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Research Article

Correlation and Path Analysis Studies in Okra (*Abelmoschus esculentus* (L.) Moench)

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Abstract

Correlation coefficient and path analysis were studied using parents (female VRO - 6 and male AOL - 09 - 02), their F1 and F2 generations. Observations were recorded on thirteen yield and its contributing characters. Among them, fruit yield/plant exhibited positive and highly significant correlation with number of fruits/plants, plant height at final harvest, fruit weight, number of branches/plants, fruit girth, number of seeds/fruits, internodal length, and 100 seed weight. Path coefficient analysis revealed that number of fruits/plants, fruit weight, days to first picking, internodal length, 100 seed weight and fruit length recorded positive direct effect on fruit yield/plant.

Keywords: Okra; Correlation Coefficient; Path Analysis

Introduction

Okra [*Abelmoschus esculentus* (L.) Moench], 2n = 130 has occupied a prominent position among vegetables; it is one of the choicest fruit vegetable grown extensively in the subtropical to tropical warm area of the world including India, Africa, Turkey and other neighbouring countries. It is widely grown during summer and rainy seasons for its tender green fruits, is one of the most important vegetable crops of India, however its tender green leaves are also eaten in the Far East countries. It is also known by many local names in different parts of the world. It is called Lady's finger in England, Gumbo in the U.S.A. and Bhindi in northern India. It is a polyploidy, belonging to the family *Malvaceae* with 2n = 8x = 72 or 144 chromosomes. It is an often cross pollinated crop, without-crossing to an extent of 4-19 per cent with the maximum of 42.2 per cent under insect assisted pollination. In India 60 per cent share of export goes to okra among fresh vegetables. India is the largest producer of okra covering an area of 528.4 thousand hactare with an annual production of 6146.0 thousand Metric ton and a productivity of 11.6 Metric ton/hactare. In India, the states like West Bengal, Gujarat, Bihar, Orissa, Jharkhand, Madhya Pradesh, Uttar Pradesh, Chhattisgarh, Andhra Pradesh, Haryana, Assam and Tamil Nadu are the major producers of okra [1].

In our country there exists a wide variation amongst the okra varieties expressing wide degree of variation for quantitative and qualitative traits. A logical way to start any crop improvement programme is to assess the variation existing in the available materials. Yield is a complex character resulting from multiplicative interactions of various yield components. Therefore, correlation studies between yield and other traits will be of interest to breeders in planning the hybridization programme and evaluating the individual plants in segregating populations. A study of correlation between different quantitative characters provides an idea of association that could be effectively exploited to formulate selection strategies for improving yield components. For any effective selection programme, it would be desirable to consider the relative magnitude of association of various characters with yield. Path analysis splits the correlation coefficient into measures of direct and indirect effects, thus providing understanding of the direct and indirect contribution of each character towards yield.

Material and Methods

Experimental material comprised of ten plants from each parent (female VRO - 6 and male AOL - 09 - 02), twenty plants of F1 and

296 F2 plants. Plants were sown at 60 cm between rows and 30 cm between plants. Experimental material was evaluated in non-replicated trials as segregating F2 generation was involved at Regional Horticultural Research Station, Navsari Agricultural University, Navsari during kharif-2016. Recommended cultural practices for okra were followed. Data was recorded on thirteen parameters viz., days to first flowering, days to first picking, fruit length, fruit girth, fruit weight, plant height at final harvest, number of branches/plants at final harvest, number of fruits/plant, internodal length, number of seeds/fruit, 100 seed weight and fruit yield/plant. The correlation coefficients were calculated using "DOOLITTLE TECHNIQUE" as described by Goulden [2] and path coefficient analysis was carried out as illustrated by Dewey and Lu [3].

Results and Discussion

In any improvement program, selection is effective only if adequate genetic variability is present. However, simultaneous selection for several characters needs to be correlated to explain the interrelationships between characters and helps in effective identification of potential genotypes. It is beneficial to know the interrelationships between various economically important characters. Association analysis of different morphological, reproductive and nutritional characters with fruit yield of okra genotypes and their inter-relationships were investigated through the study of both phenotypic and genotypic correlation co-efficients. In the present study, 15 characters were recorded and their correlation co-efficient were analysed (Table 1).

