GAU Res. J., **34** (2) : 83-87 (2009)

# Genetic variability, correlation and path analysis in moth bean

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## Abstract

**Genetic associations among 30 genotypes of moth bean were worked out for 12 characters. The genotypic coefficient of variation was highest for branches per plant followed by grain yield per plant, clusters per plant and pods per plant. High heritability estimates were observed for grain yield per plant, days to 50 % flowering, days to maturity, plant height, branches per plant, clusters per plant, pods per plant and harvest index. The expected genetic advance as % of mean was high for grain yield per plant, branches per plant, clusters per plant and pods per plant. The correlation studies revealed high correlation of grain yield with pods per plant, clusters per plant, harvest index, branches per plant, days to 50 % flowering, days to maturity and plant height.**

**Key words**: *Correlation, moth bean, path analysis, variability.*

## Introduction

Moth bean [*Vigna aconitifolia* (Jacq) Marechal] is an important pulse crop extensively grown in arid and drier semi-arid regions of India. It is known as kidney bean, aconite bean, with several vernacular names also in different linguistic zones of India. It is the most drought resistant crop among all the *kharif* pulses. A thorough knowledge of existing genetic variation and degree of association between yield contributing characters is essential for developing high yielding genotypes in moth bean. The observed variability is a combined measure of genetic and environmental causes. However, only the genetic variability is heritable from generation to generation. Heritability and genetic advance serve as useful tool to the breeder in determining the direction and magnitude of selection. Correlation studies provide an opportunity to study the magnitude and direction of association of yield with its components and also among various components. To accumulate optimum combination of yield contributing characters in a single genotype, it is essential to know the implication of the interrelationships of various characters along with path coefficients. Considering these points, the present study was undertaken to evaluate the genotypes for yield and its components and to understand inter-relationship among economic traits in moth bean.

## Materials and methods

The present investigation was conducted during *kharif* season 2003, at the Pulse Research Station, Navsari Agricultural University, Navsari with 30 genotypes of moth bean obtained from Pulse Research Station, Sardarkrushinagar Datiwada Agricultural University, Sardarkrushinagar. The experiment was laid out in randomized block design having three replications. Each genotype was grown in a plot of three rows of 2.0 m length each with inter row spacing of 45 cm. Intra row spacing of plants was kept at 15 cm. Observations were recorded on five randomly selected plants for each genotype in each replication for days to 50 % flowering, plant height (cm), branches per plant, clusters per plant, pods per plant, seeds per pod, pod length (cm), 100-seed weight (g), grain yield per plant (g), harvest index (%), and protein content (%) were recorded. Phenotypic and genotypic coefficients of variation were estimated as per standard procedure of Burton (1), heritability in broad sense and expected genetic advance by using the methodology suggested by Allard (2). Correlation coefficients were calculated by the procedure described by Panse and Sukhatme (3) and path analysis was done following the method suggested by Dewey and Lu (4).

## Results and discussion

The estimates of variability parameters for yield and its components are presented in Table 1. A wide range of phenotypic variability was observed and the genotypes showed significant differences in respect of all the characters studied. The grain yield per plant, branches per plant, clusters per plant and pods per plant showed high genotypic coefficient of variation (GCV) indicating that these characters are highly amenable for selection. Days to 50 % flowering, plant height, days to maturity, seeds per pod, pod length, 100-seed weight and harvest index showed low values of GCV. Similar results were reported by Venkateswarlu (5) and Pal *et al.* (6). The closeness between genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) indicated low environmental influence on all the characters under study. High heritability estimates give the best picture of the genetic advance that can be expected to be achieved by selection. High heritability coupled with high genetic advance were observed for branches per plant, grain yield per plant, clusters per plant and pods per plant as reported earlier by Khairnar *et al.* (7).

The correlation analysis (Table-2) revealed that grain yield was significantly and positively correlated with pods per plant, clusters per plant, branches per plant, days to 50 % flowering and days to maturity. This indicated that selection based on these characters may result in improved yield. Similar results were reported by Gupta *et al.* (8), protein content showed negative correlation with yield.

