

## Original Research Article

# Identification of genetic divergence in okra genotypes [*Abelmoschus esculentus* (L.) Moench]

### Abstract

The experiment was conducted at Main Experimental Station, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya during *Kharif*, 2019 in Randomized Complete Block Design with three replications using thirty-six genotypes of okra collected from different sources to study the existence of genetic divergence among the germplasm using Mahalanobis D<sup>2</sup> statistics. The genotypes were grouped into six clusters. Among six clusters, cluster I contained highest number of genotypes (22) followed by cluster VI (5), cluster II (3) and cluster III (2) Cluster IV (2) cluster V (2). The minimum intra cluster distance was found for cluster III (8.39) and maximum intra-cluster distance was recorded for cluster I (16.95). The maximum inter-cluster distance was observed between cluster I and III (30.83) followed by cluster III and VI (30.15) and cluster I and V (24.89), which suggested that genotypes of these two (cluster I and III) clusters are genetically very diverse to each other. The minimum inter-cluster distance was recorded between cluster IV and V (13.08) followed by cluster III and IV (14.24) and cluster II and IV (14.62). Highest per cent contribution towards total genetic divergence was exhibited by total fruit yields per plant (75.08%) followed by average fruit weight (12.38). The different clusters have higher mean values for different traits and the genotypes consisting in cluster I followed by II and VI have higher mean value for these traits and deserve to be considered as important source of genotypes which could use for further improvement programme of okra.

Keywords: Genetic divergence, D<sup>2</sup> analysis, okra (*Abelmoschus esculentus*)

### Introduction

Okra [*Abelmoschus esculentus* L. (Moench)] is an economically important vegetable crop grown in tropical and sub-tropical parts of the world. This crop is suitable for cultivation as a garden crop as well as on large commercial farms. It is quite popular in India because of easy cultivation, dependable yield and adaptability to varying moisture conditions. Okra is cultivated for its fibrous fruits or pods containing round, white seeds. Its ripe seeds are roasted, ground and used as a substitute for coffee in some countries. The D<sup>2</sup> statistic is a tool to evaluate large number of germplasm lines for their genetic diversity and helps to identify genetically divergent parents for utilization in hybridization programmes, as hybridization between lines of diverse origin display a greater magnitude of heterosis than those between closely related strains. Roy and Panwar (1993) suggested that the magnitude of resulting heterosis was largely depended on the degree of genetic diversity in parental lines. Multivariate analysis with Mahalanobis D<sup>2</sup> statistics is a powerful tool to know the clustering pattern to establish the relationship between genetic and geographic

divergence (Dhaduk *et al.* 2004) and to determine the role of different quantitative characters towards the maximum divergence (Murthy and Arunachalam, 1966).

## Materials and Methods

The research work was undertaken at the Main Experimental Station, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology Narendra Nagar (Kumarganj), Ayodhya (U.P.) during the *Kharif*, 2019. Geographically the experimental site (Kumarganj, Ayodhya) falls under humid sub-tropical climate and is located at 26.47° N latitude and 82.12° E longitude at an altitude of 113 meter above the mean sea level. The experiment was conducted in Randomized Complete Block Design with three replications to assess the performance of thirty-six genotypes. Observations were recorded on thirteen quantitative characters *viz.* days to 50% flowering, node to first flower appearance, plant height (cm), crop duration, number of branches per plant, days to first fruit harvest, fruit length (cm), fruit circumference (cm), average fruit weight, number of fruits per plant, marketable fruit yield per plant (g), unmarketable fruit yield per plant (g). The genetic diversity among 36 okra accessions was assessed by using Mahalanobis  $D^2$  statistics (Mahalanobis, 1936). The average intra cluster distances were calculated by following the formulae as given by Singh and Chaudhary (1977). The grouping of accessions was done using Tocher's method, as described by Rao (1952).

## Results and Discussion

Perusal of table-1 revealed that thirty-six genotypes were grouped into 6 different non overlapping clusters. Cluster I has highest number of genotypes (22) followed by cluster VI (5), cluster II (3) and cluster III (2) Cluster IV (2) cluster V (2). The estimation of intra and inter-cluster distance represented by  $D^2$  values are given in table 2. The minimum intra cluster distance was found for cluster III (8.39) and maximum was recorded for cluster I (16.95). The maximum inter-cluster distance was observed between cluster I and III (30.83) followed by cluster III and VI (30.15) and cluster I and V (24.89), which suggested that genotypes of these two (cluster I and III) clusters are genetically very diverse to each other. The minimum inter-cluster distance was recorded between cluster IV and V (13.08) followed by cluster III and IV (14.24) and cluster II and IV (14.62). The lower inter-cluster values between the clusters suggested that the genotypes of the clusters were not much genetically diverse from each other. The intra-cluster mean for 13 characters in okra are given in table 3. Perusal of table 3 showed that cluster mean for different traits indicated considerable differences between the clusters. Maximum cluster mean was observed in cluster I followed by cluster VI and II for character total fruit yield per plant. Cluster V showed minimum cluster mean (2.67) for number of branches per plant. Highest per cent contribution towards total genetic divergence Table-(4.) was exhibited by total fruit yields per plant (75.08%) followed by average fruit weight (12.38). While petiole length (5.24) contributed lowest towards total genetic divergence. Rest of the characters exhibited medium contribution towards total genetic divergence.

