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Morphological Characterization and Assessment of Genetic Variability in Two Burmese grape Cultivars of Bangladesh

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Abstract: *Burmese grape (Baccaurea sapida Muell) is an underexploited fruit crop grown mainly as backyard plantation and as forest plant. It is mainly used as table purpose. Burmese grape is propagated by seeds and as it is evergreen in nature. An attempt was made to characterize and compare two commercially popular burmese grape cultivars (viz. Narsingdi local and BARI Lotkan-1) in Bangladesh. Plant shape, plant feature and branching pattern were different from each other. No variation were found regarding colour of mature leaf, leaf arrangement, leaf apex shape, leaf blade shape and leaf base shape between two genotypes. Both genotypes gave flower during March to April and fruits were matured in early July. Flower bearing habit was found cauliflory in nature in both genotypes. Inflorescence stalk colour was light purple in Narsingdi local but purple in BARI Lotkan-1. The fruit was round shaped with uniformly bright yellow colour in Narsingdi local whereas that was oval shaped and partially greenish yellow colour in BARI Lotkan-1. Numbers of fruit per cluster, fruit length, fruit width and individual fruit weight were significantly higher in Narsingdi local compared to BARI Lotkan-1. Brix index was 14.2% in Narsingdi local while in BARI Lotkan-1 was (13.83%).*

Keywords:*Burmese grape, Characterization, Descriptor, Underutilized fruit.*

INTRODUCTION

Burmese grapes [*Baccaurea ramiflora* Lour., syn. *Baccaurea sapida* (Roxb.) Muell. Arg.] is a famous wild tropical fruit belongs to the family Euphorbiaceae and is native to Southeast Asia. It is grown in Nepal, Bangladesh, Thailand, Myanmar, Indonesia, India and Malaysia. This fruit crop prefers shade or semi shade condition for growth and development. So, it can be grown under another fruit crop or forest crop, where no other fruit crop can be grown successfully (Bhowmick, 2010). Bangladesh marks the highest rate of increase in fruit production among the world's fruit producing countries. It is the tenth largest tropical fruit producer, according to the Food and Agriculture Organization (FAO) of the United Nations. About 70 various kinds of fruits grow in Bangladesh (Hossain et al., 2011). Minor fruit occupies 3.55% of area and 8.85% of production compared to the total fruit production of Bangladesh (BBS, 2017). Burmease grape was cultivated as a minor crop in Bangladesh. Akter et al. (2010) reported that a wide variety of minor indigenous fruits are grown in home garden across Bangladesh including Burmese grape. The cultivation of these nutritious minor fruits including Burmease grape has largely increased over the last 4-5 years (Molla, 2019). In that time the demand of minor fruits including Burmease grape was increased day by day among the people of Bangladesh because of its taste, flavor and obviously nutritional value. According to Kermasha et al. (1987) this fruits contain 5.5 percent protein, 178 mg vitamin C per 100g of pulp and among the minerals the fruit contains 169 mg calcium, 137 mg potassium, 177 mg phosphorous and 100 mg iron per 100g of fruit pulp. It also estimated 5.34 mg of iron was found in 100g Burmese grape (Haque, et al. 2009). In Bangladesh, the fruits are mainly found in community forest or cultivated in the homestead agroforestry. It is locally name known as “Lotkan”. Due to its demand and market price commercial cultivation of Burmese grape has been started in Narsingdi, Sylhet, Mouluvibazar, Kishorgonj and Gazipur districts in Bangladesh. In these areas most of the farmer grows Burmese grape in combination with other trees, particularly with jackfruit. A high level of average benefit cost ratio (BCR= 4.59) in combination with Burmese grape and jackfruit has been reported by Alam (2004). Burmese grape is propagated by seeds and as it is dioecious in nature, so variation is present among the present plant population. Farmers have selected some superior genotypes in respect of yield and quality, which are being propagating vegetatively. Conversion of seed propagated plants especially male plants to superior ones through top working and *in-situ* grafting are common practices in Narsingdi region. No improved cultivar or prominent types are available or scientifically documented in the literature for this region. Burmese grape is an underutilized fruit crop and still now there is a very limited literature available especially morphological traits. The information as well as assessment of genetic variability in the existing germplasm of a particular crop is sought as prerequisite (Appalaswamy and Reddy, 2004). The present study was, therefore, undertaken to identify distinct morphological characteristics of two popular cultivars of Burmese grape to generate a reference database to support cultivar protection and settle

possible commercial disputes as well as to guide breeding programmes and genetic resources of the species.

