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# GENETIC VARIABILITY, HERITABILITY AND CORRELATION STUDY IN HYACINTH BEAN

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## Abstract

Forty four hyacinth bean genotypes were studied to estimate the variability, heritability, genetic advance and correlation coefficients. There was a large variation among the genotypes for all the characters among which the number of pods per plant had highest (122 to 425). Green pod yield per plant varied from 0.46 kg to 3.45 kg indicating the presence of high yielding genotypes. High genotypic coefficient of variation was obtained for 100-green seed weight, pod yield per plant, number of pods per plant and harvesting duration. The highest heritability was observed for days to first flower (98.39%) followed by days to first harvest (96.1 %).The pod yield per plant also exhibited high heritability of 77.9% with highest genetic advance (68.28) indicating the possibility of selection to improve this traits. Yield of green pods showed highly significant and positive association with number of pods per plant (r=0.71**), individual pod weight (r=0.54**) and harvesting duration (r=0.198*), which indicates the importance of these characters during selection for high yielding genotypes in hyacinth bean.

Keywords: Genetic variability, heritability, hyacinth bean.

## Introduction

Hyacinth bean *[Lablab purpureus* (L.) Sweet), most popularly known as seem, is an important winter vegetable in Bangladesh. Its green pods as well as dried seeds are rich in protein, vitamins and minerals (Gopalan *et al.,* 1982). Various morphotypes of hyacinth bean are grown by the farmers in our country (Islam *et al.,* 2002). These genotypes differed among themselves in respect of different morphological characters (Rahman *et al.,* 1985). Presence of variability in a base population is a prerequisite for any genetic improvement programme. Again, improving the efficiency of selection in any base population, the presence of genetic variability is of prime importance. Since most of the economically important plant characters are polygenic in nature and are highly influenced by environment, it becomes difficult to conclude whether the observed variability is heritable or is due to environmental factors. The partitioning of total variability into heritable and nonheritable components will enable us to know whether the superiority of selection is inherited by the progenies. Present investigation was,

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therefore, planned to estimate the extent of genetic variability, heritability, genetic advance and correlation of different characters in 44 hyacinth bean genotypes.

## Materials and Method

The experiment was conducted during July 2005 to February 2006 at the experimental Farm of Horticulture Department of Bangabandhu Sheikh Mujibur Rahman Agricultural University with 44 genotypes of hyacinth bean. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. The unit plot size was 1.5 m × 5.0 m accommodating single row per bed of five pits. Plants were spaced at 1.0 m in a bed and 2.0 m between two adjacent beds. Two seeds of all genotypes were sown in polybag and ten days old seedlings were transplanted in the experimental field on 1 August 2005. Out of two seedlings per pit, one was removed two weeks after transplanting. The crop was fertilized with cow dung 10 ton, Urea 50 kg, TSP 150 kg, and MP 150 kg per ha (Rashid, 1999). The full dose of cowdung, TSP, and half of the quantity of MP were applied basally during pit preparation one week before transplanting. The remaining MP and urea were applied in three equal installments as top dressing at 15, 30, and 45 days after transplanting. Each plant was given bamboo sticks to climb on. Weeding was done whenever it was felt necessary. The plants were irrigated properly when required. The crop was protected from the attack of pest, mainly aphids, jute hairy caterpillar, and pod borer by spraying of Maladan 2 ml/L as per requirement. Data on days to first flower, days to first harvest, and harvesting duration was counted from each plant of each replication and average was calculated. Number of pods per raceme was counted from 10 randomly selected racemes from each replication. Individual pod weight was made by weighing 30 (10+10+10) randomly selected pods from each replication at three different harvests followed by counting the number of seeds per pod. The number of pods per plant and pod yield per plant were measured from each replication considering all plants. 100-green seed weight was taken thrice just after harvest from each replication. Genotypic and phenotypic coefficient of variation were worked out as per the method suggested by Burton and De Vane (1953), heritability and genetic advance were calculated according to Johnson (1955) and Robinson *et al.* (1949). The simple correlation coefficient was calculated according to Panse and Sukhatme (1967).

## Results and Discussion

The data on variability (Table 1) revealed significant differences for all the characters under study. Based on CV values maximum variability was observed in number of pods per raceme followed by that of 100-green seed weight. Similar variability was also reported by Hossain and Haque (1992) when studied 232