Thus, overall ample divergence was there among the existing germplasm of okra under study and genotypes of cluster I and III may hybridize to get the heterotic  $F_1$  of okra in future.

**Table-1: Clustering pattern of thirty-six genotypes of okra on the basis of Mahalanobis  $D^2$  statistics**

Clusters	No. of genotypes	Genotypes
I	22	NDO-21, NDO-22, NDO-23, NDO-24, NDO-25, NDO-26, NDO-27, NDO-28, NDO-29, NDO-30, NDO-31, NDO-32, NDO-33, NDO-34, NDO-35, NDO-36, NDO-37, NDO-38, NDO-39, NDO-40, NDO-41, NDO-42
II	3	NDO-43, NDO-44, NDO-45
III	2	NDO-50, NDO-51
IV	2	NDO-49, Arka Abhay ©
V	2	NDO-52, NDO-53
VI	5	NDO-46, NDO-47, NDO-48, Arka Anamika (C), VRO-6 (C)

**Table-2: Estimates of average inter and intra cluster distance for 13 characters in okra**

Clusters	I	II	III	IV	V	VI
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I	<b>16.95</b>	20.97	30.83	24.73	24.89	16.45
II		<b>16.37</b>	18.42	14.62	18.32	20.49
III			<b>8.39</b>	14.24	18.86	30.15
IV				<b>8.40</b>	13.08	22.91
V					<b>9.14</b>	21.80
VI						<b>16.04</b>

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

**Table-3: Cluster mean for 13 characters in okra**

Clusters/Characters	Node to first flower appearance	Days to 50 % flowering	Days to first fruit harvest	Fruit length (cm)	Fruit circumference (cm)	Plant height (cm)	Number of branches per plant	Crop duration (days)	Petiole length (cm)	Average fruit weight (g)	Node per plant	Number of fruit per plant	Total fruit yield per plant (g)
I	7.26	44.61	54.99	14.20	6.04	114.09	3.32	101.49	13.71	20.39	22.61	12.05	193.64
II	7.38	43.45	53.33	14.48	6.09	117.20	3.06	103.78	12.65	20.56	22.76	12.33	173.99
III	6.88	43.67	54.83	12.80	6.45	105.36	3.25	99.50	12.73	21.88	23.50	12.50	153.24
IV	6.69	43.00	54.00	15.56	5.51	121.21	3.68	98.17	13.16	19.11	23.88	12.50	164.77
V	7.83	44.83	56.00	13.99	5.48	113.07	2.67	102.50	14.76	19.01	23.80	13.00	165.45
VI	6.85	45.53	56.60	14.46	6.12	116.79	3.00	102.67	13.97	19.33	24.15	12.33	191.16

**Table 4 : Per cent contribution of genetic advance for 13 characters in okra**

<b>S. NO</b>	<b>Character</b>	<b>Percent contribution</b>
<b>1</b>	Node to first flower appearance	0.63
<b>2</b>	Days to 50 % flowering	0.63
<b>3</b>	Days to first fruit harvest	0.00
<b>4</b>	Fruit length (cm)	0.00
<b>5</b>	Fruit circumference (cm)	2.06
<b>6</b>	Plant hight (cm)	0.00
<b>7</b>	Number of branches per plant	2.38
<b>8</b>	Crop duration (days)	0.00
<b>9</b>	Petiole length (cm)	5.24
<b>10</b>	Average fruit weight (g)	12.38
<b>11</b>	Node per plant	0.16
<b>12</b>	Number of fruits per plant	1.43
<b>13</b>	Total fruit yield per plant (g)	75.08
	Total	<b>100.00</b>

## References

Mahalanobis, P. C. On the generalized distance in statistics. Proc. Natl. Acad. Sci. India. 1936; 2(1): 49-55.

Dhaduk, L. K., Mehta, D.R. and Patel, K. D. Genetic diversity in okra. Orissa J. Hort. 2004; 32(1): 70-72.

Roy and Panwar, D.V.S. Genetic divergence in some rice (*Oryza sativa* L.) genotypes. Ann. Agric. Res. 1993; 14: 276-281.

Murthy, BR, and Arunachalam, V. The nature of divergence in relation to breeding system in some crop plants. Indian J. Genet. 1966; 26: 188-98.

Rao, C. R. Advance statistical methods in biometrical research edition I. John Wiley and Sons. New York. 1952.

Singh, R.K. and Chaudhary, B.D. Biometrical methods in quantitative genetic analysis. Kalyani Publishers, New Delhi India. 1977.