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**RESEARCH ARTICLE**

# GENETIC VARIABILITY, CORRELATION AND PATH COEFFICIENT ANALYSIS IN BITTERGOURD (Momordica charantia L.)

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## *Abstract*

Variability, correlation and Path coefficient among eight horticultural characters of twenty bitter gourd hybrids were studied. High genotypic (GCV) and phenotypic coefficient of variation (PCV) was observed for number of fruits per plant, fruit weight and fruit length whereas low GCV and PCV was observed for days to first male and female flower anthesis (days after sowing). For most of the parameters under study, PCV was found to be higher than GCV. High heritability with high genetic advance (GA) was observed for fruit weight, fruit length and number of fruits per plant which is an indicative of greater proportion of additive genetic variance and consequence a high genetic gain from selection. High heritability with low genetic advance was observed for days to first male and female flower anthesis and days to marketable maturity from anthesis, indicated that non-additive gene effects were involved for the expression of these characters. Correlation analysis revealed that number of fruits per plant had significant positive correlation for yield. Further, path coefficient analysis partitioned the correlation into direct and indirect effects. Yield was found to be directly correlated with fruit weight, number of fruits per plant and fruit length, hence selection based on these characters would be more rewarding.



## Introduction

Bitter gourd, a member of the Cucurbitaceae family, is known as bitter melon, balsam pear and karela. It grows in tropical areas of the Amazon, East Africa, Asia, India, South America and the Caribbean and is used traditionally both as food and medicine. The assessment of variability present in any crop species is an essential pre-requite for formulating an effective breeding programme, as the existing variability can be used to enhance the yield level of cultivars following appropriate breeding strategies (Patil et al., 2012). The information on heritability alone may not help to identify characters for selection whereas heritability estimates in conjunction with predicted genetic advance is more reliable (Johnson et al., 1955). Heritability provides the information on the magnitude of inheritance of characters from parent to offspring, while genetic advance will be helpful in finding the actual gain expected under selection. A rational choice of characters on which selection is to be exercised for higher yields requires an understanding of the association of characters with yield and among themselves. Further path coefficient analysis is an efficient tool to elucidate the direct and indirect effect of each character towards yield. Hence, the present investigation was taken up to study the association of yield and its component traits in bitter gourd.

## MATERIALS AND METHODS

The study was conducted at the Vegetable Science Research Farm, Punjab Agricultural University, Ludhiana during 2013. The experiment consisted of twenty bittergourd hybrids sown in randomized complete block design with three replications. Recommended cultural practices were followed to raise a good crop. Parameters viz. marketable yield per plant, number of fruits per plant, fruit weight (g), fruit length (cm), fruit width (cm), days to first male flower anthesis, days to first male and female flower anthesis (days after sowing), days to marketable maturity after anthesis were recorded from six randomly selected plants from each replication. Analysis of variance, genotypic and phenotypic coefficient of variation, heritability and genetic advance as per cent of mean were estimated by formula suggested by Singh and Chaudhary (1985). The phenotypic and genotypic correlation co-efficient was calculated as per formulae suggested by Al-Jibouri et al. (1958) and Miller et al. (1958).The path coefficient analysis was performed according to Dewey and Lu (1959).

## RESULTS AND DISCUSSION

The analysis of variance showed the presence of significant high variability for all the characters under study (Table 1). Mean sum of squares due to genotypes and error was maximum for fruit number followed by fruit weight. The phenotypic coefficient of variation was found to be higher than the genotypic coefficient of variation for all traits under study. The genotypic coefficient of variation obtained for yield and its attributing traits ranged from 4.03-37.61. The highest genotypic coefficient of variation was observed for number of fruits per plant (37.61) followed by fruit weight (31.73) and fruit length (24.05). The genotypic coefficient of variation was low for days to first male (4.75) and first female flower anthesis (4.03). Phenotypic coefficient of variation was high for number of fruits per plant (39.92) followed by fruit weight (32.26) and low for days to first female (5.63) and first male flower anthesis (5.60). Study on GCV and PCV indicated the extent of variability for different traits in bitter gourd and these results are in conformity with Islam et al (2009). Higher Genotypic and phenotypic coefficient of variation was recorded for number of fruits per plant, fruit weight and fruit length indicated that, these test hybrids exhibited much variation among themselves with respect to these characters offering more scope for selection. PCV and GCV recorded for days to first male and female flower anthesis was low and in agreement with Islam et al (2009).

