The Pharma Innovation Journal 2022; 11(3): 101-105

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(3): 101-105

www.thepharmajournal.com
Received: 18-01-2022
Accepted: 27-02-2022

Shilpashree N
Department of Vegetable Science, College of Horticulture, Bengaluru, Karnataka, India

M Anjanappa
College of Horticulture, Kolar, UHS, Bagalkot, Karnataka, India

B Fakrudin
Department of Vegetable Science, College of Horticulture, Bengaluru, Karnataka, India

M Pitchaimuthu
ICAR-IIHR, Hesarghatta, Bengaluru, Karnataka, India

RK Ramachandra
Horticultural Research and Extension Centre, Hogalagere, Kolar, Karnataka, India

KS Shankarappa
Department of Vegetable Science, College of Horticulture, Bengaluru, Karnataka, India

Aravind Kumar JS
College of Horticulture, Mysuru, UHS, Bagalkot, Karnataka, India

Corresponding Author:
Shilpashree N
Department of Vegetable Science, College of Horticulture, Bengaluru, Karnataka, India

Genetic diversity studies in ridge gourd (*Luffa acutangula* (L.) Roxb.) Genotypes

Shilpashree N, M Anjanappa, B Fakrudin, M Pitchaimuthu, RK Ramachandra, KS Shankarappa and Aravind Kumar JS

Abstract
An experiment was conducted at College of Horticulture, Bengaluru, India during *Rabi* 2019 with 55 genotypes of ridge gourd. Based on Mahalanobis D^2 statistics, genotypes were broadly grouped into nine clusters. Cluster I consisting of 21 genotypes, followed by cluster III contained 14 genotypes, cluster VI consists of 7 genotypes, cluster II consists of 5 genotypes and cluster VII consists of 4 genotypes and cluster IV, cluster V, cluster VIII and cluster IX contained each one genotype. Among the different characters studied, fruit yield/vine (26.20%) contributed maximum to the total genetic diversity among the genotypes followed by fruit length (19.06%), average fruit weight (13.60%) and number of branches/vine (10.24%). The maximum inter cluster distance (1173.86) recorded between the cluster VII and cluster IX. The genotypes belonging the clusters with maximum inter cluster distance are genetically more divergent and these genotypes could be used in hybridization programme to obtain promising segregants.

Keywords: Ridge gourd, genetic diversity, clusters, fruit yield per vine, hybridization

1. Introduction
Ridge gourd (*Luffa acutangula* (L.) Roxb.) is an important vegetable crop of the family cucurbitaceae with chromosome number of 2n=26. In Indian traditional systems of medicines, ridge gourd is used widely in the treatment of Vata, Kapha, Anaemia, Leucoderma and in splenic enlargement. Every 100 g of edible portion of ridge gourd contains 0.5 g of fibre, 0.5 per cent of protein, 0.34 per cent of carbohydrate, 37 mg of carotene, 5.0 mg of vitamin C, and 18 mg of calcium and 0.5 mg of iron (Hazra and Som, 2005) [4]. It is commonly grown in Tamil Nadu, Karnataka, Gujarat, Maharashtra (Konkan region), West Bengal, Assam, Punjab, Haryana, Madhya Pradesh and Western Uttar Pradesh. In India, the ridge gourd is cultivated over an area of 24,500 acres with a production of 3,16,295 tonnes (farmnest.com), whereas in Karnataka, it is cultivated over an area of 4,970 hectares with a production of 42,856 tonnes and productivity of 8.62 tonnes per hectare (Anon., 2018) [1]. The available genetic diversity which is essential for any crop improvement programme (Khatun *et al.*, 2010) [8]. The inclusion of diverse parents in hybridization programme serves the purpose of producing desirable recombinants. Thus, provides ample scope for utilization of hybrid vigour on commercial scale to increase the production and productivity.

