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Correlation study and cluster analysis in Burmese grape (*Baccaurea sapida* Muell. Arg.) under the sub-Himalayan *terai* region of West Bengal

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ABSTRACT

Burmese Grape (*Baccaurea sapida* Muell. Arg.), a dioecious underutilized fruit crop which is commonly grown in homestead condition under the sub-Himalayan *terai* region of West Bengal. The crop not only holds good nutritional properties but also has its ritual values in this part of the globe. Since, it is a cross pollinated crop; therefore, it is believed to have a high degree of variability. So, in this study an effort was made to group the available variability based on flowering and fruiting characteristics. Correlation and cluster analysis studies indicated strong relationships between some parameters and broad two sub-groups of Burmese grape.

Key words: Burmese Grape, Correlation, Cluster Analysis

INTRODUCTION

Burmese grape (*Baccaurea sapida* Müell. Arg.) is one of the popular underutilized fruit crop native to Southeast Asian region. This tree is well distributed in sub Himalayan tracts from Nepal to Sikkim, Darjeeling hills, Arunachal Pradesh to Assam, Tripura, Bhutan, Burma, Bangladesh, South China, Malaya Peninsula and Andamans (Sundriyal and Sundriyal, 2001). It is a slow growing, dioecious, short to medium height, evergreen, shade loving plant. It flowers during the summer months and fruits are mature during the rainy season (Bhowmick, 2010). The fruit bearing habit of Burmese grape is cauliflory and appears in bunch. Tree shows mild biennial in cropping pattern (Pal *et al.,* 2008). In West Bengal, it is mainly cultivated in Cooch Behar and Jalpaiguri districts (Bhowmick, 2011). The flowers are born on 10-40 cm long clauiflorous raceme (Chakrabarty and Gangopadhyay, 1997) and flowering is reported to be in March-April (Bhowmick, 2011). Matured fruits are roundish to oval in shape, greenish when tender and turns yellow or yellowish brown in colour at ripening. Fruits are sub-acid in taste having 3-4 segments and the edible portion of the fruit is the aril covered by the leathery skin (Bhowmick, 2011). Fruits contain 5.5% protein, 178 mg vitamin C per 100 g of pulp; besides being rich in minerals like calcium, potassium, phosphorous, and iron (Kermasha *et al*., 1987). At Citrus Research Station, Bangladesh, five superior genotypes *viz.* BSJai001, BSJai 002, BSJai 003, BSJai 004 and BSJai 005 were evaluated for different horticultural parameters (Rahman *et al.*, 2014). However, there is complete lacking in literature regarding the correlation studies in Burmese grape.

The present study is aimed to categorize the available variability and study the correlation of different horticultural parameters and make a group of closely associated accessions among various Burmese grape accessions surveyed.

MATERIALS AND METHODS

The experiment was carried out during 2010-2012 in and around the premises of Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal. Since the Burmese grape is commonly propagated by seeds, dioecious and highly heterozygous in nature, so it has been assumed that variations among the population exists; therefore, each plant was treated as a single accession during the experiment. The general information like age of the plant, yield pattern, behaviour of the plant was documented by making a questionnaire at the time of the survey during 2010-11 and after the whole survey of various home garden in different villages, a total 20 numbers of female plants (accession) were selected as superior accessions based on their age and normal vigour of tree, bearing habit, size, shape and colour of fruits, taste, appearance for further analyses during the experiment to investigate the variability among the selected plants. During the selection of accessions among the surveyed plants, points like their age, bearing pattern, fruit characteristics, size of fruits were considered. 20 numbers of female accessions were named, sequentially, starting from ACC-1 to ACC-20. Parameters like number of flowers, fruit number, length of inflorescences (cm), fruit weight (g), peel weight (g), pulp percentage, fruit set percentage, fruit retention percentage, acidity, reducing sugar percentage, total sugar percentage and total soluble solids (^{O}brix) were

recorded for correlation studies. Total soluble solids (TSS), total sugar and reducing sugar were estimated by the method described by Mazumdarand Majumder (2003). The acidity and ascorbic acid were estimated by the method described by Rangana(1977). Correlation studies were performed using Proc Corr of Statistical Analysis System (SAS) by using SAS Enterprise Guide 4.3. Dendrogram of cluster analysis was prepared by Ward's minimum variance method (Ward, 1963). One way classified data analysis was performed with twenty accessions having four replications each.

