Studies of Correlation Co-Efficient for Different Physical and Chemical Fruit Parameters of Ber (Ziziphus mauritiana Lamk)

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ABSTRACT
The present investigation was carried out at Department of Fruit Science, college of Horticulture, Banda University of Agriculture & Technology, Banda (UP) during 2019-20. Phenotypic correlations were worked out among twenty-four characters of ber to know the nature of association existing among the characters. Correlation among the quantitative characters were worked out. Fruit length showed significant and positive correlation with fruit width (0.444*) and significantly negative correlation noted with TSS (-0.448*). Fruit weight showed significant and positive correlation with specific gravity (0.985**) and non-significant positive correlation with stone width, stone weight and TSS, ascorbic acid, protein, sugar non-significant negative correlation. Stone length exhibited significant and positive correlation with stone width (0.533**) and stone weight (0.918**). Stone width showed significant and positive correlation with stone weight (0.815**). Association obtained during the study can be used while making selection, a method of crop improvement in ber or breeding programmes.

Keywords: Ber (ziziphus mauritiana L.), Variability, Correlation, Co-efficient.

INTRODUCTION
Genetic variability of ber and Chinese jujube is high in India and china respectively. Several other countries to which Ziziphus has now spread also have secondary diversity. Several horticultural varieties are in cultivation in both India and China. These varieties developed as a result of selection in different eco regions from progeny emanating from cross pollination between different Ziziphus species. In India, over 180 cultivars have been reported across the country however, there are at least 400 cultivars of Chinese jujube are reported (Hayes, 1945 & Pareek, 2001). These can be divided in to two groups: the sour type, mainly used as root stocks, medicines or animal fodder, another cultivated type (Ciminata, 1996).

The ability of Ziziphus species and the different varieties / types within ber to cross freely has allowed the buildup of a rich gene pool. Vegetative growth (tree form, leaf shape, apex, base and pubescence, petiole length, colour etc.), flowering and fruit characters (shape, size, style end, skin color, stone and pulp content, pulp colour and sweetness etc).

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Vasishtha (1983) has described morphological characteristics of a large number of ber cultivars at Jodhpur in North West India.

Rich variability in ber exists in respective regions of diversity. So far, systematic efforts to collect, characterize and conserve this variability has not been made. A large number of varieties at several research stations exist in collections particular in India and China. Some outstanding varieties have been identified and are in commercial cultivation in scattered pockets. There is also a need for varietal improvement with the objective of inducing resistance against disease (Powdery mildew), pest (fruit fly) and low and high temperature viz. limit successful cultivation. Efforts to identify and develop cultivars with suitable quality attributes for desert as well as processing uses are required. The Bundelkhand area of Uttar Pradesh (Banda, Chitrakut, Mahoba, Lalitpur, Jalaun, Jhansi, and Hamirpur) has rich diversity in ber types in terms of fruit shape, size, flowering, fruit quality, fruit ripening or maturity period etc. Therefore, keeping in view survey was carried out in Bundelkhand region of Uttar to find out variability in ber for different morphological, bio chemical quality parameters and association among quantitative parameters recorded to work out to correlation coefficient in between.

MATERIALS AND METHODS
The present investigation was carried out at Department of Fruit Science, college of Horticulture, Banda University of Agriculture & Technology, Banda (UP) during 2019-20. Thirty genotypes were collected from Bundelkhand region of Uttar Pradesh. Twenty-four fruits of ber were randomly selected from all the direction of farmer’s field and selected genotypes, and the bulk of sample of all the selected trees from each site collected then kept into bags and tagged by the number and subjected to physico-chemical analysis in laboratory. Morphological characters of fruit and leaf were described on the basis of Minimal Descriptors of Agri-Horticultural Crops as prepared by Mahajan et al. (2002).

Physical parameters like fruit weight measure by electronic weighting machine and fruits length, fruits width, size of fruit, size of spine, length, size of seed was estimated with the help of digital Vernier Calipers. Ascorbic acid was determined by using 2, 6-Dichlorophenol- indophenol visual titration method (Johnson, 1948). Sugars content were estimated using Fehling’s solutions (Lane & Eynon, 1923) and the method as described by (Rangana, 2010). Reducing sugars (Nelson, 1944). The percentage of non-reducing sugars was obtained by subtracting the values of reducing sugar from total sugars and multiplying by 0.95 (Somogyi, 1952). The data obtained during experimentation was statistically analyzed as per method given by Panse and Sukhatme (1985) and results were evaluated at 5% level of significance. The correlation coefficients among the different physico-chemical parameters were calculated as per method described by Fisher (1954).