2. Material and Methods
Field experiment was carried out to assess the diversity among 55 diverse ridge gourd genotypes during *Rabi*-2019 at the Vegetable block, College of Horticulture, Bengaluru of University of Horticultural Sciences, Bagalkot, Karnataka. The experiment was laid out in Randomized Block Design with two replications. The population of ten plants per genotype was maintained by the sowing of seeds at a spacing of *1.50 m to 1.00* m apart. The genotypes were evaluated for different growth, yield and yield related characters *viz*., vine length, number of branches per vine, days to first female flowering, days to 50 per cent flowering, node at first female flower appears, days to first fruit harvest, days to last fruit harvest, sex ratio, per cent fruit set, number of fruits per vine, average fruit weight, fruit length, fruit diameter, fruit yield per vine, number of ridges per fruit, flesh thickness and rind thickness.The genetic divergence was estimated using the D^2 statistics of Mahalanobis and the population was grouped into cluster by following methods suggested by Tocher's (Rao, 1952) [15]. The intra and inter-cluster distances were calculated formula described by Singh and Choudhary (1977) [17].

3. Results and Discussion

The analysis of variance for different characters for fifty five ridge gourd genotypes were highly significant difference among the genotypes for most of the characters studied except number of ridges per fruit. Based on the relative magnitude of D^2 estimates (Table 1), 55 ridge gourd genotypes were broadly grouped into nine clusters with variable number of genotypes revealing the presence of considerable amount genetic diversity in the materials. Among the nine clusters, Cluster I was the largest, consisting of 21 genotypes, while cluster III contained 14 genotypes, followed by cluster VI consists of 7 genotypes, cluster II consists of 5 genotypes and cluster VII consist of 4 genotypes and cluster IV, cluster V, cluster VIII and cluster IX contained each one genotype are depicted in Fig.1. The pattern of group revealed that significant variability existed among the genotypes. Similar results were also obtained by Jamadar and Desai (1999) [5], Kagadi *et al*.(2001) [6], Choudhary (2011) [2], Rabbani *et al*. (2012) [12], Sunil *et al*. (2014) [18], Gautam *et al*. (2017) [3], Khan *et al*. (2017) [7], Rani *et al*. (2017) [13], Manoj *et al*. (2018) [10], Ramesh *et al*. (2018) [14], Quamruzzaman *et al*. (2020) [11].

The mean intra and inter cluster D^2 values are given in Table 2.The intra cluster D^2 values varied from 0.00 (Cluster IV, cluster V and cluster VIII) to137.12 (Cluster VI).The cluster VI had a maximum D^2 value (137.12) followed by cluster III (113.39), cluster VII (96.22), cluster I (79.41) and cluster II (66.28) and no intra cluster distance was observed in cluster IV, cluster V and cluster VIII. The inter cluster D^2 values of the nine clusters revealed that highest inter cluster distance (1173.86) was between the cluster VII and cluster IX, similarly the lowest (130.75) was observed between the cluster I and cluster III are depicted in Fig.2.

The inter cluster distance was minimum between cluster I and cluster III indicating the narrow genetic diversity and maximum between cluster VII and cluster IX, followed by cluster VIII and cluster IX indicating wider genetic diversity among the genotypes included in these cluster groups, which could be used in the fruit yield improvement of ridge gourd. A wide range of variability was observed in the cluster means for all the characters studied (Table 3). For characters like vine length (4.17 m), number of branches per vine (7.83), days to last fruit harvest (106.35), sex ratio (12.70), per cent fruit set (49.34), number of fruits per vine (16.55), average fruit weight (205.12 g), fruit length (37.39 cm), fruit yield per vine (4.06 kg), flesh thickness (3.66 cm) and rind thickness (1.37 mm) were observed with genotypes in cluster IX. While in cluster VII recorded best cluster means for days to first female flower appears (38.30). The genotype in cluster VI recorded best mean value for days to 50% flowering (41.11) and days to first fruit harvest (46.66). The genotypes in cluster VIII recorded least cluster mean value for node at first female flowering (10.46). The cluster V comprised genotypes recorded higher fruit diameter (15.73 cm). The genotypes with maximum mean values are used a parent in future breeding and based on the genetic distance and clustering pattern the most divergent genotypes were from cluster VIII and cluster IX could be used as best parents on crop improvement programme. This is in conformity with the findings of Gautam *et al*. (2017) [3], Khan *et al*. (2017) [7], Rani *et al*. (2017) [13], Manoj *et al*. (2018) [10], Ramesh *et al*. (2018) [14], Quamruzzaman *et al*. (2020) [11].

