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Genetic variability, heritability and genetic advance for horticultural traits in okra (*Abelmoschus esculentus* (L.) Moench) germplasm

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Abstract

The present investigation was undertaken to study the extent of variability present in the 25 genotypes and also to find out interrelationship and direct and indirect effect on component characters on fruit yield. The materials were evaluated in randomized block design with three replications during the kharif 2016. Observations were recorded for twelve quantitative and qualitative characters. Analysis of Variance revealed significant difference for all the characters studied indicating sufficient variation in the genotypes. On the basis of mean performances Kashi Kranti (260.10 g), Kashi Pragati (254.27 g) and Kashi Satdhari (232.14 g) exhibited high fruit yield. The magnitude of genotypic coefficient of variation and phenotypic coefficient of variation was high for leaves/plant, branches/plant and fruit diameter, indicating the presence of sufficient variation in these traits. The characters plant height and leaves/plant showed high heritability accompanied with high genetic advance, which indicates that most likely the heritability is due to additive gene effects and selection may be effective.

Introduction

Okra (*Abelmoschus esculentus* (L.) (Moench), a member of the family *Malvaceae* is an economically important vegetable crop grown in tropical and sub-tropical parts of the world. It is an annual, herbaceous plant with erect growth habit and bisexual in nature. It has somatic chromosome number 2n=130 and is an amphidiploid of *A. tuberculatus* with 2n=58 and an unknown species with 2n=72. In India, it is grown in 53.3 thousand hectare area with a production of 6.35 million tons with productivity of 11.9 MT/ha (NHB 2015-16).

Its tender green fruits are used as a vegetable and are generally marketed in fresh form, but sometimes in canned or dehydrated form. The roots and stems of okra are used for cleaning the cane juice from which gur or brown sugar is prepared (Chauhan, 1972) [3]. Okra provides an important source of vitamins, calcium, potassium and other mineral matters which are often lacking in the diet of developing countries.

This vegetable is basically self pollinated crop, though essentially self-pollinated because of its showy corolla, the possibility of cross-pollination by insects cannot be ruled out. Consequently, cross pollination to the extent of 4.0-19.0 per cent (Purewell and Randhawa, 1947) [9] with maximum of 42.2 per cent (Mitrideri and Vencovsky, 1974) [7] is noticed with the insect assisted pollination. This accounts for considerable variation in fruit yield and its associated traits. Genetic variability plays an important role in crop breeding for selecting the elite genotypes for making rapid improvement in yield and other desirable characters as well as to select the potential parent for hybridization programme. Heritability is an index for calculating the relative influence of environment on expression of genotypes. Correlation furnishes information regarding the nature and magnitude of various associations. The correlation coefficient indicates the degree of relationship between two or more character i.e. clear picture of association between yield and its contributing traits.

Materials and Methods

Twenty five genotypes of okra were grown in a randomized block design with three replications during kharif season at the Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom Institute of Agriculture,

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Technology and Sciences, Allahabad U.P. The allocation of treatments of the individual plots using random number in each replications with spacing of 45 cm × 30 cm row to row and plant to plant respectively. Five plants from each replication were taken for recording observation on 12 characters *viz* plant height (cm), no. of branches/plant, no of leaves/plant, days to first flowering, days to 50% flowering, first flowering node, fruit length (cm), fruit diameter (cm), fresh fruit weight (g), no. of fruits/plant, fruit yield/plant (g), crude fibre content (%). The uniformly recommended agronomic practices were followed to raise a good crop during the course of investigation. The various genetic parameters, viz., genotypic co-efficient of variation and phenotypic co-efficient of variation, heritability in broad sense, the expected genetic advance and character association were calculated as suggested by Burton and Devane (1953) [2], Falconer (1981) [5], Johnson *et al*. (1955) [6] and Al-jibouri *et al* (1958) [1].

Result and Discussion

The analysis of variance (ANOVA) revealed significant differences between genotypes indicating presence of sufficient amount of variability in all the characters studied. These results are similar with the findings of Chaurasiya *et al.* (2010) [4]; Ramanjinappa *et al.* (2011) [10, 11] and Reddy *et al.* (2012) [12]. The results of analysis of variance for twelve characters are furnished in Table 1.

