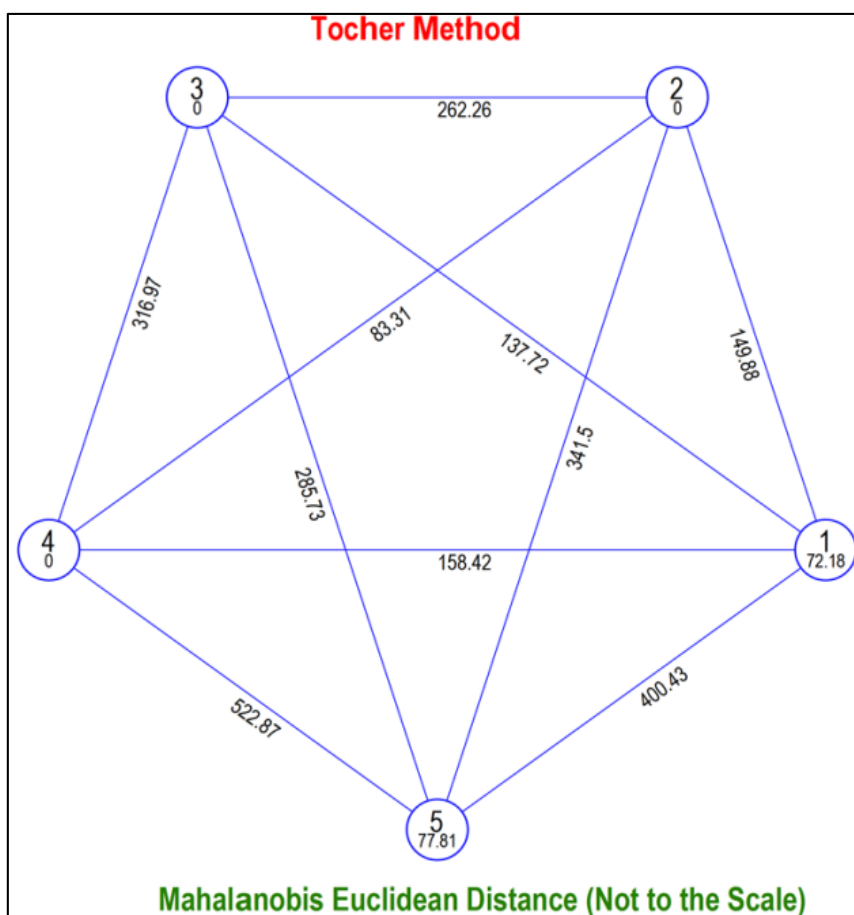


Fig 2: Cluster diagram showing average intra and inter-cluster D2 values of ridge gourd genotypes

D2 statistics, a concept developed by Mahalanobis (1936) [4] is important tool to plant breeder to classify the genotype into different groups based on genetic divergence between them. It is useful in quantifying degree of divergence between biological populations at genotypic level and assessing the relative contribution of different component traits to the total divergence at both intra and inter cluster level. Rao (1952) [10] Suggested the application of this technique for the assessment of genetic diversity in plant breeding. In present study the estimate of D² values ranged from 1.52 to 1892.99 in Rabi ridge gourd. The high range of D² values indicated the

presence of great amount of diversity in ridge gourd genotypes under study.

The Genotypes under Study were grouped into 5 clusters in rabi ridge gourd. Cluster I contained 19 genotypes followed by Cluster II (1 genotype). Cluster III, IV, V contained 1 genotype in each (Table 1).

Intra and inter cluster D² Values were worked out using D² values from divergence analysis. In rabi ridge gourd the minimum inter-cluster distance was observed in cluster II and IV (D² = 83.31) followed by cluster III and Cluster II D² (137.72) genotype falling between cluster IV and V (D² =

522.87) followed by cluster I and V (400.4) cluster II and V (341.50) indicating that genetic make up of genotypes falling in this cluster maybe entirely different from one another. The minimum intra-cluster distance was observed for the genotype falling in cluster II ($D^2 = 0$) followed by III ($D^2 = 0$). The maximum intra cluster distance was observed for the genotype falling in cluster V ($D^2 = 77.8$) followed by cluster I, ($D^2 = 72.18$). This implies that this cluster have the genotype with varied genetic architecture.

In rabi ridge gourd cluster means for 16 characters revealed wide range of variability among the clusters for the characters number of primary branches (9.44 to 14.47), number of leaves per vine (67.33 to 120.5), sex ratio (1.52 to 6.27), leaf width (15.35 to 18.61), leaf length (10.78 to 13.08), internodal length (17.51 to 23.0), days to first male flower appearance (40.78 to 40.567), days to first female flower appearance (43.45 to 47.56), vine length (3.35 to 4.01), node number for first male flower appearance (2.66 to 4.89), node number for first female flower appearance (6.88 to 9.44), average fruit weight (86.22 to 110.83), fruit length (14.98 to 21.81), fruit diameter (3.51 to 5.45), number of fruit per vine (2.55 to 6.11) and fruit yield per vine (843.9 to 1399.8). Rabbani *et al.* (2012)^[8], Ramesh *et al.* (2018)^[9] and Manoj *et al.* (2018)^[5] reported diversity in ridge gourd.

Conclusion

In overall D^2 analysis for Rabi ridge gourd suggested Highest contribution towards divergence in this regard was put forth by fruit yield per vine (14.32%), number of fruits per vine (13.24%), fruit diameter (11.50%), node number for first female flower appearance (9.78%), fruit length (8.90%), sex ratio (8.21%), node number for first male flower appearance (7.0%), average fruit weight (6.50%), days to first female flower appearance (4.00%), internodal length (3.00%), number of leaves per vine (2.00%), number of primary branches (1.09%), leaf width (1.00%), and leaf length (0.36%). Thus these were the major traits contributing to divergence. Hence, selection for divergent parents based on these characters will be useful for further breeding programmes in ridge gourd.

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