The diversity of parents is of the utmost importance for a successful breeding programme, as the crossing made between parents with maximum genetic diversity are more likely to produce desired recombinant in progeny. It is however preferable depending upon information about the genetic diversity found in accessible germplasm, to select appropriate genetically different parents.

The choice of the parents mainly depends upon contribution of characters towards divergence (Table *4)*. Among the characters, fruit yield per vine with maximum contribution of 26.20 per cent to the diversity among the different characters followed by fruit length (19.06%), average fruit weight (13.60%), number of branches per vine (10.24%), fruit diameter (9.90%), number of fruits per vine (5.19%), node at first female flower appears (4.44%), flesh thickness (3.70%), days to last fruit harvest (3.57%), rind thickness (2.63%), vine length (0.47%), sex ratio (0.34%), days to first female flowering (0.27%), days to 50 per cent flowering (0.20%), per cent fruit set (0.20%), days to first fruit harvest (0.00%) and number of ridges per fruit (0.00%). *Similar divergence studies were carried out by* Jamadar and Desai (1999) [5], Kagadi *et al*. (2001) [6], Choudhary (2011) [2], Rabbani *et al*. (2012) [12], Sunil *et al*. (2014) [18], Gautam *et al*. (2017) [3], Khan *et al*. (2017) [7].

Table 1: Clustering pattern of fifty-five ridge gourd genotypes using Tocher's method

Cluster	Number of genotypes	Genotypes included in the cluster
I	21	COHBRG-19, COHBRG-50, COHBRG-37, COHBRG-21, COHBRG-44, COHBRG-20, COHBRG-45, COHBRG-34, COHBRG-36, COHBRG-6, COHBRG-17, COHBRG-24, COHBRG-55, COHBRG-47, COHBRG-15, COHBRG-51, COHBRG-26, COHBRG-11, COHBRG-43, COHBRG-31 and COHBRG-7
II	5	COHBRG-28, COHBRG-41, COHBRG-25, COHBRG-30 and COHBRG-18
III	14	COHBRG-23, COHBRG-27, COHBRG-52, COHBRG-14, COHBRG-53, COHBRG-46, COHBRG-39, COHBRG-3, COHBRG-9, COHBRG-4, COHBRG-48, COHBRG-10, COHBRG-54 and COHBRG-38
IV	1	COHBRG-13
V	1	COHBRG-40
VI	7	COHBRG-1, COHBRG-49, COHBRG-22, COHBRG-5, COHBRG-8, COHBRG-16 and COHBRG-12
VII	4	COHBRG-29, COHBRG-35, COHBRG-32 andCOHBRG-33
VIII	1	COHBRG-2
IX	1	COHBRG-42

Table 2: Average intra and inter cluster distance D^2 for different characters of ridge gourd genotypes

Cluster	I	II	III	IV	V	VI	VII	VIII	IX
I	79.41								
II	338.30	66.28							
III	130.75	334.87	113.39						
IV	101.69	267.48	207.43	0.00					
V	168.41	252.79	173.76	214.60	0.00				
VI	144.45	386.31	190.80	152.37	278.34	137.12			
VII	175.80	612.28	209.40	295.07	294.43	291.18	96.22		
VIII	294.68	477.94	199.98	374.64	349.29	217.61	430.32	0.00	
IX	747.19	163.29	727.01	599.78	552.84	838.43	1173.86	943.93	0.00

