# GENETIC VARIABILITY FOR DIFFERENT TRAITS IN THE INDIAN BAMBOO

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**Abstract:** Evaluation of fifteen species of bamboo at the age of four years indicated significant differences among the species for all the characters. Estimates of heritability in broad sense were observed generally high for leaf breadth, biomass, leaf length, culm height and internode length. Growth characters such as tree height, diameter, culm wall thickness, bole thickness were found significantly and positively correlated with biomass. [New York Science Journal 2010; 3(6):27-31]. (ISSN 1554 – 0200).

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## 1. INTRODUCTION

India is the second richest country in bamboo genetic resources after China. These two countries together have more than half the total bamboo resources globally **(Vermah and Bahadur, 1980)**. Bamboo is fast growing species and it occupies a special place in the lives of the people especially in Asia. Being clonally propagated, much of breeder's effort goes in generating genetic variability and using the already existing and freshly generated variability for developing improved cultivars. Estimates of correlation coefficients measures the degree of relationship between pair of characters. Studies on character association are useful to breeder in identifying the suitable genotype/species for utilization in breeding programme. Therefore computation of correlations between biomass and its contributing characters are of considerable importance in plant selection. The present investigation aims to assess the genetic variability and association of component traits among different species.

## 2. MATERIAL AND METHODS

Fifteen different bamboo species collected from different parts of the India (Table 1) were selected for this study. In September 2005 these species were planted in randomized block design with three replications and sixteen plants were maintained in each block. Three plants from each block were randomly selected for recording observations. Observations were recorded twice a year (December and August) for three years and pooled data were analyzed statistically.

**Table 1:List of Bamboo species and their selection site:**

| Sl.No. | Species | Place of Collection |
|---|---|---|
| 1 | *Bambusa vulgaris* | Collection Block, Pantnagar, Uttarakhand |
| 2 | *Bambusa vulgaris* var.*striata* | Collection Block, Pantnagar, Uttarakhand |
| 3 | *Bambusa multiplex* | Forest Research Institute(FRI), Dehradun, Uttarakhand |

| Sl.No. | Species | Place of Collection |
|---|---|---|
| 4 | *Bambusa tulda* | Forest Research Institute(FRI), Dehradun, Uttarakhand |
| 5 | *Bambusa bambos* | Collection Block, Pantnagar, Uttarakhand |
| 6 | *Bambusa nutans* | Forest Research Institute(FRI), Dehradun, Uttarakhand |
| 7 | *Dendrocalamus giganteus* | Forest Research Institute(FRI), Dehradun, Uttarakhand |
| 8 | *Dendrocalamus strictus* | Collection Block, Pantnagar, Uttarakhand |
| 9 | *Bambusa vulgaris* var. *wamin* | Forest Research Institute(FRI), Dehradun, Uttarakhand |
| 10 | *Dendrocalamus asper* | Marino Pvt. Ltd., Hapur, Uttar Pradesh |
| 11 | *Dendrocalamus membraneceous* | Forest Research Institute(FRI), Dehradun |
| 12 | *Dendrocalamus hamiltonii* | Forest Research Institute(FRI), Dehradun, Uttarakhand |
| 13 | *Mellocana baccifera* | Collection Block, Pantnagar, Uttarakhand |
| 14 | *Arundinaria falcata* | Pratap Nursery, Dehradun |
| 15 | *Arundinaria falconerii* | Ranichauri, Tehri, Uttarakhand |

