Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2021; 10(3): 272-274
Received: 19-02-2021
Accepted: 07-04-2021

Valluru Manju Vani
Krishi Vigyan Kendra, Ghantasala, Krishna (Dt.), Andhra Pradesh, India

BK Singh
Dept. of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

SVS Raju
Professor, Dept. of Entomology and Agri'l Zoology, I. Ag. Sc., Banaras Hindu University, Varanasi, Uttar Pradesh, India

Anand Kr Singh
Dept. of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

Corresponding Author:
Valluru Manju Vani
Krishi Vigyan Kendra, Ghantasala, Krishna (Dt.), Andhra Pradesh, India

Studies on genetic variability, heritability and genetic advance for various quantitative traits in okra [*Abelmoschus esculentus* (L.) Monech] genotypes under north gangetic plains of Uttar Pradesh

Valluru Manju Vani, BK Singh, SVS Raju and Anand Kr Singh

Abstract
An experiment was undertaken on twelve genotypes and seventeen characters of okra to evaluate the genetic parameters like genetic variability, GCV, PCV, heritability, genetic advance and genetic gain. Significant differences among genotypes were observed for all the characters under study. The wide range of variability was observed among seventeen characters of all genotypes. The PCV values were generally higher than their respective GCV values, thus revealing the role of environmental factors. The phenotypic and genotypic variations were higher for number of branches per plant, fruit yield per plant, fruit yield per hectare, number of nodes on main stem and node at which first flower appears. The highest value of broad sense of heritability was recorded for number of branches per plant followed by fruit yield per plant, fruit yield per hectare, node at which first flower appears and plant height. The highest genetic advance as a percentage of mean was recorded fruit yield per plant, fruit yield per hectare, plant height, number of branches per plant. Number of branches per plant, fruit yield per plant and fruit yield per hectare recorded high GCV and PCV, high heritability coupled high genetic advance as per cent of mean indicates selection could be effective for improvement in these characters.

Keywords: Coefficient of variation, genetic advance, heritability, okra and variability

Introduction
Okra [*Abelmoschus esculentus* (L.)Moench] also known as lady's finger is one of the most important vegetable crops in the world. It belongs to family Malvaceae having chromosome number 2n=8x=72 or 144 and is polyploidy in nature. It is the preferred vegetable grown extensively in the tropical, subtropical and warm area of the temperate zones of the world. It is known by many local names in different parts of the world. It is quite popular in India because of easy cultivation, dependable yield and adaptability to varying moisture conditions. It gained popularity in many parts of the world for its unsurprised medicinal value and commercial importance. Being a multipurpose, okra is valued for its tender delicious fruits. Dry seeds of okra contain 20 to 30 per cent crude protein. Sometimes, the seeds are roasted and grounded to form a non-caffeinated substitute for coffee. Okra oil is pressed seed oil, extracted from the seeds of the okra. The greenish yellow edible oil has a pleasant taste and odour, and is high in unsaturated fats such as oleic acid and linoleic acid. Its dry seeds contain 13-22% edible and 20-24% crude protein (Thamburaj and Singh, 2004) [8]. In India, okra cultivated around the year in one or other region due to wide range of climatic condition in different parts of the country. It has several good features, which help the breeders and geneticists to have quick, genetic results. Among these features its growing habits, short life span and adaptability to wide range of soil and climatic conditions, ease in emasculation, very high per cent of fruit set and large number of seeds per fruit makes commercial exploitation of hybrid vigour easy. Thus, it is one of the best suited crops for genetic studies. The prospect and possibilities for increase in quality and production of okra need genetic improvement for plants with more number of nodes, short internodes, optimum seed viability, harvest index, suitability for processing, tolerant to biotic and abiotic stresses. Fruit yield in okra is depends upon many yield components, since it is polygenic character. The variability for various characters is a prerequisite for a plant breeder. Genetic variability is an important factor for any heritable improvement. Magnitude and nature of genetic variability determined the progress of breeding for the economic characters and plays an important role in a crop in selecting the best genotypes for making rapid improvement in yield and other desirable characters.