Table 3: Mean values of different characters in nine clusters of ridge gourd

Cluster	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
I	3.15	6.54	40.93	44.92	13.48	48.46	82.37	21.15	39.89	12.31	124.79	17.88	13.91	1.96	7.90	2.50	1.90
II	3.61	7.17	40.75	43.20	11.07	49.12	96.53	15.58	46.67	15.55	161.27	26.52	14.37	3.33	8.16	3.40	1.40
III	2.95	5.91	39.72	44.08	12.34	47.50	86.55	19.69	41.27	12.33	115.57	23.04	14.22	1.85	7.97	2.66	1.93
IV	3.09	7.51	44.14	45.50	14.61	49.74	90.71	17.91	40.48	13.93	158.71	18.41	13.20	2.23	5.61	2.30	1.90
V	2.64	6.84	44.18	50.64	16.62	51.39	90.71	16.69	43.82	15.97	116.43	18.73	15.73	2.27	8.09	2.95	1.66
VI	2.70	6.19	38.58	41.11	10.66	46.66	81.52	20.88	42.15	10.49	148.46	15.29	13.95	1.87	8.11	2.44	1.82
VII	3.00	6.90	38.30	42.23	13.39	47.51	89.88	22.31	39.14	12.25	63.15	15.19	13.64	1.60	8.57	2.76	1.87
VIII	1.98	4.13	40.43	42.56	10.46	47.93	90.75	17.56	41.68	10.52	144.42	21.89	14.13	1.60	7.12	2.45	1.81
IX	4.17	7.83	39.18	43.77	13.01	47.78	106.35	12.70	49.34	16.55	205.12	37.39	14.85	4.06	8.13	3.66	1.37

1. Vine length (m)
2. Number of branches per vine
3. Days to first female flower appears
4. Days to 50 per cent flowering
5. Node at first female flower appears
6. Days to first fruit harvest
7. Days to last fruit harvest
8. Sex ratio
9. Per cent fruit set
10. Number of fruits per vine
11. Average fruit weight (g)
12. Fruit length (cm)
13. Fruit diameter (cm)
14. Fruit yield per vine (kg)
15. Number of ridges per fruit
16. Flesh thickness (cm)
17. Rind thickness (mm)

Table 4: Per cent contribution from different characters to the total divergence in ridge gourd genotypes

Sl. No.	Characters	Per cent contribution
1	Vine length (m)	0.47
2	Number of branches per vine	10.24
3	Days to first female flowering	0.27
4	Days to 50 per cent flowering	0.20
5	Node at first female flower appears	4.44
6	Days to first fruit harvest	0.00
7	Days to last fruit harvest	3.57
8	Sex ratio	0.34
9	Per cent fruit set	0.20
10	Number of fruits per vine	5.19
11	Average fruit weight (g)	13.60
12	Fruit length (cm)	19.06
13	Fruit diameter (cm)	9.90
14	Fruit yield per vine (kg)	26.20
15	Number of ridges per fruit	0.00
16	Flesh thickness (cm)	3.70
17	Rind thickness (mm)	2.63