RESULTS AND DISCUSSION

The correlation studies revealed that the number of flowers was highly significant to that of number of fruits, initial fruit set percentage and reducing sugar. Likewise, number of flower was negatively significant with, total sugar and non reducing sugar. The number of fruit was highly significant with initial fruit set percentage, while it was negatively significant with TSS. Length of inflorescence was significant with fruit weight. Fruit weight was highly significant with peel weight and significant with pulp percentage and ascorbic acid content. Fruit breadth was significant with total sugar and non-reducing sugar. The peel weight was highly and negatively significant with pulp percentage and significant with fruit retention and fruit diameter. Initial fruit set was negatively significant with ascorbic acid content; while it was significant with total sugar and non reducing sugar and TSS. Reducing sugar was negatively significant with non-reducing sugar. Total sugar was highly significant with non-reducing sugar, while negatively significant with vitamin C. Non- reducing sugar was negatively significant with ascorbic acid content. In similar study Saraswathy *et al*. (2010) reported that there was a positive correlation between tree height and canopy spread in sapota and the attributes like number of fruits per tree and canopy spread had positive correlation with fruit yield per tree. The quality traits, viz., total sugars and ascorbic acid content had negative correlation with fruit yield indicating that simultaneous improvement of yield and quality was not possible. Rekha *et al.* (2011) reported that the correlation studies among most of the fruit parameters indicated positive relationship in sapota.

The cluster analysis indicates that there is certain relationship between different female accessions. There are two main cluster comprising of 8 and 12 accessions amongst which accession 1, 4, 6, 7, 10, 16, 17, 20 and accession 2, 3, 5, 8, 9, 11, 12, 13, 14, 15, 18, 19, are closely related while these two group are distantly related. Similar findings were reported by Cluster analysis study of sapota clearly indicating relationship between different accessions having four sub-clusters (Rekha *et al.*, 2011).

The study thus revealed that there is a negative correlation among the flower numbers and the fruit set percentage; however, positive correlation among the fruit numbers, that indicates high drop of fruits during early stages. Fruit weight has strong positive correlation with peel weight, pulp percentage and ascorbic acid content, whereas, the pulp content has strong negative correlation with peel content. This indicates if the pulp weight increases then the peel weight may decrease; hence, selection should be made for optimum pulp weight. Cluster analysis also showed affinity of surveyed accessions in two broad sub-groups for further evaluation programme.

Table 1: Correlation studies among various growth and quality parameter in Burmese grapes