A survey of genetic variability with the help of suitable parameters such as genotypic and phenotypic coefficient of variation, heritability and genetic advance are absolutely necessary to start an efficient breeding program (Mishra *et al*. 2015) [6]. In the present study, an attempt has been made to assess the variability of important yield and yield contributing traits, *i.e.*, GCV and PCV, heritability (h2), genetic advance and genetic gain which would facilitate an understanding behind expression of characters for various traits of okra genotypes.

Materials and Methods

The experiments were carried out at the Vegetable Research Farm of the Horticulture Department, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi. The experiment was laid out in Randomized Block Design with three replications. Experimental material for the present investigation was collected from Indian Institute of Vegetable Science (IIVR), Varanasi which comprised of 12 genotypes of *A. esculentus* belonging to different morphological and productive attributes (Table-1). The present investigation was diallel crossing of 12 parents in all possible combinations excluding reciprocals. The first crop was sown with planting material of 12 parents, the second sowing was done with planting material of 12 parents + 66 hybrids (F_1) and the 3rd sowing was done with planting material of 12 parents + 66 F_1 + 66 F_2. The spacing used was 60×30 cm (summer crop) and 60 × 45cm (rainy season crop). Data was recorded on the following 17 quantitative characters [Plant height (cm)**,** Number of branches per plant, Node at which first flower appears**,** Number of nodes on main stem**,** Internodal length (cm)**,** Days to 50 per cent flowering**,** Fruit length (cm), Fruit width (cm)**,** Fruit weight (g)**,** Number of fruits per plant**,** Days to edible maturity**,** Fruit yield per plant (kg/plant)**,** Fruit yield per hectare (q/ha)**,** Number of seeds per fruit, Hundred seed weight, seed yield per plant and seed yield per hectare]. The average values were computed as treatment mean under each replication. Phenotypic and genotypic variability were calculated as per method proposed by Burton (1952) [1]. Heritability estimates in cultivated plants were as suggested by Robinson *et al.* (1966) [7]. Genetic advance was worked out by using the formula suggested by Johnson *et al.* (1955) [4].

Table 1: List of genotypes under study

Sl.no.	Genotype
1	IC- 45831
2	IC- 282272
3	IC- 43733
4	IC- 43750
5	IC- 45802
6	Sel – 4
7	Pusa Mukhmali
8	Parbhani Kranti
9	VRO- 3
10	Sel – 10
11	Pusa A-4
12	SB – 8 and
	Commercial check was Arka Anamika

Results and Discussion

An evaluation of the potentialities of the existing varieties of okra is very essential because it is the genetic variability of the initial parental material, on which the further improvement depends. The observed variability is a combined measure of genetic and environmental causes. The heritable variability and more particularly its genetic component, is clearly the most important aspect of the genetic constitution of the breeding material, which has a close bearing on its response to selection. However, a measure of heritability alone does not give an idea about the expected gain in the next generation, but it has to be considered in conjunction with genetic advance. Thus high yield can be achieved by selection of those characters that have high heritability coupled with genetic advance.

In crop improvement, only the genetic component of variation is important because only this component is transmitted to the next generation. The extent of contribution of genotype to the phenotypic variation for the trait in a population is ordinarily expressed as the ratio of genetic variance to the total variance, *i.e.* phenotypic variance, for the traits, this ratio is known as heritability. Heritability is estimated in two ways, viz. in broad sense "ratio of total genetic variance to phenotypic variance" and in narrow sense "ratio of additive genetic variance to phenotypic variance".

