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GENETIC DIVERGENCE IN OKRA (*ABELMOSCHUS ESCULENTUS* (L.) MOENCH)

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Twenty genotypes of okra were grouped in nine constellations utilizing eleven characters by D^2 statistics and canonical test. Clusters I and II comprised four and three genotypes respectively. The maximum divergence was observed between cluster VII (G-2 and HB-57) and and IX (Sel. I). G-2 was highly divergent from all other genotypes for plant height, HB-57 for earliness and Sel. I for number of pods per plant.

Key words : *Abelmoschus esculentus*, genetic diversity, cluster analysis

A crop improvement programme is based either in utilizing plant variation already present in the population or generating broad spectrum of variability by crossing genetically diverse plants. Mahalanobis (1928) suggested D^2 technique, a parameter to measure inter and intra-group distances to isolate the genotypes of divergent and distinct characteristics to be further used as donor parents. Meagre information is available on this aspect in okra, hence there is a need for further studies.

MATERIALS AND METHODS

A trial of twenty genotypes of okra (*Abelmoschus esculentus* (L.) Moench) was conducted in a randomised complete block design with three replications at G.B. Pant University of Agriculture and Technology, Pantnagar. Each replication had a row of twelve plants of each genotype spaced 75 x 60 cm apart. The crop was raised by adopting standard cultural practices. Transformation of variables was carried out by pivotal condensation method reported by Rao (1948). Group constellations were formulated after computation of D^2 values by method suggested by Tocher and reported by Rao (1952), and confirmed by canonical test.

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RESULTS AND DISCUSSION

The mean data of different characters are given in Table 1. The germplasm showed significant variation for all the quantitative charcters. The variability ranges were observed for plant height (65 - 116 cm), branches per plant (2.5 – 5.0), leaves per plant (39 – 60), stem thickness (22 – 30 mm), 50% flowering (47 –60 days), nodes to first pod (6 – 11), pod length (7 – 13 cm), pod thickness (15 – 19 mm), weight per pod (9–14 g), number of pods per plant (21–31) and yield per plant (214–418 g).

Based on D^2 values, the 20 varieties of okra were grouped in 9 constellations. The calculated D^2 values ranged from 1.91 to 36.55. Accordingly, cluster I contains 4 genotypes followed by cluster II with 3 genotypes. The rest of clusters include 2 genotypes each besides solitary representation by the variety Sel-1 in cluster IX. The cluster means (Table 2) revealed that cluster VII produced maximum height (103.30 cm), Pod thickness (18.90 mm), weight per edible pod (22.86 g) and early flowering (49.33 days). Higher cluster means were also obtained in cluster IX for the number of pods per plant and yield per plant, whereas cluster III produced maximum leaves (64.65). The contribution of individual characters towards divergence indicated higher magnitude (14.09%) for primary branches per plant and number of pods per plant followed by stem thickness (10.91%), plant height (10.45%) and leaves per plant (10%). However, contribution due to yield per plant was observed to be much lower (3. 18%). Martin *et al.* (1981) also examined variation in okra genotypes and distinguished 5 out of 29 characters.

Maximum genetic diversity (28.85) was present between cluster VII and IX followed by VII and VIII clusters (Table 3). The minimum divergence was exhibited between I and VI clusters, indicating their close relationship. Intracluster distance ranged from 0 to 3.59 (Fig.1). The larger intracluster distance was observed in VIII followed by VII clusters (3.40). The close distance other than those where single genotype formed was observed in a cluster II and represented by varieties Clemson Spineless, KS-312 and Punjab-7.

The intracluster distance was less than the corresponding D^2 values indicating more divergence of genotypes between the clusters. Girinko and Pugachev (1985) and Koechlin (1991) observed higher diversity in West African cultivars of okra than others and reported 11 clusters represented by 15 attributes. The most divergent parents were G-2 for plant height, pod thickness; HB-57 for earliness and Sel-1 for number of pods per plant and yield per plant.

