Journal of Plant Stress Physiology 2018, 4: 41-44
doi: 10.25081/jpsp.2018.v4.3506
http://updatepublishing.com/journal/index.php/jpsp/

ISSN: 2455-0477

REGULAR ARTICLE

STUDIES ON GENETIC DIVERGENCE FOR FRUIT YIELD IN ABELMOSCHUS ESCULENTUS (L.) MOENCH.] GENOTYPES UNDER COASTAL ECO-SYSTEM

S. MUDHALVAN*, N. SENTHILKUMAR

Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University, Annamalai Nagar 608 002, Tamil Nadu, India

ABSTRACT

A study was conducted for identifying the genetic divergence in okra (*Abelmoschus esculentus* (L.) Moench) genotypes. Fifteen genotypes were evaluated with the objective of selecting superior genotypes namely, Arka Anamika, Varsha Upahar, Thunder, Dhanya, Pusa-7, Basanthi, S-51, Thanvi-66, CO-2, Akshaya, N-U-Lakshmi, Namadhri, PHS, Villupuram Local, and Karur Local for fruit yield traits. The degree of divergence among 15 genotypes was computed using Mahalanobis' D^2 analysis to assess the genetic diversity. For this programme, morphological characters *viz*., days to first flowering, plant height, inter node distance, days to fruit maturity, number of immature seeds per fruit, fruit length, fruit girth, number of branches per plant, number of fruits per plant, fruit weight, and fruit yield per plant were studied. Analysis of variance for 15 genotypes of bhendi revealed that all the genotypes were significantly differed among themselves for all the eleven traits studied. The results revealed that the mean performance for fruit yield per plant was maximum in the genotype namely Basanthi(465 g), followed by Dhanya(438 g), and S-51(433 g). The genotypes which recorded high mean performance for fruit yield per plant also exhibited significant per se performance for the traits namely inter node distance, number of fruits per plant and average fruit weight.

Keywords: *Abelmoschus esculentus*, Okra, Genetic diversity, Cluster, Fruit yield

INTRODUCTION

Okra [*Abelmoschus esculentus* (L) Moench.], family: Malvaceae, is a widely consumed vegetable crop commonly cultivated in India and some other tropical countries [1]. Cultivated okra has variations in the chromosome numbers but most frequent observed chromosome number is 2n = 130 [2]. Okra is an annual and day neutral plant cultivated in all seasons for its delicious tender pods in one and other different parts of the country [3]. Fresh okra fruit contains 35 calories, 89.6 g water, 6.4 g carbohydrate, 1.9 g protein, 0.2 g fat, 1.2 g fiber and minerals per 100 g of edible portion [4]. Okra is an often cross pollinated crop, heterosis is being exploited in form of development of hybrids. Hence, genetic divergence is an important tool while selecting the parents for hybrid breeding. Divergence analysis is more authentic and powerful tool for systematic identification of the diverse genotypes for hybridization purposes [5]. To develop high yielding varieties, genetic diversity is an important tool to select genetically diverse parents with high yield and wider adaptability in breeding programme. Progress of any breeding programmes depends to a great extent on the availability of genetic variability for desirable traits in genotypes [6, 7].

Genetic diversity helps the breeders in deciding the most appropriate breeding method to increase the genetic potentialities as well as to surpass the yield barrier [8]. Use of genetically diverse parents in recombination breeding supposed to give maximum heterosis in F1's and also getting broad spectrum of variability for quantitative traits in segregating generations to select desirable recombinant. Therefore, genetic diversity is prerequisites for any successful breeding programme.

MATERIALS AND METHODS

The experimental material comprised of 15 genotypes of okra. These genotypes were grown in randomized block design with three replications at the Plant breeding farm, Department of Genetics and Plant Breeding, Annamalai University, Annamalai Nagar. Each genotype was grown in two row of 4.5 m length with spacing of 60 × 45 cm. The observations were recorded on five randomly selected plants in each replication for each genotype on 11 characters *viz*., days to first flowering, plant height, inter node distance, days to fruit maturity, number of immature seeds per fruit, fruit length, fruit girth, number of branches per plant, number of fruits per plant, average fruit weight and fruit yield per plant were studied. The data were statistical analyzed as per Mahalanobis' D2 analysis [5] to measure of genetic divergence among 15 genotypes. The grouping of 15 genotypes into different clusters was done by following K. D. Tocher's methods [9].