hyacinth bean genotypes. Days to first flower varied from 48 days to 136 days, indicated the presence of early and late flowering genotypes. Report of such short duration flower initial was also made by Purseglove (1977) where hyacinth bean varieties can produce flower at about 6 weeks after sowing. Rashid (1976) stated that some of the varieties do not flower until December irrespective of date of sowing. Harvesting duration ranged from 42 to 95 days. This result indicates that some genotypes are able to produce flower and pod for longer period. Number of pods per raceme varied from 2.06 to 8.50. Islam *et al*. (2002) observed 2-10 pods per raceme among large number of genotypes. The genotypes differed for individual pod weight. Although the mean individual pod weight was 8.26 g but it varied from 1.47g to 12.30 g. The average number of pods per plant was 256.6. However, the range of the same was 122- 425. The variation in number of pods per plant might be due to difference in number of inflorescences per plant, pods per raceme, flower dropping tendency of the genotypes, etc. as have been reported elsewhere (Mollah *et a!.,* 1995; Khan, 2003). Similar variation in number of pods per plant 1(80-330) among nine bean lines was reported by Halim and Ahmed (1992). The mean pod yield per plant was 2.08 kg, but it varied from 0.46 kg to 3.45 kg among the genotypes indicating the presence of wide variability in respect of pod yield potential. The seed size i.e., 100-green seed weight varied from 4.0g to 73.33g, which indicates the presence of very small to very bold seeded hyacinth bean genotypes. Thus, selection for bold seeded genotype can be made since green bold seeds of hyacinth bean are very popular among many vegetables.

**Table 1. Variability of different characters of hyacinth bean from ANOVA.**

| Characters | MS (genotype) | Mean | Range | CV (%) |
|---|---|---|---|---|
| Days to first flower | 1272.94** | 104.8 | 47.6-136.3 | 2.5 |
| Days to first harvest | 1337.43** | 127.84 | 67.0-148.0 | 3.3 |
| Harvesting duration (days) | 909.50** | 64.98 | 41.6-95.0 | 10.22 |
| Pods/raceme | 8.94 | 6.90 | 2.06-8.50 | 20.24 |
| Individual pod wt (g) | 12.97** | 8.26 | 1.47-12.30 | 8.68 |
| No. of pods/plant | 16427.45** | 256.6 | 122-425 | 17.61 |
| Pod yield/plant (kg) | 1.71** | 2.08 | 0.46-3.45 | 18.48 |
| No. of seeds/pod | 0.680** | 4.56 | 3.6-5.87 | 6.19 |
| 100-green seed wt (g) | 675.89** | 40.53 | 4.0-73.33 | 19.24 |

** Significant at 1% level

In variability study, the phenotypic coefficient of variation (PCV) was higher than the genotypic coefficient of variation (GCV) (Table 2). The highest PCV (40.19%) and GCV (35.34%) were observed for 100-green seed weight, while the lowest PCV (11.6%) and GCV (9.8 1%) were exhibited by number of seeds per pod. The highest broad sense heritability (98.39%) was observed for days to

first flower followed by days to first harvest (96.1%). Rahman *et al.* (1992) obtained highest heritability for pod length followed by pod yield per plant and individual pod weight. The pod yield per plant also exhibited high heritability of 77.9% with highest genetic advance of 68.26% as percent of mean; the GCV for this character was 34.8. Uddin *et al.* (1993) also recorded high genetic gain associated with high heritability for pod yield of lablab bean per plant. Such high heritability estimates have been found to be helpful in making selection of superior genotypes on the basis of their superior phenotypic performance in respect to quantitative characters. However, the heritability estimates along with genetic gain is more useful than the heritability values alone in predicting the resultant effect for selecting the best individuals. In this study, the characters days to first flower, number of pods per plant, individual pod weight, pod yield per plant and 100-green seed weight showed high heritability associated with high genetic advance indicating the presence of additive gene action, which is desirable for effective selection for these traits.

**Table 2. Estimates of mean, range, genotypic and phenotypic variance, genotypic and phenotypic coefficient of variation, heritability and genetic advance in hyacinth bean.**

| Characters | Genotypic variance | Phenotypic variance | GCV (%) | PCV (%) | Heritability (%) | Genetic advance | Genetic advance (as % of mean) |
|---|---|---|---|---|---|---|---|
| Days to first flower | 422.0 | 428.88 | 19.6 | 19.76 | 98.39 | 42.2 | 40.26 |
| Days to first harvest | 439.86 | 457.70 | 16.4 | 16.73 | 96.1 | 42.9 | 33.55 |
| Harvesting duration | 288.5 | 332.50 | 26.13 | 28.06 | 86.76 | 34.13 | 42.53 |
| No. of pods/ raceme | 2.32 | 4.30 | 22.07 | 30.05 | 53.95 | 2.77 | 40.14 |
| Individual pod wt (g) | 4.15 | 4.66 | 24.66 | 26.13 | 89.05 | 4.12 | 49.9 |
| No. of pods/ plant | 4736.26 | 6776.9 | 26.82 | 32.08 | 79.88 | 132.58 | 51.66 |
| Pod yield/ plant (kg) | 0.524 | 0.672 | 34.8 | 39.41 | 77.9 | 1.42 | 68.26 |
| No. of seeds/ pod | 0.20 | 0.28 | 9.8 | 11.6 | 71.4 | 0.87 | 19.07 |
| 100-green seed wt (g) | 205.2 | 265.40 | 35.34 | 40.19 | 77.31 | 28.18 | 67.8 |

Correlation analysis (Table 3) showed that there was positive correlation between pod yield with individual pod weight (r=0.540**), number of pods per plant (r=0.71**) and harvesting duration (r=0.198*) indicated that selection for these traits separately can be effective in bringing about improvement in pod yield because number of pods per plant had a significantly negative correlation with individual pod weight. Significant negative correlation was observed between days to first flower with harvesting duration and number of pods per plant, which indicates delay in flowering, was associated with shorter harvesting duration and reduced number of pods per plant. The traits number of seeds per pod and 100-green seed weight had significant and positive correlation with individual pod weight indicating larger pod possessed higher number and heavier green seeds. The character number of pods per plant was positively correlated with harvesting duration and pods per raceme. So, these traits should be kept in mind during planning any breeding programme for improving the trait of number of pods per plant since this trait largely influenced pod yield per plant.