Table 1 : Mean data for different characters

Sr. No.	Genotype	Plant height (cm)	Branches per plant	Leaves per plant	Stem thickness (mm)	Days to 50% flowering	Nodes to first pod	Length of pod (cm)	Pod thickness (mm)	Wt. per edible pod(g)	Number of pods per plant	Yield per plant (g)
1	Clemsen Spineless	91.33	3.33	53.47	25.00	52.67	8.60	10.00	17.87	13.13	28.47	354.00
2	KS 312	93.20	3.63	57.50	23.33	49.67	9.40	10.20	17.33	11.27	28.77	312.00
3	Sel.2	105.47	3.67	53.60	30.33	56.00	10.20	9.70	16.03	10.30	25.47	242.00
4	12/21	65.13	4.97	52.87	30.00	60.33	11.13	7.27	17.33	9.90	23.43	214.33
5	IC 10643	90.23	3.70	47.00	25.33	50.67	8.37	11.27	18.27	13.13	27.13	349.33
6	IC 1542	98.57	3.37	68.17	25.00	58.33	9.60	9.60	17.87	12.87	27.43	344.67
7	Sel. I	91.67	3.10	61.17	25.67	49.67	7.43	11.17	16.27	13.63	30.90	403.67
8	Pusa Makhamali	92.10	3.80	53.10	23.33	55.33	8.60	8.77	17.20	8.87	26.03	230.00
9	Sel. 6-2-3	102.43	3.90	61.13	29.00	56.67	8.07	9.80	17.53	12.67	29.30	323.00
10	6-2 HP	112.60	3.77	61.60	22.00	52.00	9.33	11.23	16.60	12.20	30.67	355.00
11	Punjab 7	115.40	3.07	52.93	23.67	49.33	8.13	12.47	16.46	14.30	31.00	418.00
12	G-2	114.60	2.53	47.33	23.67	52.33	9.27	10.53	19.20	13.53	24.90	316.67
13	Pb-57	115.73	3.20	57.67	21.67	52.67	8.13	13.07	16.00	12.20	25.20	288.33
14	MDU-1	94.97	3.80	46.47	24.67	49.33	7.80	11.90	16.60	12.87	25.57	316.00
15	Vaishali Vadhu	101.77	3.60	48.93	22.33	48.33	7.07	11.40	16.07	11.80	25.70	283.00
16	Pusa Sawani	96.87	3.93	46.13	27.33	51.33	7.73	10.30	16.67	10.67	27.60	282.67
17	Punjab Padmini	83.03	3.30	54.13	22.33	54.00	8.87	12.10	17.80	11.20	25.40	267.67
18	Sel. 2-2	94.83	3.17	41.20	24.33	52.33	7.23	12.10	15.43	10.87	21.60	220.00
19	HB 57	92.00	3.23	40.13	28.67	46.33	6.67	10.23	18.60	12.20	22.47	267.33
20	HB 58	88.13	3.70	39.03	24.67	47.33	6.07	10.73	17.20	11.63	21.23	238.00
	Mean	**96.440**	**3.606**	**52.044**	**23.860**	**53.127**	**8.747**	**10.551**	**17.025**	**11.990**	**25.629**	**293.445**
	SEM ±	3.904	0.198	2.036	1.357	1.680	0.520	0.597	0.852	0.642	0.680	19.140
	CD at 5% level	10.821	0.549	5.644	3.760	4.687	1.442	1.655	2.363	1.779	1.850	54.163