Received 09 February 2018; Accepted 29 April 2018

*Corresponding Author

S. Mudhalvan

Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University, Annamalai Nagar 608 002, Tamil Nadu, India

Email: muthalvanshanmugam2012@gmail.com

Table 1: ANOVA for yield and yield component characters in okra

S. No.	Characters	df	MSS	F value
1.	Days to first flowering	14	7.39**	27.64
2.	Plant height	14	770.11**	150.97
3.	Inter node distance	14	3.25**	24.81
4.	Days to fruit maturity	14	1.50**	6.45
5.	Number of immature seeds per fruit	14	145.23**	29.84
6.	Fruit length	14	5.72**	102.62
7.	Fruit girth	14	1.45**	46.55
8.	Number of branches per plant	14	0.37**	7.68
9.	Number of fruits per plant	14	32.76**	23.75
10.	Average fruit weight	14	22.37**	53.45
11.	Fruit yield per plant	14	4341.49**	20.80

**-significant at 1 per cent level, *-significant at 5 per cent level

Table 2: Mean table

Genotypes	Days to first flowering	Plant height	Inter node distance	Days to fruit maturity	Number of immature seeds per fruit	Fruit length	Fruit girth	Number of branches per plant	Number of fruits per plant	Average fruit weight	Fruit yield per plant
Arka Anamika	39.00	103.33	7.21	6.40	64.40	13.47	5.33	2.67	19.33	20.80	402.01
Varsha upahar	40.00	82.93	7.11	5.53	51.76	13.07	4.53	2.63	18.00	17.81	320.26
Thunder	38.00	101.66	5.89	5.53	51.50	10.04	4.60	2.97	21.67	17.41	377.03
Dhanya	38.60	144.17	7.16	5.00	42.47	12.17	5.13	3.03	26.67	16.45	438.56
Pusa-7	36.20	96.67	4.55	5.40	57.78	14.63	6.23	2.90	17.33	24.46	423.93
Basanthi	38.60	122.50	7.05	5.57	49.95	13.00	5.86	2.80	21.00	22.18	465.71
S-51	38.40	122.50	5.91	5.40	50.62	13.03	5.57	2.90	25.00	17.33	433.28
Thanvi-66	36.70	112.60	6.52	5.67	56.06	15.06	5.30	2.73	18.33	20.09	359.04
Co-2	41.63	130.33	6.66	6.90	48.42	11.86	4.73	3.33	20.33	23.08	381.00
Akshaya	35.40	104.63	5.69	5.07	54.03	12.60	6.20	2.43	16.66	16.80	349.53
N-U-Lakshmi	37.33	96.80	4.52	6.40	61.64	14.48	5.27	2.57	16.00	18.75	393.76
Namadhri	37.00	95.93	5.81	7.10	54.90	10.48	5.90	3.60	20.33	20.53	406.04
PHS	38.20	118.06	3.96	4.60	37.71	13.19	4.50	3.1	23.00	23.67	426.63
Villupuram local	38.50	124.43	5.23	6.23	44.98	13.14	6.40	2.77	22.00	22.66	416.39
Karur local	36.60	115.17	6.34	5.57	54.23	12.28	4.26	2.17	15.00	17.60	383.20

Table 3: Grouping of 15 genotypes of okra in different clusters

S. No.	Cluster	Number of genotypes	Genotypes
1	I	5	Basanthi, Villupuram local, S-51, Dhanya,Thanvi-66,
2	II	5	Arka Anamika, N-U-Lakshmi, Akshaya, Namadhri, Pusa-7,
3	III	2	Thunder, Karur local,
4	IV	2	Co-2,PHS
5	V	1	Varsha Upahar

Table 4: Average intra (diagonal and bold) and inter (above diagonal) cluster distance (D^2values) in 15 genotypes of okra

Cluster	I	II	III	IV	V
I	286.72(16.93)	617.86 (24.85)	2201.25(52.02)	2705.73(52.01)	6493.93(80.58)
II		287.92(16.97)	458.40(21.41)	1579.25(39.74)	3785.81(61.53)
III			268.51(16.39)	949.64(30.82)	2445.51(49.45)
IV				244.77(15.65)	1257.51(35.46)
V					0.01(0.1)