MATERIALS AND METHODS

Two cultivar of Burmese grape, one GI viz: Narshingdi local lotkan and one released variety viz. BARI Lotkan-1 were used in present study. It was the activity of *in situ* evaluation as where the plant has been grown. A centre of diversity or most concentrated area of cultivation of the respective GI was identified through discussion with experienced fruit scientist and Department of Agricultural Extension (DAE) officials at district and upazilla level. The plants of Narsingdi local were selected from farmer's field in Belabo upazilla of Narsingdi district. Similarly, the mother plant of BARI Lotkan-1was selected from the Regional Agricultural Research Station (RARS), Akbarpur, Moulavibazar from where the variety was released. Morphological characterization data were recorded from standing plant. Three plants were selected in each location for each cultivar for data collection. The selected trees were visited frequently at different growth stage. As there are no published descriptor for morphological characterization of Burmese grape was not available, at first need to develop a descriptor for Burmese grape at the onset of the study. Qualitative and quantitative of fruits and tree data were recordedas per prepared descriptor. The total soluble solids (TSS) content in fruit juice was measured with hand refractometer. The means were compared by t-test.

RESULT AND DISCUSSION

Qualitative descriptors

The present investigation was carried out with two cultivars i.e. Narsingdi local and BARI Lotkan-1. Both the genotypes were grown from seed and now being more than 20 and 13 years of age and medium height and short height mature tree. Plants were broad and vase shaped, plant feature was spreading and erect and branching pattern was pleiochasium and sympodium in Narsingdi local and BARI Lotkan-1, respectively (Table 1).Young shoots were pubescent in both genotypes. No variations were found in respect of leaf type (simple), leaf arrangement (whorled), leaf blade shape (elliptic) and stipules fimbricate (absent) between the cultivars. Acuminate shaped leaf apex, acute shaped leaf base with pubescent leaves was present in Narsingdi local and BARI Lotkan-1. Leaf margin was wavy in Narsingdi local genotype but entire in BARI Lotkan-1. Similar colored young leaf (light green) and mature leaves (dark green) were found in both genotypes (Table 1).

Flowering precocity was 3 to 4 years in Narsingdi local whereas, BARI Lotkan-1 was noticed 7 to 9 years. Flowering was little early (mid-February to mid-March) in BARI Lotkan-1 than Narsingdi local (Late February to late March). Khan (2001) reported that the flowering time of Burmese grape is in the month of February to March which is in consonance with the present findings. Inflorescences were cauliflory and flower type was unisexual in both the genotypes but off season flowering was rarely present in Narsingdi local and completely absent in BARI Lotkan-1 (Table 1). Adventitious or cauliflory bearing habit of Burmese grape was also reported by Bhowmick (2011). Shape of pistil scar was stellate in the both genotypes. Inflorescence stalk colour was light purple in Narsingdi local and purple in BARI Lotkan-1variety. Leafy bract and pubescence was present in both genotypes under this study. Flower colour was cream in Narsingdi local whereas, light yellow in BARI Lotkan-1. Medium sized profuse flowers were observed in both the cultivars (Table 1).

