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Original Research Article

Genetic Divergence Analysis for Higher Yield and Its Contributing Traits in Sponge Gourd [*Luffa cylindrica* (L.) Roem.]

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A B S T R A C T

The present investigation was subjected to evaluate thirty sponge gourd genotypes including Pusa Chikni (national check) best suited to high yield and marketable character for eleven traits during *Zaid* 2012. In present study for genetic divergence for yield and its component traits of thirty genotypes including one check variety (Pusa Chikni) with three replications in Randomized Block Design. Test genotypes of were grouped into six non over lapping clusters. The different clusters showed considerable differences in intra-cluster group means for all the traits. Therefore, crosses between members of clusters having high cluster means for important characters coupled with high cluster distances between them, are likely to be more useful. Major cluster IV in divergence analysis contained eight genotypes of heterogeneous origin, thereby, indicating no parallelism between genetic and geographic diversity. Therefore, crosses between members of clusters separated by high inter cluster distance are likely to produces desirable segregates. In this context, cluster VI had very high inter cluster distance from cluster I, IV, V III and II.

Introduction

Luffa [*Luffa cylindrica* (L.) Roem] commonly called as sponge gourd, loofah vegetable sponge or dish cloth, having diploid chromosome number 2n = 2x = 26. It is one of the most important cucurbits grown throughout the country and world. Sponge gourd is an annual plant, produces fruits containing a fibrous vascular system having vigorous vines with cylindrical ten angled fruits. Sponge gourd is monoecious plant with branched tendrils. Flowers are yellow in colour and showy having five petals. The inflorescence of staminate flowers is raceme, while pistillate flowers are solitary and short long pendunculate. Both types flower may occur in the same leaf axil, fruits are nearly cylindrical, 0.5-1 feet straight or curved, normally with light furrows or stripes but not ribbed. It is commonly grown for its tender fruits for vegetable purpose as well as for scrubbing of body skin as a bath sponge of mature fruits, increases blood circulation and for cleaning utensils. The tender fruits are rich in vitamin A, vitamin C and iron. They can also be used for cleaning floors or cars without scratching. The small ones are softer and good for washing the face and larger ones for the body. The cellulose content varies from 55 to 90%, the lignin content is

within the range of 10 and 23%, and the hemicelluloses content is around 8 and 22% and ash 2.4% (Satyanarayana *et al*., 2007; Tanobe *et al*., 2005). Sponge gourd is a highly nutritive vegetable and contains moisture of 93.2 g, protein 1.2 g, fat 0.20 g, carbohydrate 2.9 g, vitamins (thiamin 0.02 mg, riboflavin 0.06 mg, niacin 0.4 mg and carotene 120 mg), minerals (calcium 36 mg, phosphorus 19 mg and ferrous 1.1 mg) and fibers 0.20 g per 100 g of edible portion (Gopalan *et al*., 1999). Sponge gourd is an annual climber, monoecious and cross pollinated vegetable but different sex form like hermaphrodite, staminate, pistillate, etc. are commonly found in nature (Takahashi, 1980).

Materials and Methods

Thirty sponge gourd genotypes including Pusa Chikni (national check) beast suited to high yield and marketable character were evaluated in randomized block design (RBD) at Main Experimental Station of Vegetable Science, Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad (U.P). during *Zaid* 2012. The site of conducted experiment belong to sandy loam soil having pH=7.6, EC= 0.36 rich in organic matter, Nitrogen Phosphorus and low in Potash. Each genotypes were accommodated in 3 replications with intra and enter spacing of 3m x 2.5 m respectively. The observation were recorded on eleven quantitative and marketable characters, *viz.*, node number to anthesis of first staminate flower, node number to anthesis of first pistillate flower, days to anthesis of first staminate flower, days to anthesis of first pistillate flower, days to first fruit harvest, fruit length (cm), fruit diameter (cm), average fruit weight (g), number of fruits per plant, fruit yield per plant (kg) and vine length (m). Observations were recorded on five randomly selected plants were subjected to statistical analysis, genetic divergence among the thirty genotypes of sponge gourd germplasm were carried out by using Mahalanobis D^2 statistics.

Results and Discussion

The studies of genetic divergence among the thirty genotypes of sponge gourd germplasm were carried out by using Mahalanobis D^2 statistics recognized as very effective method assessment of genetic divergence has been widely used for analysis of genetic diversity in sponge gourd (Mathew *et al.*, 2001; Badade *et al.*, 2001 and Islam, 2004). The estimates of intra and inter-cluster distances represented by D^2 values are given in Table-2. The intra cluster distance values ranged from 0.00 (cluster VI) to 57.08 (cluster V). The maximum intra-cluster distance was observed for cluster V followed by cluster III (36.69), cluster II (20.61), cluster II (11.23) and cluster I (5.83).

The maximum inter-cluster distance was observed between cluster I to cluster VI (109.40), which suggested that members of these two clusters are genetically very diverse to each other. The inter cluster values between cluster II and cluster V (807.70), cluster II and cluster IV (508.05), cluster II and cluster III (460.77) and cluster I to cluster V (377.17) were very high. The intra-cluster means for 11 characters in sponge gourd are given in Table-2. A perusal of Table-3 showed that cluster means for different traits indicated considerable differences between the clusters. All the clusters from cluster I to cluster VI had in general medium mean performance for most of the characters, exhibiting extreme cluster means for none of the characters under study.