The high positive correlation values obtained for days to 50 % flowering, days to maturity, plant height, branches per plant, clusters per plant, pods per plant and harvest index and the significant inter correlations existing among themselves revealed that these characters may be considered for improvement of yield. On the basis of present investigation of inter relationship, it can be presumed that for improving grain yield in moth bean, an ideal plant type would be late flowering, late maturity, more plant height, more number of clusters and pods more number of branches and higher harvest index. Association of the above mentioned characters with grain yield per plant elucidates the importance of proper source to sink relationship. During the vegetative phase, a plant builds up the morphological framework needed for the reproductive phase. It would be rational to expect that a genotype which has longer vegetative period as in the present case i.e., late flowering will have greater ability to give more yield than a genotype which flowers earlier. Similarly a genotype which takes more number of days to maturity is expected to fill the sink to more extent than the genotype taking less number of days to

**Table 1.** Estimates of variability parameters for yield and its components in moth bean

| Character | Range | Mean | Variance | | | GCV (%) | PCV (%) | $h^2$ (n) (%) | GA | GA as % of mean |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | $\sigma^2_g$ | $\sigma^2_p$ | $\sigma^2_e$ | | | | | |
| Grain yield per plant (g) | 1.75 - 8.05 | 4.65 | 3.27 | 3.72 | 0.45 | 38.86 | 41.48 | 95.61 | 3.80 | 81.72 |
| Days to 50% flowering | 27.66 - 51.00 | 37.80 | 55.08 | 62.30 | 7.22 | 19.63 | 20.88 | 95.82 | 15.57 | 41.19 |
| Days to maturity | 48.00 - 88.66 | 65.84 | 167.75 | 190.45 | 22.7 | 19.67 | 20.96 | 95.68 | 27.20 | 41.31 |
| Plant height (cm) | 13.66 - 31.60 | 23.33 | 22.75 | 28.26 | 5.51 | 20.45 | 22.79 | 92.55 | 10.13 | 43.42 |
| No. of branches per plant | 1.00 - 4.93 | 2.82 | 1.26 | 1.42 | 0.16 | 39.85 | 42.35 | 95.89 | 2.81 | 99.64 |
| No. of clusters per plant | 6.73 - 29.32 | 16.74 | 41.97 | 47.64 | 5.67 | 38.69 | 41.23 | 95.69 | 13.60 | 81.24 |
| No. of pods per plant | 16.84 - 73.30 | 41.85 | 262.63 | 297.91 | 35.28 | 38.72 | 41.24 | 95.71 | 8.01 | 19.13 |
| No. of seeds per pod | 4.20 - 6.89 | 5.12 | 0.34 | 0.61 | 0.26 | 11.54 | 15.32 | 79.68 | 1.28 | 25.00 |
| Pod length (cm) | 2.63 - 4.31 | 3.20 | 0.13 | 0.24 | 0.10 | 11.54 | 15.32 | 80.00 | 0.80 | 25.00 |
| 100-seed weight (g) | 1.68 - 2.82 | 1.86 | 0.04 | 0.07 | 0.03 | 10.73 | 14.89 | 76.48 | 0.43 | 23.11 |
| Harvest index (%) | 12.11 - 28.10 | 20.70 | 17.12 | 22.73 | 5.61 | 19.98 | 23.03 | 90.15 | 8.85 | 42.75 |
| Protein content (%) | 18.17 - 22.58 | 20.73 | 1.43 | 2.56 | 1.13 | 5.77 | 7.73 | 79.09 | 2.60 | 12.54 |

**Table 2.** Phenotypic correlation coefficients among twelve characters in moth bean

| Characters | Days to 50% flowering | Days to maturity | Plant height | No. of branches per plant | No. of clusters per plant | No. of pods per plant | No. of seeds per pod | Pod length | 100-seed weight | Harvest index | Protein content |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Grain yield per plant (g) | 0.420** | 0.312** | 0.330** | 0.442** | 0.809** | 0.877** | 0.170 | 0.141 | 0.203 | 0.727** | -0.104 |
| Days to 50% flowering | | 0.454** | 0.056 | 0.358** | 0.450** | 0.422** | -0.078 | 0.066 | -0.118 | 0.275** | -0.083 |
| Days to maturity | | | 0.095 | 0.007 | 0.348** | 0.258* | -0.002 | 0.173 | -0.109 | 0.120 | -0.142 |
| Plant height | | | | 0.295** | 0.211* | 0.294** | 0.203 | -0.124 | 0.087 | 0.388** | 0.006 |
| No. of branches per plant | | | | | 0.461** | 0.451** | -0.020 | 0.133 | -0.167 | 0.480** | -0.352** |
| No. of clusters per plant | | | | | | 0.786** | -0.038 | 0.077 | -0.170 | 0.633** | -0.304** |
| No. of pods per plant | | | | | | | 0.111 | 0.145 | -0.030 | 0.656** | -0.124 |
| No. of seeds per pod | | | | | | | | 0.060 | 0.316** | 0.107 | 0.041 |
| Pod length | | | | | | | | | 0.023 | 0.180 | -0.027 |
| 100-seed weight | | | | | | | | | | 0.214* | 0.388** |
| Harvest index | | | | | | | | | | | -0.075 |