Harvesting time for both genotypeswere early July with synchronize fruit ripening. Medium fruit bearing habit was observed in BARI Lotkan-1 than that was heavy fruit bearing in Narsingdi local. Bright yellow coloured fruit having round shape was observed in Narsingdi local whereas, it was greenish yellow and oval in BARI Lotkan-1 (Table 2 and Fig. 1). According to Pal et al. (2008) matured Burmese grape fruits are roundish to oval in shape, turns yellow or yellowish brown in colour but golden-yellow colour of the fruits was observed by Chakrabarty and Gangopadhay (1997). Fruit colour distribution was uniform and showing excellent fruit attractiveness in Narsingdi local than that was partial and good attractiveness in BARI Lotkan-1 variety (Table 2). Fruit shoulder shape was depressed and tip was obtuse in Narsingdi local while it was obtuse and round in BARI Lotkan-1 (Table 2 and Fig. 1). Aril colour was creamy and creamy white in Narsingdi lotkan and BARI Lotkan-1, respectively. Aril texture was soft and fibrous in both cultivars. Aril was sweet in taste and juicy with weak flavor in Narsingdi local whereas, BARI Lotkan-1 was souring sweet in taste and very juicy with intermediate flavor (Table 2).

Quantitative descriptors

The quantitative data represented from the experiment revealed that the cultivars varied significantly regarding different plant, fruit and seed characters. Crown diameter differed significantly from each other (Table 3) but there was not much variation between the cultivars in respect of leaf characters (leaf blade length, leaf blade width, petiole length). Number of petals per flower was 6.0 in Narsingdi local and 4.66 in BARI Lotkan-1. Inflorescence length did not showed significant differences but inflorescence width was significantly lower in BARI Lotkan-1compered to Narsingdi local (Table 3).

The number of fruits per cluster was in significantly higher in Narsingdi local (14) than BARI Lotkan-1 (10). Statistically significant difference was observed in number of fruit segment of studied cultivars. Narsingdi local had almost double (2.87) whereas, BARI Lotkan-1

showed 1.30 segment per fruit (Table 3 and Fig. 1). Khan (2001) stated that number of fruit per cluster varied from 5 to 20 and individual fruit weight varied from 12 to 20 g, having 3 to 4 segment. This finding is accorded with the results of present study. A little bit difference was recorded regarding fruit length between Narsingdi local and BARI Lotkan-1 and the values were 3.27 and 3.03 cm, respectively. Other fruit characters i.e. fruit width, fruit weight, weight of peel, fruit skin thickness showed significant differences between Narsingdi local and BARI Lotkan-1 (Table 4). Fruit width was significantly higher (3.27 cm) than BARI Lotkan-1 (2.78). Individual fruit weight was significantly lower in BARI Lotkan -1 (11.18 g) than Narsingdi lotkan (15.35g). Fruit peel weight also showed difference between two cultivars and higher values (8.09 g) observed in Narsingdi local than BARI Lotkan -1 (4.72 g). Fruit skin thickness was significantly lower in BARI Lotkan-1 (0.31 mm) than Narsingdi local (0.44 mm). Brix index was higher in Narsingdi local (14.2%) than BARI Lotkan-1 (13.83%) and difference was statistically significant. There was no significant variation was observed in respect of aril weight and seed weight.

CONCLUSION

The present investigation revealed that the both cultivars of Burmese grape were different in respect of morphological traits. Plant shape, plant feature and branching pattern were different. Differences in fruit shape were observed between two cultivars. Some of desirable horticultural qualitative and quantitative characters also showed similarity and dissimilarity in both studied cultivars. Total soluble solid content was quite higher in Narsingdi local than BARI Lotkan-1.