	Days to first flowering	Days to first picking	Plant height at final harvest	Number of branches/ plants at final harvest	Internodal length	Fruit length	Fruit girth	Fruit weight	Number of fruits/ plant(g)	100 seed weight	No. of seeds/ fruit
Days to first picking	0.98**										
Plant height at final harvest	-0.21**	-0.22**									
Number of branches/ plants at final harvest	-0.04	-0.06	0.41**								
Internodal length	0.09	0.07	0.27**	0.20**							
Fruit length	0.08	0.08	-0.05	-0.03	-0.09						
Fruit girth	-0.12*	-0.12*	0.25**	0.16**	0.10	-0.14*					
Fruit weight	-0.17**	-0.15*	0.14*	0.20**	0.09	0.25**	0.26**				
Number of fruits/ plants	-0.20**	-0.21**	0.69**	0.48**	0.14*	-0.08	0.26**	0.16**			
100 seed weight	0.16**	0.16**	0.00	0.20**	0.09	0.39**	0.07	0.31**	0.05		
No. of seeds/ fruit	-0.14*	-0.12*	0.10	0.13*	0.01	0.22**	0.18**	0.60**	0.12*	0.22**	
Fruit yield/ plant	-0.23**	-0.23**	0.65**	0.48**	0.16**	0.03	0.32**	0.50**	0.93**	0.15**	0.31**

Table 1. Correlation coefficients among twelve traits in okra.

In the present findings, fruit yield/plant exhibited positive and highly significant correlation with number of fruits/plants, plant height at final harvest, fruit weight, number of branches/plants, fruit girth, number of seeds/fruits, internodal length, and 100 seed weight. Similar results were obtained by Swamy., *et al*. [4], Gogineni., *et al*. [5], Kumar and Reddy [6] and Kerure., *et al*. [7] for number of fruits/plant; Swamy., *et al*. [4], Gogineni., *et al*. [5], Kumar and Reddy [6] and Yadav., *et al*. [8] for plant height at final harvest; Swamy., *et al*. [4], Gogineni., *et al*. [5], Aminu., *et al*. [9] and Kerure., *et al*. [7] for fruit weight; Nirosha., *et al*. [10], Shivaramegowda., *et al*. [11] and Kerure., *et al*. [7] for number of branches/plant; Swamy., *et al*. [4], Sundaram [12], Shivaramegowda., *et al*. [11] and Kerure.,

et al. [7] for fruit girth; Kerure., *et al*. [7] for number of seeds/fruit and Nirosha., *et al*. [10] for internodal length and Kerure., *et al*. [7] for 100 seed weight. It indicates that selection criteria based on number of fruits/plants, plant height at final harvest, fruit weight, number of branches/plants, fruit girth, number of seeds/fruits, internodal length, and 100 seed weight would be beneficial for improvement of fruit yield/plant.

100 seed weight exhibited positive and highly significant correlation with fruit length, fruit weight, number of seeds/fruits, number of branches/plants, days to first flowering and days to first picking. Similar results were obtained by Simon., *et al*. [13] for fruit weight and number of branches/plants. Number of fruits/plants had positive and highly significant correlation with plant height at final harvest followed by number of branches/plants, fruit girth and fruit weight. This was in accordance to the findings of Kumar and Kumar [14], Aminu., *et al*. [9], and Yadav., *et al*. [8] for plant height at final harvest; Singh and Goswami [15] and Shivaramegowda., *et al*. [11] for number of branches/plant; Sundaram [12], Shivaramegowda., *et al*. [11] and Yadav., *et al*. [8] for fruit girth and Swamy., *et al*. [4] and Kumar and Reddy [6] for fruit weight.

Number of seeds/fruits had positive and highly significant correlation with fruit weight followed by fruit length and fruit girth. This is in relation with earlier reports of Nwangburuka., *et al*. [16] for fruit weight; Vani., *et al*. [17] for fruit length and Nwangburuka., *et al*. [16] for fruit girth. Thus, the top priority should be given to selection based on numbers of fruits/plant for yield improvement and could be considered while formulating selection indices in the improvement of okra [18].

