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Estimation of variability, heritability and genetic advance studies in Okra

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Abstract

The present investigation was conducted with a view of analyzing the heritability, genotypic coefficient of variation, phenotypic coefficient of variation genetic advance and genetic gain on 19 genotypes of okra out at Vegetable Research Farm, Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi during the summer season of 2018. High heritability was observed for all the characters whereas high PCV and GCV was observed in number of primary branches per plant, internodal length, fruit yield per plant, fruit length, fruit diameter, seed yield and seed index. While moderate value of PCV and GCV was seen, plant height, node at which 1st flower appears, number of nodes per plant, number of fruits per plant, average fruit weight, number of seeds per fruit and moderate PCV was only found in seed weight per fruit and days to 50% flowering. Whereas GCV and PCV was found low only in days to edible maturity and low GCV was registered in seed weight per fruit and days to 50% flowering. In case of genetics advance, highest values was observed in plant height, number of primary branches per plant, fruit yield per plant and seed yield per plant. Moderate genetic advance was registered in number of seeds per fruit and low genetic advance was showed in days to 50% flowering, node at which 1st flower appears, internodal length, number of nodes per plant, number of fruits per plant, fruit length, fruit diameter, average fruit weight, seed weight per fruit, days to edible maturity and seed index.

Keywords: Okra, heritability, variation and genetic advance

Introduction

Okra (*Abelmoschus esculentus* L. Moench) is a member of the plant kingdom's Malvaceae family. It has a great nutritional value as well as export possibilities. It is grown in the regions of warm temperate, subtropical, tropical places around the world. India is the world's largest producer of okra. The total area under okra cultivation in the country is 0.50 million hectares with the production of 6.09 million tonnes of green fruits, whereas the productivity of the crop is 12 tonnes per hectare. West Bengal is the leading state in area 0.77 lakh hectare whereas Gujrat has maximum production 0.92 million and a maximum productivity of 41.42 MT/ha has been identified in Jammu and Kashmir (Anonymous, 2018). It is a versatile vegetable owing to the numerous applications of its fresh leaves, buds, blooms, pods, stems, and seeds. Fruits (green seed pods) eaten as vegetables are used in salads, soups, and stews, fresh or dried, fried or boiled (Ndunguru & Rajabu, 2004) [1]. The primary goal of plant breeding is to enhance the all the crop characters into the economic importance. Crop improvement is determined by the level of genetic diversity in the base population. The predicted development in yield components is determined largely by the factors such as the amount of the heritable component of total variations (Kumar *et al.* 2019) [4]. Phenotypically diverse genotypes, most likely derived from a diverse source, are sometimes viewed as more successful in producing efficient crosses. To begin an efficient breeding programme, a study of genetic variability using appropriate metrics such as genotypic and phenotypic coefficients of variation, heritability, and genetic progress is required. (Mishra *et al.* 2015) [2]. The purpose of present study is to analyse the variability of significant yield and yield contributing characteristics.

Material and Methods

The present study was carried out at Vegetable Research Farm, Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi during the summer season of 2018. The research work includes of 18 genotypes received from the ICAR - Indian Institute of Vegetable Research, Varanasi. The 18 geotopes were sown in randomized block design and all the agronomic practices was followed. Data was recorded on the following triats are: Days to 50% flowering, Plant height (cm), Number of primary branches per plant,

Node at which first flower appears, Internodal length (cm), Number of nodes per plant, Number of fruits per plant, Fruit yield per plant (g), Fruit yield (q/ha), Fruit length (cm), Fruit diameter (cm), Average fruit weight (g), Number of seeds per fruit, Seed weight per fruit (g), Seed yield per plant (g), Seed yield (q/ha), Days to edible fruit maturity, Seed index (g). The statistical analysis for experimental design was given by Panse and Sukhatme (1967)^[5] and the analysis of variance for testing the variation among progenies and parents was given by Singh and Chaudhary (1977)^[7]. Genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were evaluated by the method suggested by Sivasubramanian and Menon (1973)^[8]. Heritability (h²) in broad sense and narrow sense was categorized as suggested by Searle (1965)^[6]. The estimates of genetic advance and genetic gain was proposed by Johnson *et al.* (1955)^[9].