The analysis of variance revealed highly significant differences among the genotypes for all the characters under study. The range of variability and grand mean value for all 17 characters were as follows, plant height ranged from 67.00 to 89.89 with a grand mean of 77.50, number of branches per plant ranged from 12.20 to 16.40 with a grand mean of 14.39, minimum number of first flowering node is a desirable character, which shows earliness of the genotype and it was observed lowest as 4.40 and extended up to 5.60 with grand mean of 4.97, More number of nodes on main stem has a chance of producing more number of flowers/fruits per plant and it was ranged from 12.33 to 15.80 with a grand mean value of 14.37, internodal length ranged from 5.18 cm to 18.47 cm with a grand mean value of 12.47 cm, the mean number of days to 50 per cent flowering ranged from 30.29 to 43.67 with a grand mean value of 35.91, In the case of fruit length (cm), the range varied from 8.26 to 14.15 with a grand mean of 10.58, fruit width (cm) from 1.46 to 2.05 with a grand mean of 1.76, fruit weight (g) from 20.54 to 27.11 with a grand mean of 22.98, number of fruits per plant from 11.83 to 15.40 with a grand mean of 13.27, days to edible fruit maturity from 4.80 to 5.20 with a grand mean of 5.00, fruit yield per plant (g) from 243.53 to 417.63 with a grand mean of 304.16, fruit yield per ha (q) from 180.39 to 309.34 with a grand mean of 225.30, number of seeds per fruit from 55.00 to 68.53 with a grand mean of 63.17, hundred seed weight (g) from 5.69 to 6.30 with a grand mean of 6.08, seed yield per plant (g) from 14.94 to 17.46 with a grand mean of 16.20, seed yield per ha (q) from 11.07 to 12.93 with a grand mean of 12.00.

A perusal of coefficient of variability indicated that estimates of phenotypic coefficient of variations (PCV) were higher than genotypic ones (GCV) for all the metric traits. In general, both sort of variation for different attributes had showed similar trend. The differences in magnitude between PCV and GCV for all the traits were small, indicating low environmental influences. The phenotypic and genotypic variations were higher for number of branches per plant, fruit yield per plant (g) and fruit yield per hectare (q), indicating that characters would respond to selection. High coefficient of variation provides ample scope for selection of desirable types of genotype. Similar observations were made by Kumar *et al*. (2007) [5] and Dhankhar *et al*. (2013) [2].

The highest value of broad sense of heritability was recorded for number of branches per plant followed by fruit yield per plant (g) and fruit yield per hectare (q), node at which first

flower appears, plant height, fruit width (cm), internodal length (cm) and number of seeds per fruit. While, fruit length (cm), seed yield per plant (g) and seed yield per hectare (q) reported lowest heritability. High heritability (Table- 2) value indicates that the characters are less influenced by environmental factors and are controlled by additive gene effect (Table 2). Yet, the selection for improvement of such characters may be useful. It also measures the genetic relationship between parent and their progenies; hence it is widely used in determining the degree to which characters may be transmitted from parent to offspring. The above result is in accordance with the findings of Jindal *et al*. (2010) [3] and Kumar (2011) [9].

The genetic advance is yet another important selection parameter because it measures the difference between the mean genotypic value of the selected lines and mean genotypic value of the original population from which these were selected. Thus, it adds an advantage over heritability as a guiding factor to breeding in the selection programme. The highest genetic advance as a percentage of mean was recorded in fruit yield per plant (g) and fruit yield per hectare (q), plant height, number of seeds per fruit, fruit weight, number of nodes on main stem, while it was lowest for days to edible fruit maturity, fruit width and 100 seed weight. High heritability and high genetic advance suggest that the traits were predominantly controlled by additive gene action. High heritability and low genetic advance suggest that characters are highly influenced by environmental effects and selection would be ineffective. The present result is in line with the findings of Singh *et al*. (2007) [10]; Jindal *et al*. (2010) [3] and Kumar (2011) [9].

Table 2: Estimation of range, mean, Genotypic Coefficient of Variation (GCV), Phenotypic Coefficient of Variation (PCV), Heritability, Genetic Advance and Genetic Gain for 17 characters of okra