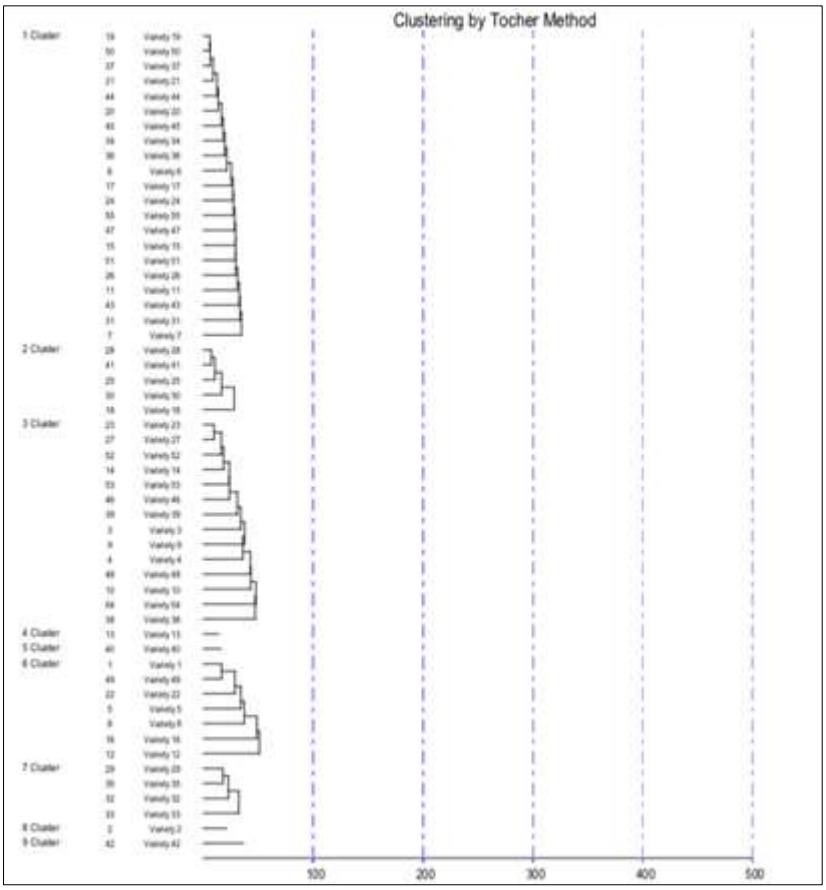

Fig 1: Dendrogram showing the genetic diversity among 55 genotypes of ridge gourd using Tocher's method

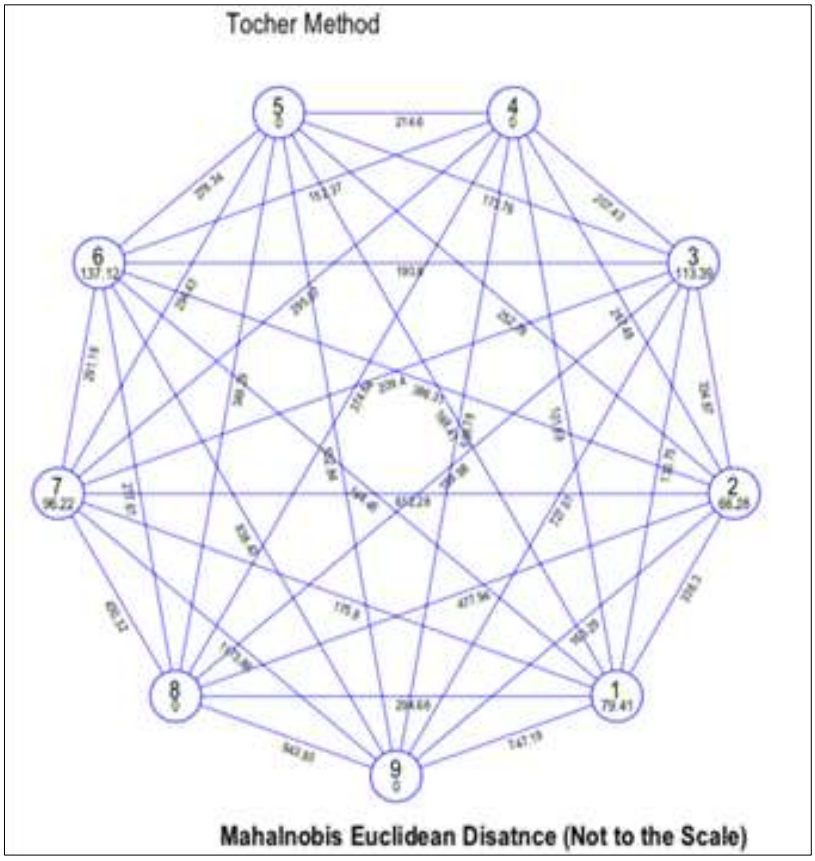

Fig 2: Distance between inter and intra cluster distances in ridge gourd genotypes

4. Conclusion

The present study clearly indicates that inter-crossing among the genotypes belonging to genetically diverse clusters and showing superior mean performance might prove beneficial

for obtaining desirable segregants in the coming generation with high yield potential in ridge gourd. Among the 55 genotypes evaluated, better performing genotypes can be selected and breeding can be done to develop high yielding ridge gourd varieties.