Observations on ten characters were recorded on three representative trees in each treatment. Culm height (m) was measured of tallest culm from base to the topmost tip of the bamboo plant by using scaled pole; Diameter of the plant (cm) was taken in the middle between at 3rd and 4th node using tree caliper**;** Internode length (cm) of each plant was taken by measuring the distance from the base between 3rd and 4th node; Culm wall thickness (cm) was taken of a representative culm , sample of which was cut between 3rd and 4th node from base and thickness was taken using vernier caliper; Number of new sprouts in each plant was counted in every season; Leaf length (cm) of the basal leaf near to DBH was measured with the help of scale from the joining point of leaf blade upto leaf tip; Leaf breadth of the same basal leaf was measured at the broadest point from one end to the other of which leaf length was recorded; Clump girth (cm) of the whole clump was measured at the height of 30cm from the ground; Total number of culms new and old were counted manually and for Biomass, fresh weight of the representative culm was taken after harvesting the culm 5cm above the ground. The data was subjected to statistical analysis and correlation coefficients according to **Fisher and Yates (1963),**

## 3. RESULT AND DISCUSSION

The success of selection depends on the extent of genetic variability present in a population. The present study showed high genotypic coefficient of variation for biomass, number of new sprouts, number of culms, leaf breadth, leaf length, tree height and diameter at third node. High estimates of heritability were observed for leaf breadth, biomass, leaf length, culm height, and internode length. The prediction of genetic variance for these characters through the additive component may be more important. These results are in agreement with earlier findings of **Randall (1987), Foster (1986), Tewari *et al.(*1992 ) and Singh (2000)**. High genetic advance estimate (as percent of mean) was observed for biomass , diameter at breast height and leaf length . Generally, characters showing high heritability also possess high value of genetic advance. High heritability with high genetic gain was observed for diameter of culms, height of culms and number of internodes by **Singh *et al.* (2004)**. High heritability coupled with high genetic advance indicated that such characters are controlled by additive gene action and will respond effectively on phenotypic selection. Low value of genetic advance were obtained for other characters.

**Table 1.** Estimation of mean, range, heritability, coefficient of variation and genetic advance (in *per cent*) for different characters in bamboo species

| S.No. | Characters | Mean | Range | Heritability | *Genetic advance | GCV | PCV |
|---|---|---|---|---|---|---|---|
| 1. | Culm height (m) | 5.62 | 2.2-8.3 | 94.91 | 55.69 | 27.76 | 28.49 |
| 2. | Diameter (cm) | 2.31 | 0.9 – 3.4 | 91.67 | 54.23 | 27.50 | 28.72 |
| 3. | Internode length (cm) | 14.51 | 9.3-22.0 | 94.02 | 54.10 | 27.09 | 27.94 |
| 4. | No. of new sprouts | 3.72 | 1.1-6.0 | 80.66 | 69.62 | 37.59 | 41.85 |
| 5. | No. of culms | 8.28 | 3.1-12.9 | 76.15 | 61.47 | 34.19 | 39.17 |
| 6. | Clump girth (cm) | 220.54 | 150.0-319.3 | 96.10 | 51.78 | 25.64 | 26.16 |
| 7. | Leaf length (cm) | 13.46 | 4.5-20.1 | 99.89 | 63.74 | 30.98 | 31.00 |
| 8. | Leaf breadth (cm) | 2.18 | 1.1-3.6 | 91.50 | 65.13 | 33.10 | 34.61 |
| 9. | Culm wall thickness (cm) | 1.50 | 0.5-2.2 | 87.54 | 52.66 | 27.39 | 29.27 |
| 10. | Biomass (Kg) | 5858.9 | 1.001-16.440 | 98.82 | 53.81 | 64.08 | 64.58 |

GCV = Genotypic coefficient of variation, PCV = Phenotypic coefficient of variation,

ECV = Environmental coefficient of variation.

* As *per cent* of mean.