Characters	Range		Grand mean	G.C.V.	P.C.V.	Heritability	Genetic advance	Genetic gain
	Min.	Max.						
Plant height (cm)	67.00	89.89	77.50	6.42	7.75	69	8.45	10.96
Number of branches per plant	12.20	16.40	14.39	18.97	19.08	99	5.21	38.85
Node at which 1st flower appears	4.40	5.60	4.97	8.04	8.99	80	0.75	14.81
No. of Nodes on main stem	12.33	15.80	14.37	8.64	11.02	61	1.94	13.96
Internodal length (cm)	5.18	18.47	12.47	8.40	10.36	66	0.78	14.04
Days to 50% flowering	30.29	43.67	35.91	2.17	3.34	42	1.21	2.90
Fruit length (cm)	8.26	14.15	10.58	4.10	9.40	19	0.46	3.69
Fruit width (cm)	1.46	2.05	1.76	8.06	9.77	68	0.24	13.71
Fruit weight (g)	20.54	27.11	22.98	7.93	10.78	54	2.72	12.01
No. of fruits per plant	11.83	15.40	13.27	4.70	8.97	28	0.66	5.08
Days to edible fruit maturity	4.80	5.20	5.00	1.22	2.70	20	0.06	1.14
Fruit yield per plant (g)	243.53	417.63	304.16	11.80	12.93	83	65.82	22.20
Fruit yield per ha (q)	180.39	309.34	225.30	11.80	12.93	83	48.75	22.20
Number of seeds per fruit	55.00	68.53	63.17	7.79	9.64	65	7.98	12.96
100 seed weight (g)	5.69	6.30	6.08	2.97	4.36	46	0.25	4.17
Seed yield per plant (g)	14.94	17.46	16.20	3.87	8.94	19	0.55	3.45
Seed yield per ha (q)	11.07	12.93	12.00	3.88	8.94	19	0.41	3.46

Conclusion

Results from present investigation clearly indicated that greater variability exist among all the characters of a selected genotypes. The trend of PCV was almost similar to GCV with higher values for most of the characters studied. The phenotypic and genotypic variations were higher for number of branches per plant, fruit yield per plant (g) and fruit yield per hectare (q). All other characters showed medium GCV and PCV values. The high heritability coupled with high genetic advance as a percentage of mean was recorded number of branches per plant had highest value followed by fruit yield per plant (g) and fruit yield per hectare (q), indicating that characters would respond to selection.

Acknowledgement

The corresponding author is highly grateful to the Department of Science and Technology for providing financial assistance in the form of INSPIRE Fellowship for the present study.

References

1. Burton GW. Quantitative inheritance in grosses. *Proceedings 6th Int. Grassland Congress* 1952;1:277-283.
2. Dhankhar SK, Vivek Hegde, Koundinya AVV. Variability, correlation and path analysis in F_1 generation of okra. Annals of Agri Bio Res 2013;18(2):231-233.
3. Jindal SK, Deepak Arora, Ghai TR. Variability studies for yield and its contributing traits in okra. Electronic J. of Pl. Breeding 2010;1(6):1495-1499.
4. Johnson HW, Robinson HF, Comstock RE. Estimation of genetic and environmental variability in soybeans. *Agro. J.* 1955;47:314-318.
5. Kumar NS, Suguna V, Thangavel P. Genetic parameters and degree of dominance for yield and its contributing traits in okra (*Abelmoschus esculentus* (L.) Moench). *Adv.in Pl. Sci.s*. 2007;20(2):617-619.
6. Mishra PK, Ram Badan RAM, Kumar N. Genetic variability, heritability, and genetic advance in strawberry (*Fragaria* × *ananassa* Duch.). Turk. J. of Agri. and For. 2015;39:451-458.
7. Robinson HF, Comstock RE, Harvey P. Quantitative genetics in relation to breeding on the cenetennial of Mendalism. Ind. J. of Genetics 1966;26:171-177.
8. Thamburaj, Singh. *Vegetables, tuber crops and spices.* Published by Directorate of information and publication of Agriculture (ICAR), New Delhi 2004.
9. Kumar NS, Heterosis in okra [*Abelmoschus esculentus* (L.) Moench]. Pl. Archives 2011;11(2):683-685.
10. Singh AK, Ahmed N, Raj Narayan Chatoo MA, Genetic variability, correlations and path coefficient analysis in okra under Kashmir conditions. Ind. J. of Horti 2007;64(4):472-474.