Number of branches/plant showed positive and highly significant relation with plant height at final harvest followed by internodal length, fruit weight and fruit girth, which is in accordance with the earlier observations made by Kumar and Kumar [14], and Aminu., *et al*. [9] for plant height at final harvest and Kumar and Reddy [6] for internodal length; Annapurna., *et al*. [19] for fruit weight and Patil., *et al*. [20] for fruit girth.

Fruit weight had positive and highly significant correlation with fruit girth followed by fruit length. Similar results were reported by Swamy., *et al*. [4], and Shivaramegowda., *et al*. [11] for fruit girth and Swamy., *et al*. [4], and Aminu., *et al*. [9], for fruit length. It showed positive and significant correlation with plant height at final harvest, which was in accordance with the findings of Vani., *et al*. [17].

Plant height at final harvest exhibited positive and highly significant correlation with internodal length followed by fruit girth. This was in accordance with the earlier observations made by Singh and Goswami [15], and Patil., *et al*. [20] for internodal length and fruit girth.

Days to first flowering showed positive and highly significant correlation with days to first picking which is in accordance with the earlier observations made by Kumar and Kumar [14]. It had negative and highly significant correlation with fruit yield/plant followed by plant height at final harvest, number of fruits/plants, fruit weight, number of seeds/fruit and fruit girth. Similar results were obtained by Singh and Goswami [15] for plant height at final harvest and for number of fruits/plant and Swamy., *et al*. [4] for fruit weight.

Days to first picking showed negative and highly significant correlation with fruit yield/plant, plant height at final harvest and number of fruits/plants. It also showed negative and significant correlation with fruit girth and number of seeds/fruits. Similar results were obtained by Simon., *et al*. [13] for number of fruits/plants. It indicates that selection of plants showing early flowering and early maturity can provide better results for improvement of fruit yield/plant. Fruit girth exhibited negative and significant correlation with fruit length. This was in accordance with the earlier observations made by Patil., *et al*. [20].

The complexity of character relationships among themselves and with fruit yield became evident from the discussion alone but did not provide a comprehensive picture of relative importance of direct and indirect influences of each of the characters to the fruit yield, as these traits were the resultant product of combined effects of various factors complementing or counter- acting. The path coefficient analyses developed by Wright [21] provides an effective means of untangling direct and indirect causes of association and permits a critical examination of the specific forces acting to produce a given co-relation. In the present study, the phenoltypic correlations were partitioned into direct and indirect effects to identify relative importance of yield component towards fruit yield of okra during both the seasons.

Green fruit in okra is important as this is utilized as vegetable throughout the world. Hence, the direct effect and positive association with fruit yield per plant was considered essential. Path

coefficient analysis revealed that number of fruits/plants had highest positive direct effect on fruit yield/plant. This was in accordance to reports by Nirosha., *et al*. [10], Gogineni., *et al*. [5], Patil., *et al*. [20], Yadav., *et al*. [8] and Mishra., *et al*. [22]. Positive direct effect on fruit yield/plant was recorded for fruit weight, days to first picking, internodal length, 100 seed weight and fruit length. Similar results were reported by Swamy., *et al*. [4], Saryam., *et al*. [23], Patil., *et al*. [20], Yadav., *et al*. [8] and Mishra., *et al*. [22] for fruit weight; Chhatrola and Monapara [24] for days to first picking; Koundinya and Dhankhar [25] for internodal length; Swamy., *et al*. [4] and Saryam., *et al*. [23] for 100 seed weight and Umesh., *et al*. [26], Sundaram [12], Kumar and Reddy [6], Yadav., *et al*. [8] and Mishra., *et al*. [22] for fruit length. Direct selection practiced on these characters will result in improvement in yield [27].

Fruit girth, plant height at final harvest, number of branches/plants, days to first flowering and number of seeds/fruits had negative direct effect on fruit yield/plant. Similar results were reported by Umesh., *et al*. [26], Sundaram [12], Yadav., *et al*. [8] and Mishra., *et al*. [22] for fruit girth; Gogineni., *et al*. [5] for plant height at final harvest; Singh and Goswami [15], Kumar and Reddy [6] and Mishra., *et al*. [22] for number of branches/plant; Umesh., *et al*. [26] and Yadav., *et al*. [8] for days to first flowering and and Yadav., *et al*. [8] for number of seeds/fruit. These important traits may be viewed in selection programme for the further improvement of okra.