High heritability coupled with low genetic advance, low heritability with high genetic advance or low heritability and low genetic advance offers less scope for selection because of non additive genetic effects. High heritability coupled with high genetic advance showed greater proportion of additive genetic variance and consequence a high genetic gain expected from selection (Devi and Mariappan, 2013). The characters having heritability with low genetic advance as percent of mean appeared to be controlled by non-additive gene action and selection for such characters may not be effective (Singh and Singh, 2007). Heritability values were found to be high for most of the characters. Heritability value was found to be high for fruit weight (96.74%) followed by fruit length (91.25%) and number of fruits per plant (88.75%). Genetic advance as percent of mean ranged from 72.99 for number of fruits per plant to 5.65 for days to marketable maturity. High genetic advance was recorded for fruit weight (64.29%) and fruit length (47.33%) whereas, moderate for marketable yield per plant (17.25%) and fruit width (17.59%) (Table 1). High genetic advance indicated that, additive genes govern these characters and selection will be rewarding for improvement of these traits. The genetic advance was low for days taken to marketable maturity, days to first male and female flower anthesis. Similar results were reported for fruit weight and fruit yield by Malek et al. (2007), Sachan and Tikka (1971) and Singh et al. (1977) in pointed gourd, water melon and bitter gourd, respectively. Singh and Prasad (1989) and Masud et al. (1998) also reported high heritability for number of fruits per plant, fruit weight and fruit yield in pointed gourd and pumpkin, respectively.

Yield is the result of the expression and association of several yield attributing traits, which contribute additively or help in some conditions in modifying the expression of other traits directly or indirectly. It is therefore desirable for plant breeder to know the extent of relationship between yield and its various components, which will inevitably facilitate selection of desirable characteristics. Correlation and path coefficient become necessary tools at the disposal of the breeder. Correlation measures the mutual association between two variables, which aids in determining the most effective procedures for selection of superior genotypes. When there is positive association for major yield trait components, breeding would be very effective but on the contrary, it becomes difficult to exercise simultaneous selection for them to develop a variety. According to Cramer and Wehner (2000) path coefficient analysis can be employed to partition the correlation between yield and its components into direct and indirect effects. Salahuddin et al. (2010) affirms that path coefficient analysis provides an effective means of partitioning correlation coefficients into unidirectional and alternative pathways thus permitting a critical examination of specific factors that produce a given correlation, which can be successfully employed in formulating an effective selection programme.

Correlation studies showed that for most of the characters, genotypic correlation was higher than the corresponding phenotypic correlation (Table 2). This could be interpreted on the basis that there was a strong inherent genotypic relationship between the characters under study, but their phenotypic expression was impeded by the influences of environmental factors. Days taken to marketable maturity showed non significant negative whereas number of fruits per plant significant positive correlation for marketable yield per plant. Fruit length showed significant high correlation for fruit weight. Days to first female flower anthesis, fruit weight and fruit length had negative but non-significant phenotypic and genotypic correlation whereas fruit width exhibited significant negative correlation with yield. Our results are in concordance with Islam et al. (2009). A strong significant positive correlation was observed between days to first female flower anthesis, fruit weight, fruit length and fruit width.

It was observed from path analysis that fruit number followed by fruit weight, days to first male flower anthesis, days to first female flower anthesis and fruit length exhibited maximum positive direct effect (Table 3). Days to first male flower anthesis exhibited negative effect on yield. Phenotypic path coefficient showed positive direct effect of fruit length and days to marketable maturity on yield whereas genotypic path coefficient had negative direct effect. Fruit weight, fruit length and days to first female flower anthesis although, exhibited high positive direct effect upon yield but negative correlation because of indirect effect by means of other characters. The fruit weight showed more negative indirect effect via fruit length. It might be due to the fact that with increase in fruit size the number of fruits per plant gets decreased. Hence, it presumed to be difficult to increase the fruit weight and number of fruits simultaneously through selection beyond a certain limit.

From the present study it can be inferred that the characters viz. fruit number, fruit weight, fruit length, days to first female flower anthesis showed positive direct effect on yield Therefore these characters should be considered for selection to improve yield.