Result and Discussion

The assessment of variability revealed that all the characters are highly significant and there is a huge amount of variation among the okra genotypes of different characters. The estimates of different parameters of variability shown in Table 1. The representation of genetic variability parameters for various traits are as followed:

Considering every genotypes, days to 50% flowering ranged from 34.33 to 51.00 days with a mean value 45.54 days and the value of GCV (9.33%) was found to be low and PCV (10.53%) was moderate. In case of plant height, the value ranged from 81.68 to 126.52 cm with a mean value 101.24 cm. and the value of GCV (14.21%) and PCV (14.41%) was found to be moderate. The number of primary branches per plant varied from 1.53 to 4.00 days with a mean value 2.49 and high value of GCV (26.42%) and PCV (27.96%). Node at which first flower appears ranged in between 5.73 to 12.30 with a mean value 9.72 and the value of GCV (17.32%) and PCV (18.12%) was found to be moderate. Considering every genotypes, internodal length ranged from 3.03 to 7.03 cm days with a mean value 4.57 cm and the value of GCV (20.56%) and PCV (22.96%) was exhibited high. In case of number of nodes per plant ranged from 15.27 to 21.20 with a mean value 17.80 with moderate value of GCV (10.35%) and PCV (12.28%). The number of fruits per plant across the genotype was from 11.40 to 19.47 with a mean value 14.02 and the value of GCV (17.01%) and PCV (18.62%) was reported moderate. Fruit yield per plant ranged from 105.18 to 244.90 g with an average value 167.62 g and the value of GCV (21.32%) and PCV (21.71%) was recorded high. Fruit yield per plant (q/ha) varied from 28.40 to 66.12 q/ha with an average value 45.26 q/ha and the high value of GCV (21.32%) and PCV (21.71%). Across all genotypes, fruit length (cm) ranged from 7.56 to 15.47 cm with a mean value 11.35 cm and high value of GCV (23.98%) and PCV (26.00%) was noted. Considering every genotypes, fruit diameter (cm) varied from 1.30 to 2.59 cm with a mean value 1.71 cm and the value of GCV (21.03%) and PCV (26.91%) was observed high. In all genotypes, average fruit weight (g) varied from 8.68 to 13.70 g with a mean value 11.97 g and the

moderate value of GCV and PCV was 10.41 and 11.79% respectively. In case of number of seeds per fruit ranged from 39.90 to 65.13 with a mean value 46.00 with moderate value of GCV (13.74%) and PCV (14.65%). Considering every genotypes, seed weight per fruit (g) ranged in between 3.38 to 4.60 g days with average value 3.88 g and low value of GCV (9.49%) and moderate PCV (10.77%). Seed yield per plant (g) ranged from 40.20 to 85.99 g with a mean value 54.90 g and the high value of GCV (24.32%) and PCV (26.21%). Across all genotypes, seed yield (q/ha) varied from 10.86 to 23.21 q/ha with a mean value 14.82 q/ha and high value of GCV and PCV was high i.e., 24.32 and 26.21% respectively. Considering every genotypes, days to edible fruit maturity ranged from 46.67 to 64.20 days with a mean value 55.73 days and the value of GCV (7.90%) and PCV (8.68%) was noted low. In all genotypes, seed index in between 2.71 to 7.40 g with an average value 4.84 g and value of GCV and PCV was high 23.68 and 24.39% respectively.

Days to 50% flowering depicted very high heritability (88.86%) accompanied with low genetic advance (8.78). For plant height had very high heritability (97.23%) coupled with high genetic advance (29.23). Number of primary branches per plant showed very high heritability (89.26%) along with low genetic advance (1.28). In node at which first flower had very high heritability (91.36%) accompanied with low genetic advance (3.32). Internodal length observed very high heritability (80.21%) coupled with low genetic advance (1.73). For number of nodes per plant had high heritability (71.1%) coupled with low genetic advance (3.20). Number of fruits per plant registered very high heritability (83.43%) along with low genetic advance (4.49).