Thus, okra fruit yield is a cumulative consequence of fruit number and fruit weight. These two traits deserve considerable attention by okra breeders and need to be collectively enhanced to develop an ideotype.

SR. No.	Days to first flowering	Days to first picking	Plant height at final harvest	Number of branches/ plants at final harvest	Internodal length	Fruit length	Fruit girth	Fruit weight	Number of fruits/ plants	100 seed weight	No. of seeds/ fruit	Correlation Coefficient with fruit yield/plant
Days to first flowering	**-0.01**	0.01	0.0013	0.0003	0.0006	0.0001	0.0002	-0.06	-0.18	0.0005	0.001	-0.23**
Days to first picking	-0.01	**0.01**	0.0013	0.0005	0.0005	0.0001	0.0002	-0.05	-0.19	0.0005	0.001	-0.23**
Plant height at final harvest	0.002	-0.003	**-0.006**	-0.003	0.002	-0.0001	-0.0003	0.05	0.61	0	-0.001	0.65**
Number of branches/ plants at final harvest	0.0005	-0.0008	-0.0025	**-0.008**	0.001	0	-0.0002	0.07	0.42	0.0006	-0.001	0.48**
Internodal length	-0.001	0.001	-0.0016	-0.002	**0.007**	-0.0001	-0.0001	0.03	0.12	0.0003	-0.0002	0.16**
Fruit length	-0.0009	0.001	0.0003	0.0002	-0.0006	**0.001**	0.0002	0.09	-0.07	0.001	-0.003	0.03
Fruit girth	0.001	-0.002	-0.0015	-0.001	0.0007	-0.0002	**-0.001**	0.1	0.23	0.0002	-0.002	0.32**
Fruit weight	0.002	-0.002	-0.0008	-0.002	0.0006	0.0003	-0.0003	**0.36**	0.14	0.001	-0.007	0.50**
Number of fruits/plants	0.002	-0.003	-0.0042	-0.004	0.0009	-0.0001	-0.0003	0.06	**0.88**	0.0001	-0.001	0.93**
100 seed weight	-0.002	0.002	0	-0.002	0.0006	0.0004	-0.0001	0.11	0.04	**0.003**	-0.003	0.15**
No. of seeds/ fruit	0.002	-0.002	-0.0006	-0.001	0.0001	0.0003	-0.0002	0.21	0.11	0.0007	**-0.01**	0.31**

Table 2: Direct and indirect effects of eleven casual variables on fruit yield/plant in okra.

Residual effect = 0.0108

Note: Dark values indicate direct effect of different characters on fruit yield.

Conclusion

The results of the present investigation indicated that fruit yield/plant exhibited positive and highly significant correlation with number of fruits/plants, plant height at final harvest, fruit weight, number of branches/plants, fruit girth, number of seeds/fruits, internodal length, and 100 seed weight. Path coefficient analysis revealed that number of fruits/plants, fruit weight, days to first picking, internodal length, 100 seed weight and fruit length are the most important characters contributing towards fruit yield.

Bibliography

1. Anonymous. "Horticultural Statistics at a Glance 2017". Horticulture Statistics Division Department of Agriculture, Cooperation and Farmers Welfare. Ministry of Agriculture and Farmers Welfare Government of India (2017).

2. Goulden CH. "Methods of statistical analysis". Asia Publishing house Calcutta (1959).

3. Dewey DR and Lu KH. "A correlation and path coefficient analysis of components of crested wheat grass seed production". *Agronomy Journal* 51 (1959): 515-518.

4. Swamy BN., *et al.* "Correlation and path coefficient analysis studies for quantitative traits in okra (Abelmoschus esculentus (L.) Moench)". *Environment and Ecology* 32.4B (2014): 1767-1771.

5. Gogineni S., *et al.* "Character association and path analysis for yield and yield components in okra (Abelmoschus esculentus (L.) Moench)". *International Journal of Scientific Research* 4.6 (2015): 141-143.

6. Kumar S and Reddy MT. "Correlation and path coefficient analysis for yield and its components in okra (Abelmoschus esculentus (L.) Moench)". *Advances in Agricultural Science* 4.4 (2016): 72-83.