Genotypic coefficient of variation was recorded highest for Leaves/ Plant (32.20 %) followed by crude fibre content (%)

(23.88) and branches/ plant (15.81 %) while recorded minimum for days to 50% flowering (2.25 %). The estimation of phenotypic coefficient of variance was higher than the genotypic coefficient of variance for all the traits. Heritability in broad sense was noticed high for crude fibre content (%) (98 %) followed by leaves/ plant (94 %) and plant height (cm) (93 %) whereas recorded minimum for branches/ plant (42 %). On the other hand the high genetic advance as per cent of mean was observed for Leaves/ Plant (64.30%) and Crude fibre content (%) (48.73%) whereas moderate genetic advance as per cent of mean was observed for plant height (cm) (27.31%), fruit weight (g) (22.72 %), fruit diameter (cm) (21.38 %), branches/plant (21.01%) and first flowering node (12.13 %). The least genetic advance as percent of mean was observed for days to first flowering (3.23%). Plant height and leaves/plant showed high heritability accompanied with high genetic advance which indicates the presence of additive genetic effects and hence selection for these characters in early generation will be most effective. A high range of variation, genotypic coefficient of variation, heritability and genetic advance on per cent mean for plant height, leaves per plant, fruit yield per plant and crude fibre content was recorded. This indicated broad genetic base, less environmental influence and these traits are under the control of additive genes which means simple and early selection schemes would be effective for improvement of these traits. The results of Coefficient of variance, h^2 (b. s.), Genetic Advance and Genetic Advance as % of mean for twelve characters are furnished in Table 2.

Table 1: Analysis of variance for fruit yield and its components in okra

Source of variation	Mean sum of square		
	Replication	Genotypes	Error
Plant Height (cm)	11.59	840.59 **	21.91
Leaves/ Plant	0.91	101.37 **	2.12
Branches/ Plant	0.56	1.22 **	0.39
Days to First Flowering	0.57	2.86 **	0.82
Days to 50 % Flowering	0.94	3.06 **	0.75
First Flowering Node	0.06	0.71 **	0.12
Fruits/ Plant	0.14	5.9**	1.58
Fruit Length (cm)	0.15	3.37 **	0.14
Fruit Diameter (cm)	0.02	0.32 **	0.07
Fruit Weight (g)	0.39	6.68 **	0.28
Fruit Yield/ Plant (g)	64.73	2520.87 **	594.96
Crude Fibre Content (%)	0.0012	1.11**	0.007

*Significant at 5% level of probability, ** Significant at 1% level of probability

Table 2: Genetic parameter of yield and its attributing traits of okra

S No.	Characters	Mean	Range		Coefficient of variance		h^2 (b.s.) (%)	Genetic Advance (5%)	Genetic Advance as % of mean (5%)
			Min.	Max.	GCV (%)	PCV (%)			
1	Plant Height (cm)	119.90	85.27	146.63	13.78	14.32	93	32.74	27.31
2	Leaves/ Plant	17.86	12.70	31.27	32.20	33.21	94	11.49	64.30
3	Branches/ Plant	3.33	2.23	4.53	15.81	24.50	42	0.70	21.01
4	Days to First Flowering	35.39	33.20	38.43	2.33	3.46	45	1.14	3.23
5	Days to 50 % Flowering	39.06	36.57	41.87	2.25	3.16	51	1.28	3.29
6	First Flowering Node	5.90	5.30	7.17	7.51	9.57	62	0.72	12.13
7	Fruits/ Plant	15.92	13.33	18.77	7.53	10.93	48	1.70	10.70
8	Fruits length (cm)	11.30	9.13	14.07	9.18	9.77	88	2.01	17.79
9	Fruits diameter (cm)	2.08	1.67	2.77	13.95	18.75	55	0.45	21.38
10	Fruit Weight (g)	12.44	10.07	15.03	11.74	12.50	88	2.83	22.72
11	Fruit Yield/ Plant (g))	197.76	143.14	260.10	12.81	17.78	52	37.60	19.01
1.	Crude Fibre Content (%)	2.54	1.30	4.40	23.88	24.10	98	1.24	48.73

GCV= Genotypic coefficient of variation, PCV= Phenotypic coefficient of variation and h^2 (b. s.)= Heritability (broad Sense).

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