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# STUDIES ON GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE IN OKRA (*Abelmoschus esculentus* L. MONECH)

**BHARAT TUKARAM PATIL, VRUSHALI RANGANATH RODE, MADHUKAR NILKANTH BHALEKAR AND KAILAS GOPAL SHINDE**

*All India Coordinated Research Project on Vegetable Crops,*
*Mahatma Phule Krishi Vidyapeeth, Rahuri,( Maharashtra State ) India.*
*Corresponding author's email: btpatilveg@rediffmail.com.*

**Abstract**

*Significant differences were found among genotypes for all the characters studied except number of lobes leaf$^{-1}$, number of branches plant$^{-1}$, number of ridges fruit$^{-1}$, node at which first flower appear, diameter of fruit and average weight of fruit. The highest genotypic and phenotypic coefficient observed for number of branches plant$^{-1}$. The GCV and PCV values were found influenced by environmental factors. The heritability estimates in broad sense were high for plant height and number of ridges/fruit, while low heritability estimates were observed for node at which first flower appear. The genetic advance as percentage of mean was high for number of branches plant$^{-1}$. High heritability coupled with high genetic advance observed for number of branches plant$^{-1}$ indicating that they are governed by additive gene action and could be improved through simple selection.*

**Key words**: Variability, heritability, genetic advance and Okra.

## INTRODUCTION

Okra (*Abelmoschus esculentus* L. Monech) syn. Bhindi is an important vegetable crop grown for its tender green pods, throughout India, Turkey, Sri Lanka and other neighboring countries. Fruit yield of is depends upon many yield components, since it is polygenic character. Exploitation of variability is of a great importance and pre-requisite for the effective screening of superior genotypes. Magnitude and nature of genetic variability determined the progress of breeding for the economic characters and play an important role in a crop in selecting the best genotypes for making rapid improvement in yield and other desirable characters, Vavilov (1951). Heritability is an index for calculating the relative influence of environment on expression of genotypes. It became very difficult to judge how much of variability is heritable and much of variability is non-heritable. Hence, it is essential to partition overall variability into its heritable and non-heritable components with the help of genetic parameters like genotypic coefficient of variation, phenotypic coefficient of variation, heritability and genetic advance. The present investigation was carried out to study the variability, heritability and genetic advance for fifteen quantitative traits in okra.

## MATERIAL AND METHODS

The experimental comprised of forty genotypes of okra. All genotypes were sown at spacing 15cm in randomized block design with three replications at All India Coordinated Research Project on Vegetable

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Crops, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri,( Maharashtra State ) India during summer, 2015.. The soil of experimental plot was prepared to fine tilth by giving two crosswise ploughing to the depth of 20 cm. Followed by discing and two harrowing. Farm Yard Manure was applied before last harrowing as basal dose and mixed with soil. The ridges and furrows were opened at a spacing of 60 cm and seeds was sown on ridges 15 cm apart from both sides of ridges to maintain spacing for okra crop. The hand weeding was done to remove weeds in experimental plots to avoid competition of weeds for soil moisture and essential nutrients and kept plot clean for better growth of plant. The plant protection measures like spraying of insecticides viz., Dimethoate, Deltametrin, Quinolphos, Imadachloprid and Thimithaxon was applied for control of jassids, fruit borer and aphids. For control of diseases like Yellow Vein Mosaic and powdery mildew the fungicides like Sulphur (80%) and Kerathen was applied during growing period of crop at interval of 10. The experimental plot having medium black soil. The topography of experimental site was uniform and well leveled. The nutrient status of experimental plot was 198.0 kg N/ha., 20.0 kg P2O5, 431.20 kg K2O and 7.8 ph os soil. The observations were recorded on five randomly selected plants of fortygenotypes viz., IC-0090246 ,IC-0090234, EC-169350, IC-045804, IC-033301-A, IC-117321, EC-169513, IC-117298, IC-045836, IC-090203, IC-0045827, EC-0112231, EC-0305693, IC-0044896, IC-0369611, IC-08935, EC-0102605, EC-0169347, EC-169493, IC-034124-A, IC-0090291, IC-045827, IC-117299, IC-0069303, EC-0177900, IC-0510698, IC-090298, IC-117324, IC-0090269, IC-0045824-B, EC-0305735, IC-117244, EC-019450, IC-0128063, IC-0361258, IC-0010256-A, IC-0045993, IC-0111484 ,IC-0588162 , IC-0279447 in all the replications on 14 important characters like plant height, days to 50 % flowering, number of nodes plant$^{-1}$, number of lobes leaf$^{-1}$, number of branches plant$^{-1}$, number of ridges fruit$^{-1}$, internodal length, node at which first flower appear, length of fruit, diameter of fruit, average weight of fruit, number of fruits/plant, yield per plant and fruit yield per hectare.