5. References

1. Anonymous. National Horticulture Board database, National Horticulture Board, Ministry of Agriculture, Government of India, Gurgaon, 2018.
2. Choudhary BR, Pandey S, Singh PK, Singh R. Genetic divergence in hermaphrodite ridge gourd. Vegetable Science. 2011;38(1):68-72.
3. Gautam A, Maurya SK, Yadav H, Pooja. Genetic divergence and character association studies in indigenous ridge gourd (*Luffa acutangula* (L.) Roxb.) genotypes. Journal of Pharmacognsy and Phytochemistry. 2017;6(4):1769-1774.
4. Hazra P, Som MG. Vegetable Science. Kalyani publishers, New Delhi, 2005, 5-10.
5. Jamadar MM, Desai SA. Reaction of ridge gourd local cultivated against downy mildew caused by *Pseudoperonospora cubensis* Rostow. Karnataka Journal of Agricultural Sciences. 1999;12(1-4):204-205.
6. Kagadi SR, Pawar DR, Gadre UA, Mandaokhot AM. Varietal evaluation in ridge gourd against downy mildew. Journal of Maharashtra Agricultral University. 2001;26(2):193.
7. Khan ASMMR, Eyasmin R, Rashid HM, Ishtiaque S, Chaki KA. Variability, heritability, character association, path analysis and morphological diversity in snake gourd. Agricultural Natural Resources, 2017, 1-7.
8. Khatun M, Rabbani MG, Rahaman EHMS. Estimate of genetic diversity in Snake gourd (*Trichosanthes cucumerina*). Bangladesh Journal of Agricultural Research. 2010;35:95-100.
9. Mahalanobis PC. On the generalized distance in statistics. National Institute of Science of India, 1936.
10. Manoj YB, Lakshmana D, Kolakar SS, Chandana BC. Assessment of genetic diversity and variability in ridge gourd for growth and yield parameters. Green Farming. 2018;9(2):239-243.
11. Quamruzzaman AKM, Islam F, Salim MMR, Akhter L, Rahman MM, Chowdhury MAZ. Variability and genetic diversity of bottle gourd [*Lagenaria siceraria* (mol.) Stand.] in Bangladesh. Journal of Biological Life Science. 2020;11(2):127-137.
12. Rabbani MG, Naher MJ, Hoque S. Variability, character association and diversity analysis of ridge gourd (*Luffa acutangula* (L.) Roxb.) genotypes of Bangladesh. SAARC Journal of Agriculture. 2012;10(2):1-10.
13. Rani EA, Jansirani P, Bapu JRK. Assessment of breeding potential of ridge gourd [*Luffa acutangula* (L.) Roxb.] germplasm for growth, yield and quality using diversity (D^2) analysis. International Journal Current Microbiological Applied Sciences. 2017;6(3):128-133.
14. Ramesh ND, Choyal P, Dewangan P, Gudadinni PS, Ligade PP. Study on genetic variability, heritability and genetic advance in ridge gourd (*Luffa acutangula* (L.) Roxb.). International Journal of Chemical Studies. 2018;6(4):1329-1333.
15. Rao CR. Advanced statistical methods in biometrics research. John Wiley and Sons, New York, 1952, 357-369.
16. Ridge gourd cultivation guide published by farmnest.com (https://discuss. farmnest. com/ t/ridge-gourd-cultivation-guide/22189).
17. Singh RK, Choudhary BD. Biometrical methods in quantitative genetic analysis. Kalyani Publishers, New Delhi, 1977.
18. Sunil N, Reddy MT, Hameedunnisa B, Vinod, Rao PS, Sivaraj N, *et al*. Diversity in bottle gourd (Lagenaria siceraria - (Molina) Standl.) germplasm from peninsular India. Electronic Journal of Plant Breeding. 2014;5(2):236-243.