In fruit yield per plant had very high heritability (96.44%) accompanied with high genetic advance (72.29). Fruit yield per plant recorded very high heritability (96.44%) along with moderate genetic advance (19.52). Fruit length (cm) had very high heritability (85.06%) coupled with low genetic advance (5.17). Fruit diameter (cm) showed high heritability (61.05%) accompanied with low genetic advance (0.58). Average fruit weight (g) exhibited high heritability (78.05%) coupled with low genetic advance (2.27). Number of seeds per fruit had very high heritability (87.92%) along with moderate genetic advance (12.21). Seed weight per fruit (g) recorded high heritability (77.65%) accompanied with low genetic advance (0.67). In seed yield per plant (g) had very high heritability (86.09%) coupled with high genetic advance (25.52). Seed yield (q/ha) depicted very high heritability (86.09%) along with low genetic advance (6.89). Days to edible fruit maturity had very high heritability (82.86%) accompanied with low genetic advance (8.26). Seed index (g) noted very high heritability (94.31%) coupled with low genetic advance (2.29). Highest genetic gain was observed in trait seed index (47.38%) whereas lowest was reported in days to edible fruit maturity (14.82%). All the findings are in association with Sharma *et al.* (2007)^[10], Singh *et al.* (2007)^[11], Kumar *et al.* (2019)^[14], Raval *et al.* (2018)^[12], Verma *et al.* (2018)^[13], Syfullah *et al.* (2018)^[15], Alam *et al.* (2020)^[16], Singh *et al.* (2020)^[17] Vani *et al.* (2021)^[18].

Table 1: Estimation of heritability, variability and genetic advance for different characters under study in okra

S. No.	Parameter	Mean	Range	GCV	PCV	Heritability	Genetic Advance	Genetic Gain
1.	Days to 50% flowering	45.54	34.33-51.00	9.93	10.53	88.86	8.78	19.28
2.	Plant height	101.24	81.68-126.52	14.21	14.41	97.23	29.23	28.87
3.	No of primary branches	2.49	1.53-4.00	26.42	27.96	89.26	1.28	51.41
4.	Node at 1st flower appear	9.72	5.73-12.30	17.32	18.12	91.36	3.32	34.11

5.	Internodal Length	4.57	3.03-6.15	20.56	22.96	80.21	1.73	37.93
6.	No. of nodes per plant	17.80	15.27-21.20	10.35	12.28	71.1	3.20	17.99
7.	No. of fruits per plant	14.02	11.40-19.47	17.01	18.62	83.43	4.49	32.00
8.	Fruit yield per plant	167.62	105.18-218.59	21.32	21.71	96.44	72.29	43.13
9.	Fruit yield (q/ha)	45.26	28.40-66.12	21.32	21.71	96.44	19.52	43.13
10.	Fruit length (cm)	11.35	7.74-15.47	23.98	26.00	85.06	5.17	44.56
11.	Fruit diameter (cm)	1.71	1.30-2.59	21.03	26.91	61.05	0.58	33.84
12.	Average fruit weight (g)	11.97	8.68-13.70	10.41	11.79	78.05	2.27	18.95
13.	No. of seeds per fruit	46.00	39.90-65.13	13.74	14.65	87.92	12.21	26.54
14.	Seed weight per fruit (g)	3.88	3.38-4.60	9.49	10.77	77.65	0.67	17.23
15.	Seed yield per plant	54.90	40.20-85.99	24.32	26.21	86.09	25.52	46.49
16.	Seed yield (q/ha)	14.82	10.86-23.21	24.32	26.21	86.08	6.89	46.48
17.	Days to edible fruit maturity	55.73	46.67-64.20	7.90	8.68	82.86	8.26	14.82
18.	Seed index (g)	4.84	2.71-7.40	23.68	24.39	94.31	2.29	47.38

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