It is concluded from the study that a wide range of variability is present for all the characters in hyacinth bean. The characters like days to first flower, individual pod weight, number of pods per plant and pod yield can further be improved through selection, which will be the basis for overall improvement in the varietal development programme for this crop.

**Table 3. Phenotypic correlation coefficient among different characters of hyacinth bean genotypes.**

| Traits | DTH | HD | PPR | IPW | NPPP | PYPP | NSPP | 100-GSW |
|---|---|---|---|---|---|---|---|---|
| DTF | 0.962** | -0.752** | 0.049 | 0.428** | -0.227** | 0.096 | 0.103 | 0.190* |
| DTH | | 0.784** | 0.005 | 0.365** | -0.242** | 0.052 | 0.077 | 0.200* |
| HD | | | -0.147 | -0.094 | 0.316** | 0.198* | 0.162 | -0.063 |
| PPR | | | | 0.275** | 0.251** | 0.039 | -0.272** | 0.195* |
| IPW | | | | | -0.172* | 0.54** | 0.389** | 0.304** |
| NPPP | | | | | | 0.71** | 0.11 | 0.055 |
| PYPP | | | | | | | 0.35** | 0.273 |
| NSPP | | | | | | | | 0.003 |

*=Significant at *5%* level, **=Significant at 1% level.

DTF=Days to first flower, DTH= Days to first harvest, HD= Harvesting duration

PPR= Pods per raceme, IPW= Individual pod weight, NPPP= Number of pods per plant

PYPP= Pod yield per plant, NSPP= Number of seeds per pod.

100-GSW= 100- green seed weight

## References

Burton, G. W. and E. H. Devane. 1953. Estimatig heritability in tall fescue *(Festuca arundiaceae* from replicated colonial material. *Agron J*. **45:** 478-481.

Gopalan, C. V., B. Y. Ramasastri and S. C. Balasubramanium. 1982. Nutritive values of Indian food. National Institute of Nutrition, ICMR, Hydrabad. p. *75.*

Halim, G. M. A. and S. Ahmed. 1992. Study of the morphogenetic divergence in country bean. *Bangladesh Hort.* **20**(2): 103-107.

Hossain, S. M. M and M. M. Haque.1992. Genetic diversity of local vegetables. In: Germplasm conservation, evaluation, documentation AVRDC Publication Number 93-398, 9Spp.

Islam, T., M. M. Haque and M. M. Rabman. 2002. Catalogue on hyacinth bean germplasm. PGRC., BARI, Gazipur. p55.

Johnson, H. W., H. E. Robinson and R. E. Comstock. 1955. Estimates of genetic and environmental variability in soybeans. *Agron. J.* **47:** 314-318.

Khan, M. M. R. 2003. Performance of lablab bean genotypes under different supports. M.S. Thesis, Department of Horticulture, BSMRAU, Salna, Gazipur '76p.

Mollah, M. S., S. R. Saha and M. S. Islam. 1995. Effect of method of support on the yield performance of some advanced lines of hyacinth bean. *Bangladesh J. Crop Sci*. **6**(1&2): 37-40.

Panse, V. G. and P. V. Sukhatme. 1967. Statistical method for Agricultural workers. 2nd Ed. Indian Council of Agricultural Research, New Delhi. pp.381.

Purseglove, J. W. 1977. Tropical Crops. Dicotyledons. Longman, London, pp. 273-276.

Rahman, M. M., K. R. Haque , M. Mahtabuddin and M. K. Das. 1992. Variability, correlation and path analysis in country bean. *Bangladesh Hort.* 20(1): 85-90.

Rahman, M. S., M. S. Ahmed and K. R. Haque. 1985. Study on the morphological characters of twenty local collections of country bean. *Bangladesh Hort.* **13**(1+2): 51-55.

Rashid, M. M. 1976. Bangladesher Sabje (Vegetables of Bangladesh). **1st** Ed. Bangla Academy, Dhaka, Bangladesh. pp. 313-323.

Rashid, M. M. 1999. Sabji Biggan (In Bengali). Rashid Publising House, 94, Old DOHS, Dhaka-1206. pp.307-409.

Robinson, H. F., R. E. Comstock and B. H. Harvey. 1949. Estimation of heritability and the degree of dominance in corn. *Agron. J.* **42:** 553-559.

Uddin, M., M. A. Newaz, M. M. Ali and A. K. Chowdhury. 1993. Variability and relationship between yield and yield components in lablab bean. *Bangladesh Hort.* **21**(2): 39-43.