Table 5: Cluster mean of 15 genotypes for 11 characters in okra

Character	Clusters with their number of genotypes				
	I	II	III	IV	V
	5	5	2	2	1
Days to first flowering	48.81	58.55	52.86	43.01	51.76
Plant height	125.24	99.47	108.42	124.2	82.93
Inter node distance	6.37	5.55	6.11	5.31	7.11
Days to fruit maturity	5.57	6.07	5.54	5.75	5.53
Number of immature seeds per fruit	48.81	58.55	52.86	43.06	51.75
Fruit length	13.28	13.12	11.16	12.52	13.07
Fruit girth	5.65	5.78	4.43	4.61	4.53
Number of branches per plant	2.84	2.83	2.56	3.23	2.63
Number of fruits per plant	22.60	17.93	18.33	21.66	18.00
Average fruit weight	19.74	20.26	17.50	23.37	17.81
Fruit yield per plant	422.59	473.80	380.11	403.61	320.26

Table 6: Relative contribution of 11 different characters to divergence in 15 genotypes of okra

Characters	Rank total	Rank
Days to first flowering	7.61	8
Plant height	12.38	13
Inter node distance	6.67	7
Days to fruit maturity	0	0
Number of immature seeds per fruit	20.95	22
Fruit length	11.43	12
Fruit girth	4.76	5
Number of branches per plant	3.80	4
Number of fruits per plant	1.91	2
Average fruit weight	11.43	12
Fruit yield per plant	19.05	20

RESULTS AND DISCUSSION

The analysis of variance for all the eleven traits studied were given in table 1. The results revealed that the mean performance for fruit yield per plant was maximum in the genotype namely Basanthi (465 g), followed by Dhanya (438 g), and S-51(433 g). The genotypes which recorded high mean performance for fruit yield per plant also exhibited significant per se performance for the traits (table 2). Wilk's criteria were used to test the aggregate effects of all the characters. Genetic divergence among 15 genotypes for 11 characters was made by using Mahalanobis' D2 analysis as per Rao [9]. Based on Mahalanobis' D2 analysis, 15genotypes were grouped into five clusters on the basis of observed smaller D2 values among genotypes within a cluster than those belonging to different cluster following Tocher's methods (table 3). Fifteen diverse genotypes were grouped into five clusters with the highest of five genotypes in the cluster I and II each and two genotype in the cluster III and IV each and only one genotype in the cluster V. It is indicating that Cluster V is more diverse from resting other clusters. The genotypes in these clusters are more genetically diverse and may be used as potential parents for breeding programmes to develop high yielding cultivars. It was also observed that geographical distance between the genotypes had no relation with the genetic divergence as the genotypes from same source had fallen into different clusters as well as the same cluster contained genotypes from different sources. It indicates that clustering pattern of okra genotypes did not follow their geographic distribution. These findings are in agreement to earlier reports [10-15].

The D^2 values of intra cluster and inter cluster ranged from 15.65 to 16.97 and 21.41 to 80.58 respectively. Maximum intra cluster distance was observed in cluster II (16.97) followed by cluster I (16.93) while inter cluster distance was maximum in between cluster I and cluster V (80.58) followed by cluster II and cluster V (61.53) and cluster I and cluster III (52.02). Higher intra and inter cluster distance indicating that high degree of genetic divergence within cluster and between clusters respectively. Therefore, genotypes belonging to these inter clusters may be used in hybridization programme to obtain transgressive segregants with broad spectrum of genetic variability for yield and other component traits to isolate high yielding genotypes in okra. These results are in accordance with the previous findings [11-17].

The cluster means for 11 characters (table 5) indicated that considerable variability present in characters among the five clusters. The data showed that maximum cluster mean variation was observed for fruit yield per plant (320.26 g in cluster V to 473.80 g in cluster II), average weight (17.50 g in cluster III to 23.37 g in cluster IV), number of immature seeds per fruit (43.06 in cluster IV to 58.55 in cluster II) and plant height (82.93 cm in cluster V to 125.24 cm in cluster I).

It was observed that genotypes under cluster II has highest desirable cluster mean for five characters followed by cluster I for three characters, two characters in cluster IV and one character in cluster V. Cluster IV recorded highest mean for days to first flowering (58.55), days to fruit maturity (6.07), number of immature seeds per fruit (58.55), fruit girth (5.78 cm), and fruit yield per plant (473.80 g). Cluster III recorded highest desirable cluster mean for plant height (48.81 cm), fruit length (13.38 cm), and number of fruits per plant (22.60). Cluster IV and cluster V have lowest desirable cluster mean for number of

branches per plant (3.23), average fruit weight (23.37) and inter node distance (7.11).

The results on relative contribution of different character presented in table 6 showed that number of fruits per plant (1.91) followed by number of branches per plant (3.80), fruit girth (4.76), days to fruit maturity (6.67) and days to first flowering (7.61) contributed maximum towards the genetic divergence. It suggested that these characters are highly genetic variable and these characters should be considered while selecting parents for hybridization programmes under studied genotypes. Previous works [1, 14, 15, 18] also observed contribution of plant height, fruit length and weight of fruits towards the genetic divergence.