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TABLES AND FIGURES

Table 1. *Plant, leaf, inflorescence characters of two Burmese grape cutivars*

Plant descriptor	**Narsingdi local**	**BARI Lotkan-1**
Plant shape	Broad	Vase shaped
Plant features	Spreading	Erect
Branching pattern	Pleiochasium	Sympodium
Young shoot pubescence	Pubescent	Pubescent
Leaf descriptor		
Leaf type	Simple	Simple
Leaf arrangement	Whorled	Whorled
Leaf blade shape	Elliptic	Elliptic
Stipules fimbricate	Absent	Absent
Leaf apex shape	Acuminate	Acuminate
Leaf base shape	Acute	Acute
Leaf margin	Wavy	Entire
Leaf pubescence	Present	Present
Colour of young leaf (recorded on fully opened leaf)	Light green	Light green
Colour of mature leaf	Dark green	Dark green
Inflorescence descriptor		
Flowering precocity (years)	3-4	7-9
Flowering duration	Late February to late March	Mid-February to mid-March
Flowering duration (female)	Late March to late April	Last week of March to last week of April
Position of inflorescence	Cauliflori	Cauliflori
Secondary/off-season flowering	Rare	Absent
Regularity of flowering	Regular	Regular
Inflorescence stalk colour	Light purple	Purple
Pubescence on inflorescence rachis	Pubescent	Pubescent
Presence of leafy bract	Present	Present
Flower type	Unisexual	Unisexual
Colour of flower	Cream	Light yellow
Flower size	Medium	Medium
Abundance of flower	Profuse	Profuse

Table 2. *Fruit characters of two Burmese grape cultivars*

Fruit descriptor	**Narsingdi local**	**BARI Lotkan-1**
Harvesting time	Early July	Early July
Fruit ripening nature	Synchronize	Synchronize
Fruit bearing habit	Regular	Regular
Fruit bearing intensity	Heavy	Medium
Fruit clustering habit	Cluster	Cluster
Fruit shape	Round	Oval
Fruit shoulder	Depressed	Obtuse
Fruit tip shape	Obtuse	Round
Shape of pistil scar	Stellate	Stellate
Mature fruit colour	Bright yellow	Greenish yellow
Distribution of colour on fruit	Uniform	Partial
Fruit attractiveness	Excellent	Good
Aril texture	Soft and fibrous	Soft and fibrous
Aril flavor	Weak	Intermediate
Aril eating quality	Sweet	Sour sweet
Aril juiceyness	Juicy	Very juicy
Aril colour	Creamy	Creamy white
Adherence aril to seed	Adhere	Adhere
Seed shape	Heart shape	Heart shape

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Table 3. *Quantitative characters of two Burmese grape cultivars*

Cultivar name	Trunk circumference (cm)	Crown diameter (m)	Leaf blade length (cm)	Leaf blade width (cm)	Petiole length (cm)	No. of petal per flower	Length of inflorescence (cm)	Width of inflorescence (cm)
Norsingdi local	85	19.17	19.16	8.1	4.93	6.0	14.57	1.87
BARI Lotkan-1	69	7.5	19.60	7.27	3.94	4.66	12.03	1.30
t-value	2.63	8.04	2.33	2.94	1.84	1.51	2.09	16.04
P<0.05	NS	*	NS	NS	NS	NS	NS	*

Table 4. *Fruit and seed descriptor's of Burmese grape*

Cultivar name	No. of fruit/ cluster	Fruit segment	Fruit length (cm)	Fruit width (cm)	Fruit weight (g)	Weight of peel (g)	Fruit skin thickness (mm)	Weight of aril (g)	Weight of seed (g)	Brix index (%)
Narsingdi local	14	2.87	3.27	3.27	15.35	8.09	0.44	7.4	1.01	14.2
BARI Lotkan-1	10	1.30	3.03	2.78	11.18	4.72	0.31	6.93	0.87	13.83
t-value	2.24	16.91	2.45	8.21	4.56	15.93	4.69	1.08	2.80	10.97
P<0.05	NS	*	NS	*	*	*	*	NS	NS	*

NS: Non significant

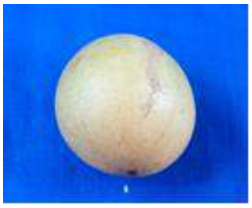
Cultivar name	Fruit shape	Fruit shoulder shape	Fruit skin colour	Fruit segment
Narsingdi local				
	Round	Depressed	Bright yellow	3-4 segment
BARI Lotkan - 1				
	Oval	Obtuse	Greenish yellow	2 segment

Figure 1. *Differences between two cultivars of Burmese grape in respect of fruit descriptor*