* Significant at 5 % level
** Significant at 1 % level

**Table 3.** Direct and indirect effect of twelve casual variable on grain yield in moth bean

| Characters | Direct effect | Indirect effect via: Days to 50% flowering | Days to maturity | Plant height | No. of branches per plant | No. of clusters per plant | No. of pods per plant | No. of seeds per pod | Pod length | 100-seed weight | Harvest index | Protein content | Correlation coefficient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Days to 50% flowering | 0.320 | - | -0.016 | -0.040 | -0.163 | -0.220 | 0.654 | 0.029 | 0.011 | -0.110 | -0.074 | 0.087 | 0.477** |
| Days to maturity | -0.033 | 0.151 | - | 0.010 | 0.003 | -0.167 | 0.384 | -0.028 | 0.033 | -0.104 | -0.040 | 0.153 | 0.362** |
| Plant height (cm) | 0.421 | -0.030 | -0.001 | - | -0.126 | -0.106 | 0.471 | -0.225 | -0.027 | 0.151 | -0.116 | -0.008 | 0.404** |
| No. of branches per plant | -0.388 | 0.134 | 0.000 | 0.136 | - | -0.197 | 0.692 | 0.051 | 0.020 | -0.022 | -0.125 | 0.374 | 0.476** |
| No. of clusters per plant | -0.415 | 0.169 | -0.013 | 0.107 | -0.184 | - | 1.238 | 0.023 | 0.012 | -0.191 | -0.163 | 0.315 | 0.897** |
| No. of pods per plant | 1.379 | 0.151 | -0.009 | 0.144 | -0.195 | -0.373 | - | -0.111 | 0.016 | -0.073 | -0.167 | 0.158 | 0.920** |
| No. of seeds per pod | -0.541 | -0.017 | -0.002 | 0.175 | 0.036 | 0.017 | 0.283 | - | -0.034 | 0.476 | -0.022 | -0.114 | 0.258* |
| Pod length | 0.127 | 0.028 | -0.009 | -0.089 | -0.062 | -0.038 | 0.172 | 0.146 | - | -0.057 | -0.051 | -0.049 | 0.118 |
| 100-seed weight | 0.797 | -0.044 | 0.004 | 0.080 | 0.108 | 0.100 | -0.127 | -0.323 | 0.009 | - | -0.012 | -0.482 | 0.093 |
| Harvest index | 0.218 | 0.108 | -0.006 | 0.224 | -0.222 | -0.311 | 1.058 | -0.055 | 0.030 | 0.043 | - | 0.093 | 0.745** |
| Protein content | -0.712 | -0.039 | 0.007 | 0.005 | 0.204 | 0.184 | -0.307 | -0.087 | 0.009 | 0.539 | 0.029 | - | -0.168 |

Residual effect = 0.0704

* Significant at 5 % level

** Significant at 1 % level

maturity (9 and 10). The lack of desirable association between grain yield per plant and days to flowering could be combined together through crossing programme for developing high yielding early genotypes of the moth bean.

Path analysis (Table-3) revealed that highest positive direct effect on the grain yield was of pods per plant followed by 100-seed weight, plant height, days to 50 % flowering and harvest index. This suggested that an increase in pods per plant, harvest index, 100-seed weight, days to 50 % flowering and plant height might increase the grain yield if other variables are held constant. Similar results were also obtained for high direct effect on yield by Dikshit *et al.* (11). Negative direct effect on grain yield was found with protein content, seeds pod pods, clusters per plant, branches, days to maturity. Similar, results were reported by Haritha and Reddy (12), pod length had lower positive direct effect. Harvest index and pod length content had lower indirect effect while days to 50 % flowering, plant height and cluster per plant had high indirect effect, indicating that these three characters are vary important contributors of grain yield per plant. The residual effect observed in path analysis was low (0.0704) indicating that the characters included in the present study were able to explain the most effects on grain yield in moth bean.

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