**Statistical analysis:** The analysis of variance was carried out as suggested by Fisher. (1950) and Panse and Sukhatme (1985). Phenotypic and genotypic coefficient of variation, heritability and genetic advance were computed by the formula suggested by Burton (1953) and Johnson et al. (1955).

## RESULTS AND DISCUSSIONS

The data presented in Table 1 regarding analysis of variance revealed the significant differences among the genotypes used in the present investigation for all the characters studied except number of lobes leaf$^{-1}$, number of branches plant$^{-1}$, number of ridges fruit$^{-1}$, node at which first flower appear, diameter of fruit and average weight of fruit and rest of traits viz., plant height, days to 50 % flowering, number of nodes/plant, internodal length, length of fruit, number of fruits plant$^{-1}$, yield plant$^{-1}$, yield hectare$^{-1}$ indicated wide spectrum of variation among the genotypes.

High magnitude of variability for many of these traits has been reported earlier by Kumar et al. (2006) and Mulge et al (2006). A wide range of variation was recorded for all the characters suggesting presence of high genetic variability. The extent of genetic variability present in okra genotypes was measured for various traits in terms of mean, range, phenotypic coefficient of variation (PCV) genotypic coefficient of variation (GCV), heritability (broad sense), genetic advance and genetic advance as percentage of mean are given in Table 2. Among the 14 traits showed a range of GCV for various characters varied from 1.59 for diameter of fruit to 30.10 for number of branches plant$^{-1}$. The GCV and PCV values were found very distant to each other for most of the characters suggesting the presence of large amount of variability. High amount of phenotypic coefficient of variation (PCV) observed for number of branches. Characters like number of nodes plant$^{-1}$, number of lobes leaf$^{-1}$, internodal length, length of fruit and average weight of fruit have moderate GCV and PCV values For all the traits studied GCV values less than PCV values, similar findings were also reported by Bendale et al. (2004) and Mehta et al. (2006) in okra. To determine the amount of heritable variation estimates of GCV alone is not sufficient. Therefore, heritable variation can be found out with greater degree of accuracy heritability is studied in conjunction with genetic advance. The value of heritability in broad sense for all the characters

ranged from 34.55 for node at which first flower appear to 90.20 for diameter of fruit. The character like plant height and number of ridges fruit$^{-1}$ had high heritability indicated that characters were less influenced by environment. Moderate heritability were recorded for length of fruit, average weight of fruit, number of fruits plant$^{-1}$, fruit yield hectare$^{-1}$. These results are in close conformity with the findings of Bendale et al. (2004), Mulge et al (2006), Mehta et al. (2006) and Jagan et al. (2013).

The data presented in Table 2 also revealed that number of branches/plant, number of fruits/plant, fruit yield/plant, fruit yield/plot and per hectare also showed equally high genetic advance (as percentage of mean). High heritability coupled with high genetic advance also observed for these characters would respond to selection better than those with high heritability and low genetic advance is confirmed with Kumar et al. (2006) and similar findings were reported by Chaukande (2010) and Bairagi (2010). The heritability was mainly due to additive gene action, it would be associated with high genetic gain and if it is due to non-additive gene action, genetic gain would be low. Moderate heritability and genetic advance was observed for average weight of fruit, length of fruit, number of ridges fruit$^{-1}$ and number of nodes plant$^{-1}$ indicating that these characters were governed by additive gene action could be equally improved through selection. The characters like number of fruits plant$^{-1}$, fruit yield plant$^{-1}$, hectare$^{-1}$ had high GCV, heritability and genetic advance as percentage of mean. This indicated that these characters were governed by additive gene effect and improved through effective selection. These findings are in close agreement with Jagan et al. (2013). Moreover, diameter of fruit, node at which first flower appear and days to 50 % flowering exhibited low GCV, heritability and genetic advance as percentage of mean indicating non-additive gene effect and for improving these traits heterosis breeding or recurrent selection should be followed. Similar findings are reported by Jagan et al. (2013). Genotypes which exhibited both high variability and high genetic advance for certain traits may be evaluated in multilocation trials and isolated as donors for these characters or used as parents in hybrid development programme.