Table.1 Clustering pattern of thirty genotypes on the basis of MahalanobisD^2 statistics

Cluster number	No. of genotypes	Genotypes
I	**7**	**NDSG-5, NDSG-10, NDSG-17, NDSG-23, NDSG-30, NDSG-54, NDSG-63**
II	**3**	**NDSG-27, NDSG-39, NDSG-41**
III	**3**	**NDSG-43, NDSG-47, NDSG-53**
IV	**8**	**NDSG-29, NDSG-33, NDSG-49, NDSG-51, NDSG-52, NDSG-55, NDSG-61, NDSG-62**
V	**5**	**NDSG-8, NDSG-13, NDSG-20, NDSG-32, NDSG-57**
VI	**4**	**NDSG-1, NDSG-3, NDSG-60, PusaChikni (c)**

Table.2 Average of intra and inter clusters D^2 values for six clusters in sponge gourd

Cluster number	I	II	III	IV	V	VI
I	**5.83**	27.38	56.82	54.78	57.23	109.40
II		**11.23**	40.05	63.69	44.15	87.63
III			**20.61**	58.56	53.91	87.76
IV				**36.69**	95.13	99.83
V					**57.08**	99.69
VI						**0.00**

Table.3 Intra-cluster group means for eleven characters in sponge gourd

Clusters	Node no. to anthesis of first staminate flower	Node no. to anthesis of first pistillate flower	Days to anthesis of first staminate flower	Days to anthesis of first pistillate flower	Days to first marketable fruit harvest	Fruit length (cm)	Fruit diameter (cm)	Vine length (m)	No. of fruits/ plant	Average fruit weight (g)	Fruit yield/ plant (kg)
I	5.67	10.83	44.00	50.33	63.67	26.18	3.40	5.95	20.25	179.24	3.28
II	7.44	14.89	39.89	45.44	57.67	21.40	3.88	6.55	26.41	132.13	3.11
III	7.28	12.11	39.11	46.39	58.50	19.80	2.87	7.09	22.87	110.43	2.23
IV	6.83	12.54	39.75	46.25	60.92	30.51	3.46	7.57	15.35	190.86	2.50
V	8.10	14.53	42.23	48.33	62.87	20.25	2.95	5.23	25.63	120.00	2.64
VI	18.33	27.00	60.33	63.00	76.00	27.17	3.05	6.58	18.20	179.40	2.88

Table.4 Per cent contribution in eleven characters towards total genetic divergence in Sponge gourd

S. No.	Characters	Per cent contribution
1.	Node no. to anthesis of first staminate flower	1.61
2.	Node no. to anthesis of first pistillate flower	12.64
3.	Days to anthesis of first staminate flower	1.15
4.	Days to anthesis of first pistillate flower	0.46
5.	Days to first marketable fruit harvest	0.23
6.	Fruit length (cm)	18.16
7.	Fruit diameter (cm)	6.44
8.	Vine length (m)	30.80
9.	Number of fruits / plant	14.02
10.	Average fruit weight (g)	1.61
11.	Fruit yield /plant(kg)	12.87

Cluster VI showed maximum mean values for node number to anthesis of first staminate flower (18.33), node number to anthesis of first pistillate flower (27.00), days to anthesis of first staminate flower (60.00), days to first fruit harvest (76.00). Cluster IV showed maximum mean values for fruit length (30.51cm), vine length (7.57m) and average fruit weight (190.86g), cluster II showed maximum mean values for fruit diameter (3.88cm), days to first fruit harvest (76.00) and number of fruits per plant (26.41), cluster I showed maximum mean value for fruit yield per plant (3.28). Cluster V had showed minimum mean values for fruit length (20.25 cm), and vine length (5.23m), Cluster III showed minimum mean values for fruit diameter (2.87cm) and yield per plant (2.23kg). In present investigation 30 genotypes of sponge gourd were grouped in six distinct non-over lapping clusters using Mahalanobis' D^2 statistics. This indicated presence of considerable genetic diversity in the germplasm collections, evaluated in the present study (Table-1). This finding is in agreement with the report of (Day *et al.*, 2007; Sundaram and Vadivel, 2007) advocating lack of definite relationship between genetic and geographic diversity. The lowest inter-cluster distance was observed between cluster V to VI, followed by cluster IV to V, cluster II to III and cluster III to V, which indicated that genotypes present in these cluster pair were genetically closed to each other the crosses between genotypes belonging to clusters separated by low inter-cluster distances are unlikely to produce promising recombinant in the segregating generations.

A perusal of (Table-3) revealed that cluster III showed minimum mean values for four entries which were characterized by low cluster mean for node number to anthesis of first staminate flower, node number to anthesis of first pistillate flower, days to anthesis of first pistillate flower and days to first fruit harvest. While cluster II showed maximum mean values for first diameter, cluster IV showed mean values for vine length, and cluste II showed mean values for number of fruits per plant. Highest per cent contribution observed for the trait vine length (30.28 m), followed by numberof fruit per plant (14.02) and marketable yield per plant (12.87) while, lowest per cent contribution was observed for days to first fruit harvest (0.23), days to anthesis of first pistillate flower (0.46) and days to anthesis of first staminate flower (1.15) given in Table-4.

In conclusion, Maximum cluster mean for average fruit weight (g) was observed in cluster IV followed by cluster VI. The maximum direct effect for fruit yield per plant indicated that more emphasis should be given on these characters in formulating selection strategy. Major cluster in divergence analysis contained genotypes of heterogeneous origin, thereby, indicating no parallelism between genetic and geographic diversity. Therefore, crosses between members of clusters separated by high inter cluster distance are likely to produces desirable segregates. In this context, cluster VI had very high inter cluster distance from cluster I, IV, V, III and II. Highest contribution towards genetic diversity observed in vine length (30.80 %) followed by fruit length (18.16 %).

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