Table 2 : Cluster means for 20 genotypes of okra for genotypic divergence

Cluster	Genotype*	Plant height (cm)	Branches per plant	Leaves per plant	Stem thickness (mm)	Days to 50 per cent flowerin	Nodes to first pod	Length of pod (cm)	Pod thickness (mm)	Weight per edible pod (g)	Pods per plant	Yield per plant (g)
I	5, 15, 16, 20	94.25	3.73	45.27	24.91	49.41	7.32	10.92	17.05	18.81	24.91	287.08
II	1, 2, 11	99.97	3.34	54.63	24.00	50.55	8.71	10.89	17.22	12.20	29.41	361.33
III	6, 9	100.50	3.63	64.65	27.00	57.50	8.83	9.70	17.70	12.77	28.36	33.83
IV	17, 18	88.93	3.23	40.66	23.33	53.16	8.06	12.10	16.61	11.03	23.50	243.83
V	10, 13	114.16	3.48	59.63	21.83	52.33	8.77	12.15	16.30	12.20	27.93	321.66
VI	3, 14	100.22	3.73	50.03	27.50	52.66	9.00	10.80	16.01	11.58	25.52	279.00
VII	12, 19	103.30	2.88	43.73	26.17	49.33	7.97	10.38	18.90	22.86	23.68	292.00
VIII	4, 8	78.61	4.38	52.98	26.66	57.83	9.86	8.02	17.26	9.58	24.73	222.17
IX	7	91.67	3.10	61.17	25.67	49.67	7.43	11.17	16.27	13.67	30.90	403.67
No. of times appearing first in ranking		23	31	22	24	21	13	18	10	20	31	7
Per cent contribution		10.45	14.09	10.00	10.91	9.45	5.91	8.18	4.55	9.09	14.09	3.18

*refer to Table 1 for genotype identification against Sr. Nos. mentioned below

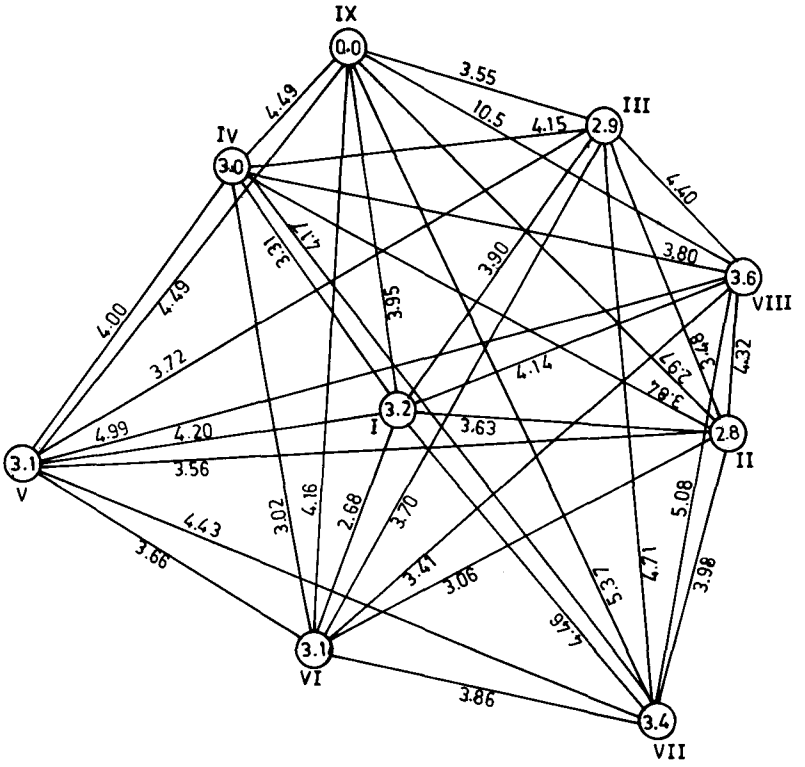

Fig. 1. Mutual relationship between population

Table 3 : Average Intra (diagonal) and Inter cluster D^2 values

Cluster	I	II	III	IV	V	VI	VII	VIII	IX
I	10.46	13.21	15.20	10.94	17.66	7.18	19.86	17.13	15.63
II		7.81	12.08	14.75	12.65	9.39	15.38	18.56	8.83
III			8.80	17.24	13.85	13.70	22.22	19.35	12.58
IV				9.02	16.01	9.10	17.39	14.42	20.16
V					9.34	13.39	19.57	24.88	20.18
VI						9.37	14.89	11.65	17.34
VII							11.56	25.78	28.85
VIII								12.88	25.09
IX									0.00

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