**Table 1: Estimates of genetic parameters for some economic characters in bitter gourd**

| Characters | CD | CV | Hy (%) | GA (%) | PCV | GCV | MSG | MSE |
|---|---|---|---|---|---|---|---|---|
| **Fruit number per plant** | 12.37 | 13.39 | 88.75 | 72.99 | 39.92 | 37.61 | 1382.29 | 56.01 |
| **Fruit weight (g)** | 5.11 | 5.82 | 96.74 | 64.29 | 32.26 | 31.73 | 862.89 | 9.57 |
| **Fruit length (cm)** | 1.66 | 7.45 | 91.25 | 47.33 | 25.18 | 24.05 | 32.52 | 1.01 |
| **Fruit width (cm)** | 0.54 | 8.92 | 60.30 | 17.59 | 14.16 | 10.99 | 0.60 | 0.11 |
| **Days to first male flower anthesis** | 3.03 | 2.96 | 72.02 | 8.30 | 5.60 | 4.75 | 29.37 | 3.37 |
| **Days to first female flower anthesis** | 4.43 | 3.94 | 51.19 | 5.94 | 5.63 | 4.03 | 29.79 | 7.18 |
| **Days to marketable maturity** | 2.01 | 10.39 | 23.16 | 5.65 | 11.85 | 5.70 | 2.83 | 1.49 |
| **Marketable yield per plant (kg)** | 0.45 | 10.24 | 54.93 | 17.25 | 15.25 | 11.30 | 0.35 | 0.07 |

CD= critical difference, CV= coefficient of variance, Hy (%) = heritability, GA= genetic advance, PCV= phenotypic coefficient of variance, GCV= genotypic coefficient of variance, MSG= mean sum of square due to genotypes, MSE= mean sum of square due to error.

**Table 2: Genotypic and phenotypic correlation co-efficient among different characters of bitter gourd**

| Characters | | Fruit number per plant | Fruit weight (g) | Fruit length (cm) | Fruit width (cm) | Days to first male flower anthesis | Days to first female flower anthesis | Days to marketable maturity |
|---|---|---|---|---|---|---|---|---|
| **Fruit weight (g)** | **G** | -0.8728* | | | | | | |
| | **P** | -0.8381* | | | | | | |
| **Fruit length (cm)** | **G** | -0.8079* | 0.7189* | | | | | |
| | **P** | -0.7157* | 0.6814* | | | | | |
| **Fruit width (cm)** | **G** | -0.4645* | 0.3286* | 0.0833 | | | | |
| | **P** | -0.3738* | 0.2685* | 0.0696 | | | | |
| **Days to first male flower anthesis** | **G** | -0.3201* | 0.1435 | 0.3423* | 0.3288* | | | |
| | **P** | -0.2527 | 0.1112 | 0.2402 | 0.1641 | | | |
| **Days to first female flower anthesis** | **G** | -0.5854* | 0.3340* | 0.5560* | 0.4591* | 1.1116* | | |
| | **P** | -0.4273* | 0.2654* | 0.3622* | 0.2537 | 0.6479* | | |
| **Days to marketable maturity** | **G** | 0.1692 | -0.2572* | -0.4135* | 0.6313* | 0.7304* | 0.6220* | |
| | **P** | 0.1162 | -0.1376 | -0.1721 | 0.2602* | 0.3829* | 0.3128* | |
| **Marketable yield per plant** | **G** | 0.2768* | -0.0740 | -0.1102 | -0.4493* | -0.0108 | -0.0681 | 0.1905 |
| | **P** | 0.3679* | -0.0568 | -0.0583 | -0.3006* | -0.0300 | -0.0814 | 0.1332 |

*significant at 5%, G= Genotypic correlation coefficient, P= Phenotypic correlation coefficient

**Table 3: Genotypic and phenotypic path coefficients among different characters of bitter gourd**

| Characters | | Fruit number per plant | Fruit weight (g) | Fruit length (cm) | Fruit width (cm) | Days to first male flower anthesis | Days to first female flower anthesis | Days to marketable maturity |
|---|---|---|---|---|---|---|---|---|
| **Fruit number per plant** | **G** | **1.3492** | -0.9652 | 0.8051 | -0.1195 | -0.4103 | -0.1430 | -0.2395 |
| | **P** | **1.1962** | -0.6880 | -0.1640 | 0.0594 | -0.0072 | -0.0452 | 0.0167 |
| **Fruit weight (g)** | **G** | -1.1776 | **1.1058** | -0.7163 | 0.0845 | 0.1838 | 0.0816 | 0.3641 |
| | **P** | -1.0026 | **0.8209** | 0.1562 | -0.0426 | 0.0031 | 0.0281 | -0.0198 |
| **Fruit length (cm)** | **G** | -1.0901 | 0.7950 | **-0.9964** | 0.0214 | 0.4387 | 0.1358 | 0.5854 |
| | **P** | -0.8562 | 0.5594 | **0.2292** | -0.0111 | 0.0068 | 0.0383 | -0.0248 |
| **Fruit width (cm)** | **G** | -0.6267 | 0.3634 | -0.0830 | **0.2573** | 0.4213 | 0.1121 | -0.8938 |
| | **P** | -0.4471 | 0.2204 | 0.0159 | **-0.1588** | 0.0046 | 0.0269 | 0.0375 |
| **Days to first male flower anthesis** | **G** | -0.4319 | 0.1586 | -0.3411 | 0.0846 | **1.2816** | 0.2716 | -1.0342 |
| | **P** | -0.3023 | 0.0913 | 0.0550 | -0.0261 | **0.0283** | 0.0686 | 0.0551 |
| **Days to first female flower anthesis** | **G** | -0.7898 | 0.3694 | -0.5540 | 0.1181 | 1.4246 | **0.2443** | -0.8807 |
| | **P** | -0.5112 | 0.2178 | 0.0830 | -0.0403 | 0.0184 | **0.1059** | 0.0450 |
| **Days to marketable maturity** | **G** | 0.2282 | -0.2844 | 0.4120 | 0.1624 | 0.9361 | 0.1520 | **-1.4158** |
| | **P** | 0.1390 | -0.1129 | -0.0394 | -0.0413 | 0.0108 | 0.0331 | **0.1440** |

