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Physiochemical and protein profiling of *Bacaurea ramiflora* (Burmese grape) - an underutilized fruit crop in Arunachal Pradesh

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ABSTRACT

A survey was conducted in the Napit, Pekung and Runne village of East Siang district of Arunachal Pradesh, India during the period 2015-2016 for the documentation on the variability of *Bacaurea ramiflora* (Burmese grape) in this region. These plants are found wild or in the homestead garden. From the investigation two types of morphotype could be identified in this region (mild acidic and sweet type). Study on its different physical and quality parameters revealed that the sweetness ranges from 12.5 to 16.5° Brix and the fruit parameters like fruit weight, pulp weight, fruit juice, TSS, total sugar and acidity are found to be significant among the genotypes. However, the biochemical marker (SDS PAGE) revealed monomorphic banding pattern and no variable is found in among the genotypes which can be confirmed using molecular marker in the near future.

Key words: Burmese grape, physicochemical, SDS-PAGE, Underutilized fruit crop.

INTRODUCTION

Burmese grape (*Baccaurea ramiflora* Syn. *Baccaurea sapida*) is an under exploited minor fruit crop, belong to Phyllanthaceae family. It is grown mainly in the forest and homestead garden in East Siang district of Arunachal Pradesh. It has become an alternative source of income for the local people of the district and fetches huge amounts in the local market. The generic name is derived from Latin 'baccaurea' referring to the golden-yellow colour of the fruits (Chakrabarty and Gangopadhyay, 1997). It is native to the South East Asian region (Deb and Bhomik, 2013) and distributed all through Asia most commonly in India and Malaysia (Mann *et al*. 2016). The tree is found wild or cultivated in the sub-Himalayan tract in eastern India from Bihar to Arunachal Pradesh and in the lower hills and valleys of Meghalaya, Assam, Nagaland, Manipur, Mizoram, Tripura and Orissa, ascending to an altitude of 900 m, and in Andaman and Nicobar Islands, chiefly in the moist tropical forests (Anon., 1988). In North Eastern part of India the fruits are grown mainly as wild underutilized minor fruit crops and few growers have started in homestead condition in Manipur, Nagaland, Meghalaya, Mizoram, Tripura and Arunachal Pradesh. Locally the fruit is known as *Motok hei* in Manipuri, *Bureng* in *Adi* language in Arunachal Pradesh, *leteku* in Assamese language in Assam and *Sohramdieng* in khasi hill and *Gasampe* in Garo hill districts of Meghalaya. In West Bengal, it is an important underutilized fruit crop locally known as '*Latka', or 'Latkan' or 'Lotko' or 'Notko'* (Deb and Bhowmick, 2013) and in Northern India commonly known as Kusum (Mann *et al*. 2016). It is a mild acidic fruit and mainly used as fresh fruit consumption. Besides, the pulp of it is used for making chutney, sauce, pickle, squash and is also a good source of vitamin C (Sandriyal and Sundriyal, 2003). It flowers during the summer months and fruits are mature in rainy season i.e. July to August month. However, in the Northern part of India its availability period is reported in May-July (Mann *et al*. 2016) and in the North Bengal its availability period is May-June (Deb and Bhowmick, 2013). The fruit has been used medicinally for skin disease treatment. Bark, wood and root are also used medicinally to treat arthritis, abscesses and injuries and fruit juice is mainly used for the treatment of constipation. Besides, it has antiviral and antioxidant properties in the fruit and diuretic properties in the stem bark (Lin *et al.* 2003 and Goyal *et al*. 2013). It is also reported to be used for curing skin diseases in Manipur and Meghalaya (Singh *et al*. 2014 and Momin *et al.* 2016). The fruit is oval to round in shape and turns yellow or yellowish brown in ripen condition. The type of fruit is berry and edible portion is aril which is covered by leathery rind and 3-4seeds / fruit. Until now vegetative propagation method is not standardized; so, variation is present among the present plant population having mild acidic and sweet genotype in East Siang district of Arunachal Pradesh. For fresh consumption, sweet genotype is preferred by the local people. However, no improved cultivar or prominent types are available for this region and vegetative propagation method is also not standardized for this minor fruit crop in Arunachal Pradesh.

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Besides, there is no varietal screening in India as well as aboard for the selection of superior genotype for this important underutilized fruit crop. In the present study, an attempt has been made to evaluate the physicochemical and biochemical marker for the screening of variability of Burmese grape genotypes in East Siang district of Arunachal Pradesh.