7. Kerure P., *et al.* "Studies on variability, correlation and path analysis of traits contributing to fruit yield and its components in okra (Abelmoschus esculentus (L.) Moench)". *Electronic Journal of Plant Breeding* 8.1 (2017): 134-141.

8. Yadav R., *et al.* "Correlation and path analyses for fruit yield and its component traits in okra [Abelmoschus esculentus (L.) Moench] genotypes". *International Journal of Agriculture Sciences* 9.13 (2017): 4063-4067.

9. Aminu D., *et al.* "Varietal performance and correlation of okra pod yield and yield components". Acta Universitatis Sapientiae Agriculture and Environment 8 (2016): 112-125.

10. Nirosha K., *et al.* "Correlation and path analysis studies in okra (Abelmoschus esculentus (L.) Moench)". *Agricultural Science Digest* 34.4 (2014): 313-315.

11. Shivaramegowda KD., *et al.* "Genotypic variation among okra (Abelmoschus esculentus (L.) Moench) Germplasms in South India". *Plant Breed Biotechnology* 4.2 (2016): 234-241.

12. Sundaram V. "Genetic analysis in bhendi (Abelmoschus esculentus (L.) Moench)". *Agricultural Science Digest* 35.3 (2015): 233-236.

13. Simon SY., *et al.* "Correlation and path coefficient analyses of seed yield and yield components in okra (Abelmoschus esculentus (L.) Moench)". *International Journal of Advanced Research* 1.3 (2013): 45-51.

14. Kumar P and Kumar R. "Variability, heritability and character association in okra [Abelmoschus esculentus (L.) Moench]". *Asian Journal of Biological Sciences* 9.1 (2014): 9-13.

15. Singh B and Goswami, A. "Correlation and path coefficient analysis in okra (Abelmoschus esculentus)". *Indian Journal of Agricultural Sciences* 84.10 (2014): 1262-1266.

16. Nwangburuka CC., *et al.* "Genetic variability and heritability in cultivated okra [Abelmoschus esculentus (L.) Moench]". *Spanish Journal of Agriculture Research* 10.1 (2012): 123-129.

17. Vani VM., *et al.* "Variability studies in okra Abelmoschus esculentus (L.) Moench". *Environment and Ecology* 30 (2012): 1203-1206.

18. Das S., *et al.* "Genetic parameters and path analysis of yield and its components in okra at different sowing date in gangetic plains of eastern India". *African Journal of Biotechnology* 11.95 (2012): 16132-16141.

19. Annapurna Yadav., *et al.* "Genetic variability, heritability, genetic advance, correlation and path analysis in okra". *HortFlora Research Spectrum* 1.2 (2012): 139-144

20. Patil BT., *et al.* "Correlation and path analysis studies in okra (Abelmoschus esculentus (L.) Moench)". *Vegetable Science* 43.2 (2016): 226-229.

21. Wright S. "Correlation and causation". *Journal of Agricultural Research* 20 (1921): 557-587.

22. Mishra A., *et al.* "Path co-efficient analysis in okra (Abelmoschus esculentus (L.) Moench)". *International Journal of Advanced Research* 6.1 (2018): 441-444.

23. Saryam DK., *et al.* "Correlation and path co-efficient analysis of quantitative traits in okra (Abelmoschus esculentus (L.) Moench)". *The Bioscan* 10.2 (2015): 735-773.

24. Chhatrola MD and Monpara BA. "Correlation and path analysis - their implications in okra (Abelmoschus esculentus (L.) Moench) improvement". *National Journal of Improve* 7.2 (2005): 127-130.

25. Koundinya AVV and Dhankar SK. "Correlation and path analysis of seed yield components in okra (Abelmoschus esculentus (L.) Moench)". *Annals of Horticulture* 6.1 (2013): 145-148.

26. Umesh Chauhan PS., *et al.* "Correlation and path analysis of yield and yield contributing traits in okra (Abelmoschus esculenltus (L.) Moench)". *Progressive Horticulture* 46.2 (2014): 349-353.

27. Kumar S., *et al.* "Correlation co-efficient and path analysis studies in okra (Abelmoschus esculentus (L.) Moench)". *Annals of Horticulture* 2.2 (2009): 166-170.

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