Diagonal (Bold) = direct effect, G= genotypic path coefficient, P= phenotypic path coefficient

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## REFERENCES

Al-Jibouri, H.A., Miller, P.A., Robinson, H. F. (1958): Genetic and environmental variances and covariances in upland cotton cross of interspecific origin. Agron. J., 50: 633-37.

Cramer, C. S. and Wehner, T. C. (2000): Path analysis of the correlation between fruit number and plant traits of cucumber populations. Hort Sci., 35(4): 708-11.

Devi, N.D. and Mariappan, S. (2013): Genetic variability, heritability and genetic advance for yield and its components snake gourd (Trichosanthes anguina L.). African J. Agric. Res., 8(26):3857-3859.

Dewey, D.R. and Lu, K.H. (1959): A correlation and path analysis of components of crested wheat grass seed production. Agron. J., 51: 515-518.

Islam, M.R., Hossain, M.S., Buiyan, M.S.R., Husna, A., Syed, M.A. (2009): Genetic variability and path coefficient analysis of bittergourd (Momordica charantia L.). Intl. J. Sustainable Agric., 1(3): 53-57.

Johnson, H.W., Robinson, H.F., Comstock, R.E. (1955): Estimation of Genetic variability and environmental variability in soybean. J. Agron., 47:314-318.

Malek, M. A. Bari Miah1,M.A., Islam, M.O., Mosiul, A.M.M., Gomes, R. (2007): Genetic variability, heritability and genetic advance in pointed gourd (Trichosanthes dioica Roxb.) Bangladesh J. Pl. Breed. Genet., 20(1): 47-52.

Masud, M. A. T., Ahmed, S.U., Saha, S.R. (1998): Variability and association of yield and yield attributes in pumpkin land races. Bangladesh Hort., 26 (1-2): 5-8.

Miller, P.A., Williams, C.V., Robinson, H.F., Comstock, R.E. (1958): Estimates of genotypic and environmental variance and covariance in upland cotton and their implication in selection. Agron. J., 50 : 126-31.

Patil, P.R., Surve, V.H., Mehta H.D. (2012): Line x Tester analysis in Rice (Oryza sativa L.). Madras Agric. J., 99:210-213.

Sachan, S. C. P. and Tikka. S. B. B. (1971): Genetic variability and correlation studies in water melon. Rajasthan J. Agric. Sci., 2: 91-96.

Salahuddin, S., Abro, M., Kandhro, M., Salahuddin, L., Laghari, S. (2010): Correlation and path coefficient analysis of yield components of upland cotton [Gossypium hirsutum (L.)] sympodial. World Appl. Sci. J., 8: 71-75.

Singh, A.K. and Singh, N. (2007): Studies on genetic variability and heritability in balsam (Impaties balsamina). J. Ornamental Hort., 10:128-130.

Singh, D. P. and V. S. R. K Prasad. (1989): Variability and correlation studies in pointed gourd (Trichosanthes diocica Roxb). Indian J. Hort., 46 (2): 204-209.

Singh, H. N., Srivastava, J.P., Prasad, R. (1977): Genetic variability and correlation studies in bittergourd. Indian J. Agril. Scientist, 47: 604-07.

Singh, R.K. and Chaudhary B.D. (1985): Biometrical methods of quantitative genetic analysis. Haryana J.Hort. Sci., 12(2): 151-156.