**Table 1. Analysis of variance (ANOVA) for different characters in okra**

| Sr. No. | Characters | Mean squares | |
|---|---|---|---|
| | | Treatments (39) | Error (78) |
| 1 | Plant height (cm) | 15865.9** | 1543 |
| 2 | Days to 50 % flowering | 544.95** | 77.80 |
| 3 | Number of nodes/plant | 581.79** | 117.4 |
| 4 | Number of lobes/leaf | 39.55 | 5.95 |
| 5 | Number of branches/plant | 33.23 | 5.25 |
| 6 | Number of ridges / fruit | 18.76 | 1.94 |
| 7 | Internodal length (cm) | 50.80 | 9.26 |
| 8 | Node at which 1$^{St}$ flower appear | 4.44 | 2.16 |
| 9 | Length of the fruit (cm) | 114.01** | 22.33 |
| 10 | Diameter of fruit (cm) | 0.07 | 0.004 |
| 11 | Average weight of fruit (g) | 81.84 | 15.21 |
| 12 | Number of fruits /plant | 807.05** | 171.07 |
| 13 | Fruit yield / plant (g) | 63854** | 14132 |
| 14 | Fruit yield/hectare (q) | 314835** | 69893 |

*, ** denotes significance at 5% and 1% level, respectively.
Figures inscribed in parentheses indicate degree of freedom.

| Table 2. Genetic variability parameters in 40 genotypes of okra. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sr No.** | **Characters** | **Range** | **General mean** | **GCV** | **PCV** | **Heritability (%) in b.s.** | **Genetic advance** | **GA as % of mean** |
| 1 | Plant height (cm) | 36.60-88.00 | 67.14 | 20.19 | 22.25 | 82.27 | 25.32 | 37.72 |
| 2 | Days to 50 % flowering | 49.50-61.00 | 52.73 | 4.64 | 5.36 | 75.01 | 4.37 | 8.28 |
| 3 | Number of nodes/plant | 13.10-25.30 | 16.96 | 14.39 | 17.65 | 66.41 | 4.10 | 24.15 |
| 4 | Number of lobes/ leaf | 3.0-5.0 | 4.58 | 14.35 | 16.69 | 73.85 | 1.16 | 25.40 |
| 5 | Number of branches/plant | 1.30-4.30 | 1.99 | 30.10 | 35.30 | 72.72 | 1.05 | 52.88 |
| 6 | Number of ridges / fruit | 5.00-7.20 | 5.48 | 8.47 | 9.40 | 81.26 | 0.86 | 15.73 |
| 7 | Internodal length (cm) | 1.98-5.56 | 4.02 | 18.17 | 21.85 | 69.16 | 1.25 | 31.13 |
| 8 | Node at which 1$^{St}$ flower appear | 3.0-4.10 | 3.45 | 4.96 | 8.43 | 34.55 | 0.21 | 6.00 |
| 9 | Length of the fruit (cm) | 6.85-11.88 | 9.43 | 11.49 | 14.01 | 67.25 | 1.83 | 19.41 |
| 10 | Diameter of fruit (cm) | 1.79-1.94 | 1.81 | 1.59 | 1.67 | 90.20 | 0.06 | 3.11 |
| 11 | Average weight of fruit (g) | 7.41-12.04 | 8.97 | 10.30 | 12.43 | 68.66 | 1.58 | 17.58 |
| 12 | Number of fruits /plant | 8.50-22.0 | 13.81 | 20.68 | 25.64 | 65.02 | 4.74 | 34.34 |
| 13 | Fruit yield / plant (g) | 70.50-228.0 | 112.56 | 20.60 | 25.80 | 63.76 | 41.53 | 33.89 |
| 14 | Fruit yield /hectare(q) | 156.67-506.67 | 272.18 | 20.59 | 25.80 | 64.67 | 92.11 | 33.84 |

*GCV = Genetic coefficient of variation, PCV = Phenotypic coefficient of variation.*

## CONCLUSION

The high heritability estimates in broad sense were observed for plant height and number of ridges fruit$^{-1}$, similarly high heritability coupled with high genetic advance observed for number of branches plant$^{-1}$ indicating that they are governed by additive gene action and could be improved through simple selection for getting maximum fruit yield in okra.

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