Characters	2	3	4	5	6	7	8	9	10	11	12	13. Ascorbic acid
1. Flower Number	0.516** (<.0001)	-0.059 (0.601)	0.096 (0.398)	0.087 (0.442)	-0.001 (0.992)	-0.324* (0.003)	-0.084 (0.458)	-0.069 (0.541)	0.245* (0.028)	-0.378** (0.0002)	0.004 (0.971)	0.164 0.147
2. Fruit number	-	0.078 (0.490)	-0.042 (0.714)	-0.050 (0.660)	0.047 (0.681)	0.640** (<.0001)	-0.204 (0.069)	0.137 (0.227)	0.052 (0.649)	-0.034 (0.764)	-0.240* (0.032)	-0.183 0.104
3.Length of inflorescence	-	-	0.279* (0.012)	0.134 (0.235)	0.169 (0.135)	0.131 (0.245)	-0.013 (0.911)	0.129 (0.254)	0.040 (0.722)	0.118 (0.296)	-0.056 (0.624)	-0.100 0.376
4.Fruit weight	-	-	-	0.552** (<.0001)	0.338* (0.002)	-0.132 (0.242)	0.190 (0.092)	-0.091 (0.423)	-0.005 (0.964)	0.084 (0.457)	0.011 (0.926)	0.228* 0.042
5.Peel weight	-	-	-	-	-0.569** (<.0001)	-0.122 (0.280)	0.291* (0.009)	0.034 (0.765)	0.014 (0.900)	-0.105 (0.354)	-0.027 (0.814)	0.155 0.169
6.Pulp %	-	-	-	-	-	0.038 (0.737)	0.138 (-0.221)	-0.113 (0.320)	-0.030 (0.792)	0.198 (0.078)	0.055 (0.626)	0.022 0.848
7.Fruit set%	-	-	-	-	-	-	-0.142 (0.211)	0.217 (0.053)	-0.157 (0.165)	0.316* (0.004)	-0.260* (0.020)	-0.351** 0.001
8.Fruit retention%	-	-	-	-	-	-	-	-0.083 (0.462)	0.007 (0.949)	-0.025 (0.826)	0.004 (0.975)	-0.068 0.552
9.Acidity %	-	-	-	-	-	-	-	-	0.076 (0.504)	0.216 (0.054)	-0.143 (0.207)	-0.218 0.053
10.Reducing sugar%	-	-	-	-	-	-	-	-	-	-0.218 (0.052)	0.102 (0.369)	0.198 0.078
11.Total sugar%	-	-	-	-	-	-	-	-	-	-	0.071 (0.534)	-0.547** <.001
12.Total Soluble solids	-	-	-	-	-	-	-	-	-	-	-	-0.017 0.879

(*significant at 1% and **significant at 5% level of significance, value in parenthesis is the table value)

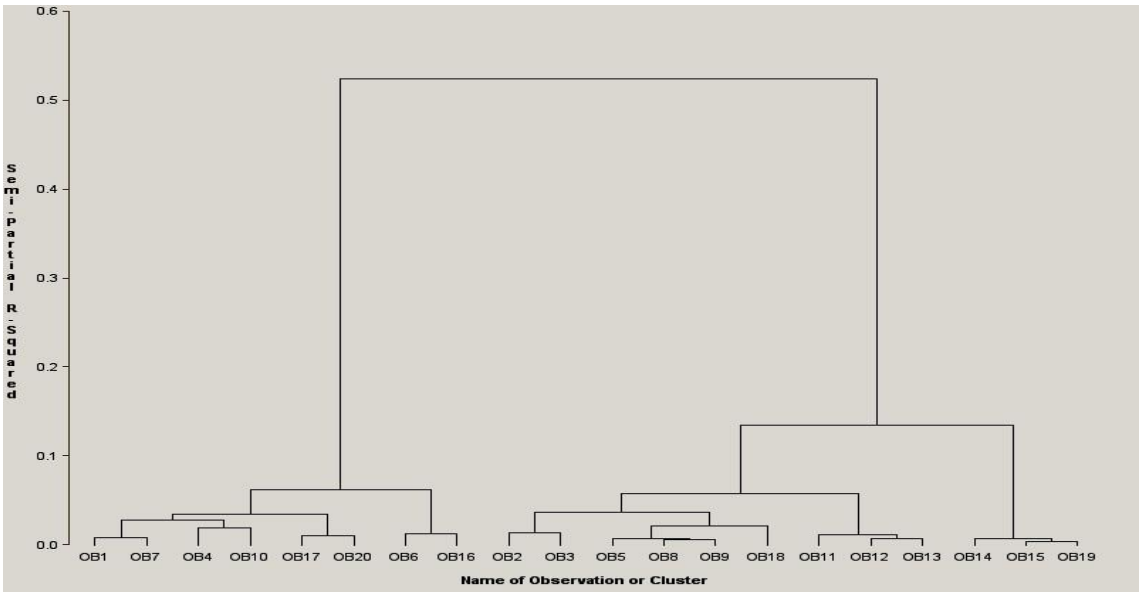

Fig.1. Dendrogram derived using Ward's method for Cluster Analysis showing genetic relationships among the 20 Burmese grape accessions

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