In the present study, it is concluded that genotypes for hybridization programme should be selected between cluster I and cluster II followed by cluster IV and cluster II and cluster V and cluster II and cluster III and cluster II. These clusters contain wide genetic diversity among the genotypes for different traits under studied. Therefore, selection of these divergent genotypes and use in crossing programme would give greater chances of obtaining high heterosis and high genetic variability for quantitative and other desirable traits in segregating generations to develop high yielding cultivars in okra.

REFERENCES

1. John, M. S., George, W. and Mc Collum, J. P. 1992. Producing Vegetable Crops. (4th edn.) International Book Distribution Co. Lucknow.
2. Joshi, A. B. and Hardas, M. W. 1956. Alloploid Nature of Okra, *Abelmoschus esculentus* (L.) Monech. *Nature*. 178:1190.
3. Balai TC, Maurya IB, Verma S, Kumar N. Research Note Genetic divergence studies in okra [Abelmoschus esculentus (L.) Moench.] genotypes. Electronic Journal of Plant Breeding. 2015 Jun; 6:619-24.
4. Gopalan, C., Rama Sastri, B. V. and Balasubramanian, S. 2007. Nutritive Value of Indian Foods, published by National Institute of Nutrition (NIN), ICMR.
5. Mahalanobis, P. C. 1936. On the generalized distance in statistics. *Proc. Nat. Inst. Sci.*, India, 2:49-55.
6. Kumar, N., Joshi, V. N. and Dagla, M. C. 2013. Estimation of components of genetic variance in maize (*Zea mays* L.). *The Bioscan*. 8 : 503-507.
7. Balai, T. C., Maurya, I. B., Verma, S. and Kumar, N. 2014. Correlation and path analysis in genotypes of okra [*Abelmoschus esculentus* (L.) Moench]. *The Bioscan,* (Supplement on Genetics and Plant Breeding). 9 : 799-802.
8. Langade, D. M., Ram, C. N., Vishwakarma, D. N. and Sharma, A. 2013. Evaluation of genetic divergence in berseem (*Trifolium alexandrinum* L.) germplasms. *The Bioscan*. 8 : 767-770, 2013.
9. Rao, C. R. 1952. Advanced statistical methods in Biometric Research. John Wiley and Sons Inc. New York.
10. Bindu, K. K., Manju, P. and Sarashwathy, P. 1994. Genetic divergence in bhindi [*Abelmoschus esculentus* (L.) Moench]. *J. Trop. Agric.*, 32 : 115-117.
11. Bisht, I. S., Mahajan, R. K. and Rana, R. S. 1995. Genetic diversity in South Asian okra [*Abelmoschus esculentus* (L.) Moench] germplasm collection. *Annals of Appl. Biol.*, 126 : 539-550.
12. Mishra, S. N., Dash, S. N. and Mishra, D. 1996. Multivariate analysis of genetic divergence in okra (*Hibiscus esculentus*). *Indian J. Agric. Sci.,* 66 : 502-503.
13. Dhaduk, L. K., Mehta, D. R. and Patel, K. D. 2004. Genetic diversity in okra. *The Orissa J. Horti.,* 32 : 70-72.
14. Akotkar, P. K., De, D. K. and Pal, A. K. 2010. Genetic Variability and Diversity in Okra [*Abelmoschus esculentus* (L.) Moench]. *Electron. J. Plant Breed.,* 1 : 393-398.
15. Ab. Mazid, S. M. S. A. M., Mohrir, M. N and Jadhav, R. S. 2013. Genetic divergence in okra (*Abelmoschus esculentus* L. Moench.). *Electron. J. Plant Breed.,* 4 : 1258-1260.
16. Vahab, M. A., Devi, S. N., Mathew, S. K. and Prabhakaran, P. V. 1994. Genetic divergence in okra [*Abelmoschus esculentus* (L.) Moench]. *Hort. J.,* 7 : 117-120.
17. Reddy, M. T., Haribabu, K., Ganesh, M., Reddy, K. C. and Begum H. 2012. Genetic divergence analysis of indigenous and exotic collections of okra (*Abelmoschus esculentus* (L.) Moench). *J. Agric. Technol.,* 8 : 611-623.
18. Kumari, M. and Chaudhury, D. N. 2006. Genetic divergence in okra [*Abelmoschus esculentus* (L.) Moench]. *Veg. Sci.*, 33 : 71-72.