MATERIALS AND METHODS

The study was carried out by randomly selecting the Burmese grape plant from different sites of East Siang district *viz.* Napit village, Pekung village and Runne villages of Arunachal Pradesh. These villages are inhabited by the *Adi* tribal community. The average altitude of the sites are about 155 m MSL and represent a typical subtropical zone with short cool, dry and windy winter, a hot summer and a heavy monsoon season. The climate of Arunachal Pradesh varies with topography and elevation. Study site represents a subtropical, hot and humid climate; in the lower valleys, summer temperatures in June, July, and August typically rise to about 30°C, while winter temperatures in December, January, and February usually drops to 13°C. Annual rainfall in the state averages 3,300 mm, falling mostly between April and September in the centre of the state. The fruits were subjected for studies on physico-chemical and SDS PAGE analysis for the screening of superior genotype found in this region. Three fruit bunches were harvested randomly from each selected plant and ten fruits of each bunch were taken for the evaluation of fruit morphology variable viz. length (cm), fruit diameter (cm), fruit weight (g), peel weight (g), peel thickness (mm) in average, seed weight (g), juice content (ml/fruits) and quality parameters like total soluble solids (TSS), reducing sugar, total sugar, tritable acidity and vitamin C were determined with standard of A.O.A.C.(1985) and observations were analyzed in simple Completely Randomized Block Designed (CRD) as suggested by Gomez and Gomez (1983). The genetic diversity of the selected genotypes was screened using SDS PAGE method as described by Nei and Li (1979).

RESULTS AND DISCUSSION

According to earlier investigations, the sweetness range of Burmese grape found in North Bengal is 11.6° to 13.1° Brix (Bhowmick *et al.* 2013). In Arunachal Pradesh, there is still no report about the variability of Burmese grape which grows in a few pockets of East Siang district of Arunachal Pradesh. During our survey, it is observed that variation in fruit size having cauliflorious bearing habit (Fig. 1) and two types of morphotype in this region *viz.* sweet (16.5 °Brix) and mild acidic (12.5 °Brix) based on the sweetness character (Fig. 4) and the edible part of sweet type are larger as compared to mild acidic type.

The physical and physiochemical properties of the two morphotype of Burmese grape viz. fruit weight, fruit size, peel weight, number of fruit/panicle, panicle length, number of seed/fruit, seed size are presented in Table 1 and the quality parameters like vitamin C, total sugar, TSS, reducing sugar are presented in Table 2. The physicochemical analysis of the selected genotypes was done at fully mature stage (fruit turn yellow colour).

Among this two morphotype of Burmese grape found in this region, there are significant difference in their characters like fruit weight, pulp weight, TSS, total sugar and acidity of the fruit. However, there is no significant difference in panicle length, number of fruit/panicle, seed weight, peel weight, seed size, fruit juice and fruit size

Fig 1: Burmese grape cauliflory bearing habit

Table 1: Morphological characteristics features of Burmese grape (*Baccaurea ramiflora*)

Location	Panicle length (cm)	Frts./ Panicle	Pulp Wt.(g)	Peel Wt.(g)	Frt. Wt. (g)	Frt. Len(cm)	Frt. Br.(cm)	Frt. Juice (ml)	No. of seeds/frt.	Seed wt.(g)	Seed Len.(cm)	Seed Br. (cm)
R_1L_1	33.0	18.0	8.2	4.8	14.2	2.4	2.5	46.0	3.5	1.1	1.0	0.7
R_2L_1	30.0	8.0	8.8	4.8	14.7	2.5	2.6	43.0	3.0	1.1	1.2	1.0
R_3L_1	29.0	13.0	8.0	4.8	14.0	2.4	2.5	38.0	2.7	1.1	1.2	0.8
R_1L_2	21.0	8.0	6.4	4.8	12.4	2.6	2.8	33.0	3.2	1.1	1.3	0.9
R_2L_2	30.0	16.0	6.3	4.7	12.2	2.5	2.6	36.0	3.0	1.2	1.0	0.9
R_3L_2	28.0	10.0	6.2	4.7	12.1	2.4	2.5	34.0	2.6	1.2	1.1	0.8
R_1L_3	17.0	12.0	6.3	4.7	12.2	2.3	2.4	36.0	3.8	1.1	1.0	0.7
R_2L_3	19.0	9.0	6.3	4.8	12.3	2.5	2.7	35.0	2.6	1.1	1.2	0.7
R_3L_3	27.0	16.0	6.1	4.4	10.5	2.6	2.8	31.0	2.4	1.0	1.3	0.75
Mean	26.0	12.3	6.8	4.7	12.7	2.4	2.6	36.9	2.8	1.1	1.2	0.8
SEM±	….	….	4.94	….	5.1	….	….	2.38	….	….	….	….
CD@5%	….	…..	12.2	….	12.66	….	….	5.84	**….**	**….**	**….**	**….**