**Table No. 4. 3 Phenotypic, Genotypic and Environmental correlation coefficients between different characters of Bamboo species**

| | Culm height | Diameter | Internode length | No. of new sprouts | No. of culms | Clump girth | Leaf length | Leaf breadth | Culm wall thickness | Biomass |
|---|---|---|---|---|---|---|---|---|---|---|
| Culm height | $r_p$ | 0.532* | 0.836** | 0.354 | 0.369 | 0.450 | 0.406 | 0.256 | -0.296 | 0.828** |
| | $r_g$ | 0.542* | 0.714** | 0.309 | 0.205 | 0.430 | 0.302 | 0.228 | -0.288 | 0.641** |
| | $r_e$ | 0.248 | 0.191 | -0.004 | -0.777 | -2.315 | 0.231 | -0.150 | -0.220 | -0.061 |
| Diameter | | $r_p$ | -0.121 | 0.733** | 0.368 | 0.353 | 0.030 | 0.952 | 0.657* | 0.559* |
| | | $r_g$ | -0.110 | 0.709** | 0.337 | 0.340 | 0.028 | 0.693 | 0.632* | 0.562* |
| | | $r_e$ | 0.038 | 0.144 | 0.221 | 0.157 | -0.246 | -0.168 | 0.359 | 0.095 |
| Internode length | | | $r_p$ | 0.384 | 0.355 | 0.415 | 0.426 | 0.308 | -0.451 | -0.191 |
| | | | $r_g$ | 0.343 | 0.307 | 0.379 | 0.413 | 0.290 | -0.447 | -0.192 |
| | | | $r_e$ | 0.850 | 0.540 | 0.314 | 0.105 | 0.629 | -0.458 | -0.313 |
| No. of new sprouts | | | | $r_p$ | 0.998** | 0.762** | 0.014 | 0.144 | 0.272 | -0.163 |
| | | | | $r_g$ | 0.950** | 0.683** | 0.011 | 0.160 | 0.013 | -0.062 |
| | | | | $r_e$ | 0.783 | 0.143 | -0.130 | 0.286 | -0.207 | -0.091 |

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|---|---|---|---|---|---|---|
| No. of culms | $r_p$ | 0.140 | -0.843 | 0.045 | 0.042 | 0.156 |
| | $r_g$ | 0.154 | -0.076 | 0.075 | 0.018 | 0.140 |
| | $r_e$ | 0.339 | -0.177 | 0.263 | -0.139 | -0.08 |
| Clump girth | $r_p$ | | 0.220 | 0.435 | 0.221 | 0.323 |
| | $r_g$ | | 0.216 | 0.413 | 0.211 | 0.323 |
| | $r_e$ | | 0.658 | 0.074 | 0.128 | 0.306 |
| | $r_p$ | | | 0.194** | -0.063 | -0.188 |
| | $r_g$ | | | 0.212** | -0.013 | -0.187 |
| | $r_e$ | | | -0.413 | -0.300 | -0.075 |
| Leaf length | $r_p$ | | | | 0.225 | -0.316 |
| | $r_g$ | | | | 0.225 | -0.307 |
| | $r_e$ | | | | 0.319 | 0.235 |
| Culm wall thickness | $r_p$ | | | | | 0.680* |
| | $r_g$ | | | | | 0.528* |
| | $r_e$ | | | | | 0.250 |

*, ** significant at 5% and 1% respectively.

Culm height showed significant and positive correlation with diameter at third node, While it showed highly significant and positive correlation with internode length and biomass. Correlation coefficient of diameter showed highly significant and positive correlation with number of new sprouts, while it was significant and positively correlated with culm wall thickness and biomass. Number of new sprouts showed positive and highly significant correlation with number of culms and clump girth. Leaf length also showed positive and highly significant correlation with leaf breadth . Culm wall thickness showed positive and significant correlation with biomass. Positive correlation of tree height and diameter at breast height with tree volume have been reported by **Foster(1986), Tewari *et al.*,(1994), Tewari *et. al* (1999)and Singh (2000)**.

At genotypic level, in general similar trend of association was observed, however, with some exception, the magnitude of coefficients was very high as compared to phenotypic correlation coefficients. At genotypic level, some character showed slight differences in association pattern with other characters. This suggest complex role of environment in ultimate expression of association at phenotypic level. Selection for high biomass should therefore be based on culm height, diameter at breast height, internode length and culm wall thickness.

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