In the present study 100 seed weight, pod length, number of branches per plant, green pod weight and number of seeds per pod were the major grain yield contributing characters whereas green pod weight, pod length and number of branches per plant were the major vegetable yield contributing characters. Hence during selection weightage should be given to the above characters to improve the grain yield and vegetable yield.

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Research Notes

Genetic parameters of selected yield attributes in Okra *(Abelmoschus esculentus* (L.) Moench)

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Okra *(Abelmoschus esculentus* (L.) Moench) is a highly adaptable crop and grown for tender green fruits. Presently the productivity of okra shows a declining trend. Hence developing high yielding varieties is of utmost important. Selection of desirable genotypes must

be performed with reliable estimates. The genetic parameters like coefficient of variation, heritability and genetic advance provide a clear insight into the extent of variability and a relative measure of efficiency of selection of genotypes based on phenotype, in a highly variable population. Hence, the present study was carried out to find the genetic parameters for yield and its component traits in okra germplasm.

One hundred and one accessions of okra collected from various parts of India, were screened for YVM resistance under field conditions from April to July 2001 at the Department of Plant breeding and Genetics, College of Agriculture, Velllayani. The accessions including known Yellow Vein Mosaic (YVM) resistant varieties, varieties relased by Kerala Agricultural University, types from NBPGR Regional Station, Vellanikkara and local collections formed the material for the study. The experiment was laid out in randomised block design with three replications and ten plants per plot. Data were recorded for yield (fruit weight plant^{-1}) and its component traits *viz.,* days to first flower, leaf axil bearing first flower, leaf area (cm^2), pollen sterility (%), fruits plant^{-1}, average fruit weight (g), fruit and shoot borer incidence (%) and yellow vein mosaic incidence. The genetic parameters *viz.,* the phenotypic and genotypic coefficients of variation, heritability and genetic advance for these nine characters were estimated as per Singh and Choudhary (1985).

A unit free tool of evaluation is highly essential for comparing the characters measured in diverse units. Unlike variance, coefficient of variation provides an excellent means for such a need. Phenotypic value being the aggregate of genotypic effect and environmental influence, selection solely based on external parameters may be misleading. Thus, in comparison with its phenotypic counterpart, genoitypic coefficient of variation (GCV) is a more precise and true indicator of the extent of genetic variability in a population.

During the current study, the highest values of phenotypic as well as genotypic coefficient of variation were observed for yield *i.e.,* fruit weight plant^{-1} (51.35 and 48.97 respectively). Phenotoypic and genotypic coefficients of variation were the least for plant duration (9.53 and 7.26 respectively).

Table 1. Genetic parameters of yield attributes in okra germplasm

Character	PCV	GCV	h^2 (%)	GA (% of mean)
Days to first flower	23.53	20.31	74.49	36.46
Leaf axil bearing first flower	18.36	14.00	58.17	22.10
Leaf area	38.85	34.41	78.46	62.80
Pollen sterility	36.20	25.02	47.76	35.60
Fruits plant^{-1}	34.83	33.42	92.06	66.10
Average fruit weight	25.95	22.31	73.94	39.50
Fruit weight plant^{-1}	51.35	48.97	90.93	96.19
Fruit and shoot borer incidence	30.69	20.73	45.63	28.86
YVM incidence	34.11	21.26	38.87	27.50

High phenotypic and genotypic coefficients of variation were observed for most of the traits including yield and its major components. However, GCV was moderate for leaf axil bearing first flower but low for plant duration. Information regarding PCV and GCV values which were high for incidence of YVM and fruit and shoot borer and low for plant duration reported by Philip (1998) agrees with the above results. Meanwhile, the same author also expressed contradictory view by projecting low PCV and GCV for leaf area and days to first flower. High values of PCV with corresponding high values of GCV in most of the traits indicate the presence of great extent of genetic variability in these characters suggesting better scope for improvement through phenotypic selection.

Selection acts on genetic differences and the benefit from selection for a particular trait depends largely on its heritability (Allard, 1960). So it is evident that GCV alone is not sufficient for successful selection. In the view of Burton (1952), GCV along with heritability would provide a precise idea regarding the amount of genetic gain to be expected from selection.