Table 2: Fruit quality parameters of Burmese grape (*Baccaurea ramiflora*)

Location	TSS	Total sugar	Vitamin C	Reducing sugar	Acidity
R_1L_1	16.0	4.2	21.0	4.0	2.0
R_2L_1	16.5	4.1	23.0	3.9	1.9
R_3L_1	17.0	4.1	20.0	4.0	1.9
R_1L_2	12.8	4	20.0	4.0	2.2
R_2L_2	12.0	3.8	22.0	3.7	2.1
R_3L_2	12.9	3.9	21.0	3.9	2.2
R_1L_3	13.5	4.1	20.0	4.0	2.2
R_2L_3	13.7	4	19.0	3.7	2.0
R_3L_3	13.4	4	22.0	3.7	2.0
Mean	14.2	4.0	20.9	3.8	2.0
SEM±	**0.3**	**0.05**	**....**	**....**	**0.06**
CD@5%	**0.82**	**0.14**	**....**	**....**	**0.16**

NB: L_1: Napit village L_2: Pekung village L_3: Runne village

Fig 2: Variation in number of fruits/panicle

significantly (Fig. 2). The sweetness range from 12.5-16.5° Brix found in East Siang district of Arunachal Pradesh. Similar sweetness is also reported by Deb and Bhowmick (2013) and Pradhan *et al*. (2017) from West Bengal but better sweeter genotype are found in this region. The sweet genotypes found in this region are also bigger in size 143g/ fruit as compared to other genotype 116g/fruit (Fig.3). Although, the sweet genotype are bigger as compared to the mild acidic genotypes but not significantly difference in between this two morphotype. This underutilized fruit crop is a source of protective food and income generation in the remote villages of East Siang district of Arunachal Pradesh in which the people prefer sweet genotype for fresh consumption.

Fig 3: Variation in fruit size

The variability of Burmese grape germplasm was screen by SDS-PAGE using tris-glycine buffer. From 1g of seed of the selected and the protein are extracted using SDS PAGE methods as described by (Nei and Li, 1979) and loaded at 5ìl/lane and compared it variability from the banding pattern. From the investigation, it is confirmed that the genotypes found in the Napit, Runne and Pekung villages have the same composition of protein - with monomorphic band pattern (Fig 5). In future applications of DNA based molecular marker and wider area for documentation; - subtropical and tropical regions of Arunachal Pradesh can be explored for identification of variable genotypes of Burmese grape having the sweet taste in large size fruit for vegetative propagation in order to develop a clonal variety in the near future. Similarly, Yadav (2008) also reported that DNA marker can be used to provide varietal profile for screening of variation which is distinct and understandable in genetic terms.

Fig 4: Variation in edible fruit part

CONCLUSION

Burmese grape is an acidic fruit in nature. However, the low acidity, bigger size of fruits and high TSS are the

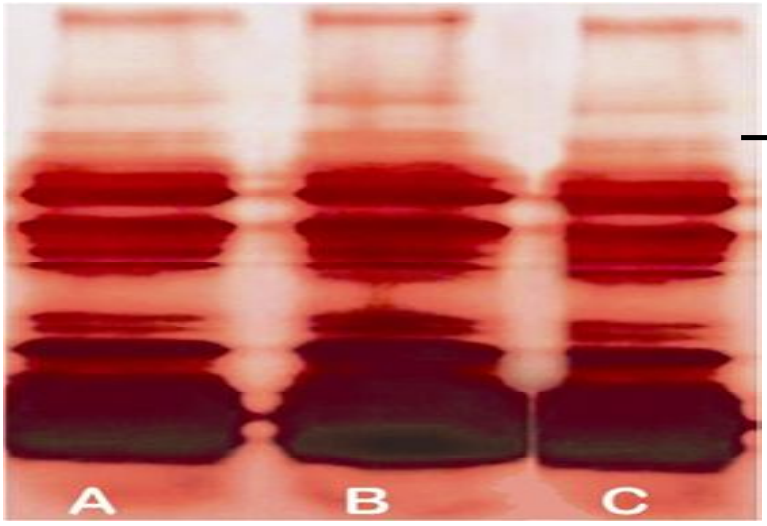

Fig 5: SDS-PAGE banding pattern of Burmese grape from East Siang district of Arunachal Pradesh. A represents genotype from Napit village , B represents genotype from Pekung village and Crepresents genotype from Runne village

desirable characteristics for local fresh consumption. It is found from the present investigation that the genotype from Napit village is superior genotype in terms of sweetness for local consumption and can be used for clonal multiplication in future.

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