### Table 1: Correlation coefficient for 11 characters of ber (Ziziphus mauritiana Lamk) genotypes

| Variable                  | Fruit length (cm) | Fruit length (cm) | Fruit weight (g) | Specific gravity (g/ml) | Stone length (cm) | Stone weight (g) | Stone length (cm) | Stone weight (g) | TSS (Brix) | Ascorbic Acid (mg/100g) | Protein (%) | Sugar (%) |
|---------------------------|-------------------|-------------------|------------------|-------------------------|-------------------|------------------|------------------|------------------|------------|--------------------------|-------------|-----------|
| Fruit length (cm)         | 1                 | 0.114             | 0.948            | -0.176                  | -0.235            | -0.241           | -0.445           | 0.014            | 0.218      | -0.326                   | 0.215        | 0.257     |
| Fruit width (cm)          | 1                 | 0.025             | 0.055            | 0.175                   | 0.139             | -0.388           | -0.089           | 0.129            | 0.099      | 0.016                    | 0.001        | 0.059     |
| Fruit weight (g)          | 1                 | 0.983**           | -0.041           | 0.166                   | 0.135             | -0.113           | -0.249           | 0.095            | 0.014      | 0.016                    | 0.001        | 0.059     |
| Specific gravity (g/ml)   | 1                 | -0.064            | 0.588            | 0.151                   | 0.029             | 0.473            | 0.094            | 0.014            | 0.013      | 0.288                    | 0.020        | 0.059     |
| Stone length (cm)         | 1                 | 0.535**           | 0.918**          | -0.65                   | 0.183             | 0.175            | 0.137            | 0.077            | 0.013      | 0.218                    | 0.216        | 0.257     |
| Stone width (cm)          | 1                 | 0.014             | 0.170            | -0.230                  | 0.315             | -0.149           |                   | 0.024            | 0.135      | 0.011                    | 0.001        | 0.059     |
| Stone weight (g)          | 1                 | 0.251             | 0.014            | 0.268                   | 0.288             | 0.266            | 0.426            | 0.257            | 0.077      | 0.013                    | 0.001        | 0.059     |
| TSS (Brix)                | 1                 | 0.014             | 0.170            | -0.230                  | 0.315             | -0.149           |                   | 0.024            | 0.135      | 0.011                    | 0.001        | 0.059     |
| Ascorbic acid (mg/100g)   | 1                 | 0.251             | 0.014            | 0.268                   | 0.288             | 0.266            | 0.426            | 0.257            | 0.077      | 0.013                    | 0.001        | 0.059     |
| Protein (%)               | 1                 | 0.014             | 0.170            | -0.230                  | 0.315             | -0.149           |                   | 0.024            | 0.135      | 0.011                    | 0.001        | 0.059     |

**Correlation is significant at the 0.01 level
* Correlation is significant at the 0.05 level
RESULT AND DISCUSSION

Correlation co-efficient for different characters phenotypic correlations were worked out among eleven characters of ber to know the nature of association existing among the characters. The results regarding correlation studies are presented in Table -1. Correlation coefficient among different bio-chemical parameters showed significant and positive correlation in between fruit length with fruit width; Fruit weight and specific gravity; stone length and stone width; stone width and stone weight. Non-significant positive correlation in between fruit width and fruit weight; fruit width and specific gravity; stone length and stone width; stone width and protein.

Fruits width showed significant and positive correlation with fruits length (0.444*) and significant negative correlation with TSS (-0.448*). Non-significant but positive correlation was noted with fruit weight, specific gravity, ascorbic acid and total sugar. Non-significant negative correlation was recorded with stone length, stone width, stone weight, TSS and protein.

Width of fruit (cm) showed positive correlations with Specific gravity (g/cm3) (0.208), Stone length (0.035), Stone weight, and protein. However, non-significant but negative correlation was recorded with TSS (°Brix), total sugar and ascorbic acid. Fruit weight showed significant positive correlations with specific gravity (0.985**). Non-significant but positive correlation was noted with stone width and stone weight. Non-significant negative correlation was also recorded with stone length, TSS, ascorbic acid, protein and sugar. Specific gravity showed non-significant positive correlations with stone width, stone weight and non-significant negative correlation recorded with stone length, TSS, ascorbic acid, protein and sugar. Stone length showed significant positive correlations with stone width (0.533**) and stone weight (0.918**). Non-significant but positive correlation was found with ascorbic acid, protein and sugar. However, it was observed that non-significant negative correlations exist with stone length and TSS. Stone width showed significant positive correlations with stone weight (0.815**). Non-significant but positive correlation recorded with TSS, and protein. However, non-significant but negative correlation found with ascorbic acid and sugar. Stone weight has showed non-significant positive correlations with vitamin C, TSS, protein and sugar.

Total sugar showed non-significant and positive correlation with ascorbic acid and non-significant negative correlation with protein and sugar. Correlations among the quantitative characters were worked out. Fruit length showed significant and positive correlation with fruit width (0.444*) and significantly negative correlation noted with TSS (-0.448*). Fruit weight showed significant and positive correlation with specific gravity (0.985**) and non-significant positive correlation with stone width, stone weight and TSS, ascorbic acid, protein, sugar non-significant negative correlation. Stone length exhibited significant and positive correlation with stone width (0.533**) and stone weight (0.918**). Stone width showed significant and positive correlation with stone width (0.815**). Results are in accordance with Jindal and Rana (1986); Gupta and Mehta (2000) and Srivastava (2002).

CONCLUSION

Biochemical characters viz. total soluble solid, total sugars, protein, acidity, specific gravity, ratio of TSS and acidity. Non-significant variation was noted for acidity content among the available genotypes. Significant and positive correlation in between fruit length with fruit width; fruit weight and specific gravity; stone length and stone width; stone width and stone weight. Significantly negative correlation was noted between with fruit length and TSS of fruits. Association obtained during the study can be used in breeding programmes or while making selection, a method of crop improvement in ber.

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