High heritability (broad sense) was exhibited by majority of the characters (Table 1). Very high heritability was exhibited by fruits plant^{-1} (92.06%) and fruit weight plant^{-1} (90.93%). The other traits which expressed high heritability were days to first flower, leaf area and average fruit weight.

Present investigation revealed high values of heritability for the characters studied that include yield and its major components *viz.,* fruits plant^{-1}, average fruit weight, days to first flower and leaf area indicating the predominance of genetic component and low environmental influence on these characters. Very high estimates of heritability (>90%) as observed for fruit yield and fruit number is a highly desirable phenomenon.

This result is in conformity with the reports of many earlier workers *viz.,* El-Macksoud *et al.* (1986) for days to first flower, number of fruits and fruit weight, Yadav (1986) for number and yield of fruits, Sadashiva (1988) for fruit weight and Yassin and Anbu (1997) for number, average weight and yield of fruits. But low heritability as observed by Ngah and Graham (1973) for fruit weight, Singh *et al.* (1974) for fruit number and weight of fruits, Lal *et al.* (1977) for yield, Thaker *et al.* (1981) for leaf area, fruit weight and yield, Patel and Dalal (1992) and Rajani and Manju (1997 for fruit number are in disagreement with the present results obtained.

More or less equal influence of genetic and environmental factors in the case of pollen sterility, leaf axil bearing first flower, plant duration and incidence of fruit and shoot borer and YVM was evident. However, from the view of Philip (1998) all these traits possessed high heritability.

High heritability (broad sense) does not always indicate better response to selection since it is inclusive of non-additive genetic variance also. Hence, for predicting the real resultant effects of selection, high heritability coupled with high genetic advance would be a more reliable criterion than simple heritability value alone (Johnson *et al.,* 1955).

In the current study, maximum genetic advance (% mean) was observed for fruit weight plant^{-1} (96.19%) and fruits plant^{-1}. The character with moderate genetic advance was plant duration (11.41%). Very high genetic

advance was plant duration (11.41%). Very high genetic advance observed for fruit yield clearly indicates the additive gene action involved in this trait which makes the selection highly effective. This is in conformity with the opinion of Mishra and Chhonkar (1979).

All other traits, except plant duration, were bestowed with high genetic advance. Supporting evidences for this were previously presented by Murthy and Bavaji (1980) for number of fruits and days to flower, Thaker *et al.* (1981) for leaf area and number, average weight and yield of fruits and Yassin and Anbu (1997) for fruit number and yield.

High heritability coupled with high genetic advance (as %of mean) was displayed by five traits *viz.,* days to first flower, leaf area, fruits plant $^{-1}$, average fruit weight, fruit weight plant^{-1}.

Four traits *viz.,* pollen sterility, leaf axil bearing first flower and incidence of fruit and shoot borer and YVM possessed moderate heritability along with high genetic advance (as % of mean) indicating the nature of additive gene effects. Opposite opinions expressing low values of both heritability and genetic advance were furnished by Bindu *et al.* (1997) for leaf axil bearing first flower and Sheela (1994) for YVM incidence. Estimates of both heritability and genetic advance were moderate for plant duration revealing more environmental influence which makes the selection less effective for this character.

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Research Notes

High frequency of callusing from root explants of Assam Rice Collection

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The regeneration of plants from cell and tissue culture is an important and essential component of biotechnology that is required for the genetic manipulation and improvement of plants. Rice is the world's single most important food crop and a primary food source for more than one third of world's population. Callusing and subsequent regeneration of rice from different explants were reported by Rueb *et al.* (1994), Seraj *et al.* (1997), Wenjing *et al.* (1997) and Mukopadhyay *et al.* (1997). However there are only a few reports on the induction of callus from root explants in rice. Mature seeds of Assam rice collection were obtained from Central Rice Research Institute Cuttack, along with *japonica* check Taipei 309, and were used for this study. For obtaining root explants, mature seeds were dehusked and sterilized under aseptic condition. MS medium was supplemented with 2 mgL^{-1} 1AA or NAA (Indole acetic acid or Naphthalene acetic acid) and used for obtaining adventitious roots from rice seedlings. Eighteen to twenty days old roots from rice seedlings were selected as explants (Anju John and Prathapasenan, 1999). Effects of different carbon sources (sucrose/maltose) were also tested. Approximately 1.5 cm length root explants were transferred to callus induction medium (MS medium containing 2 mg 2, 4-D L^{-1}).