

## FLOWERING, FRUITING AND GERMPLASM CHARACTERIZATION OF BURMESE GRAPE (*BACCAUREA SAPIDA* MUELL. ARG.)

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### Abstract

Burmese grape (*Baccaurea sapida* Muell. Arg.) belongs to the family Euphorbiaceae, is a minor underexploited fruit crop grown wild as well as under cultivation in Nepal, India, Myanmar, Bangladesh, China, Thailand, for fresh consumption. It is a dioecious plant and reported to have an excellent nutritive value, but mainly grown in homestead condition mostly in neglected ways. The present study was aimed to characterize the germplasm nature, details of flowering and fruiting system of Burmese grape. Tree growth habit and crown shape of all the accessions surveyed were semi erect and irregular, respectively. The colour of the male flowers varied from yellow to green yellow shades while the colour of the female flowers varied from yellow to yellow green and green yellow shades. The variation present on fruit length (2.81 cm to 3.80 cm), fruit weight (12.25g to 22.95g), pulp percentage (49.82% to 65.33%), total soluble solids (9.00° to 13.10°Brix), titratable acidity (0.73mg to 1.28mg/100g fruit pulp) and ascorbic acid content ranged from (23.18mg to 57.80mg/100g fruit pulp) suggest suitable selection method for identification of promising Burmese grape genotypes.

### Introduction

*Baccaurea* is a genus of flowering plants belonging to the family Euphorbiaceae. Burmese grape (*Baccaurea sapida*) is one of the popular underutilized fruit plants native to South East Asian region and growing wild as well as under cultivation in Nepal, India, Myanmar, Bangladesh, South China, Indo- China, Thailand, the Andaman Island and Peninsular Malaysia. The generic name is derived from Latin '*Baccaurea*' referring to its golden yellow colour of the fruits (Chakrabarty and Gangopadhyay 1997). This fruit crop is grown in forest, semi-forest, forest fringed areas and also domesticated in homestead condition. In India it is grown as a minor underexploited fruit crop under the sub-Himalayan Terai region of West Bengal and north east India, Andaman Island for fresh local consumption. It is a slow growing, evergreen, dioecious, short to medium height (Fig. 1a), shade loving plant species, and fruits are acidic in taste (Bhowmick, 2009). Apart from fresh consumption the fruits can be used for making wine, juice and jams. The haploid chromosome no. of *B. sapida* is reported to be 13 (Mehra and Hans 1969). It flowers during summer months and fruits are matured during rainy season. The edible portion is aril (3-4 in no. per fruit) and is covered by leathery rind (Fig 1h, i). The tree show mild bienniality in cropping pattern (Pal *et. al.* 2008). It is a hardy plant, and grown as neglected crop without much more care even in forest fringed area, road side plantation. The Burmese grapes have plentiful nutrients as reflected in world literature. Though the crop is reported to contain good nutritional properties such as ascorbic acid, antioxidant capacity, proteins, minerals such as calcium, phosphorous, and seeds having antifungal activity, however, its potentiality for alleviation of rural malnutrition particularly in south east Asiatic region (area of its occurrence) has yet not tapped properly, which may be explored. Fruits of Burmese grape contain 5.5 percent

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protein, 178 mg vitamin C, 169 mg calcium, 137 mg potassium, 177 mg phosphorous, and 100 mg iron per 100g of fruit pulp (Kermesha *et al.*, 1987) indicating its nutritive value for the rural areas. In spite of the potentiality, the Burmese grape is grown as little care on homestead condition raised by seeds creating variability in genotypes. However, very little systematic information is available in world literature regarding the characterization of germplasms and flowering, fruiting behaviour of this crop. The present attempt was the first report to characterize the genotypes of Burmese grape and systematic documentation of flowering time, flowering duration, number of flowers per panicle, initial fruit set per panicle, ultimate fruit retention, yield and; physico-chemical properties of fruit.

### Materials and Methods

Burmese grape (*Baccaurea sapida* Muell.Arg) is dioecious and highly heterozygous in nature as well as no information is available regarding the variety/cultivars/types of the crop in worldwide. Keeping this point in consideration it has assumed that a variation among the population is present and each germplasm was treated as single accession during this experiment. During the study a survey was made on various home gardens of sub-Himalayan Terai region of West Bengal by making a questionnaire and after the whole survey, twenty numbers of female plants (accession) and fifteen numbers of male plants (accession) were selected as superior accessions based on plant vigour, bearing habit, size, shape and colour of fruits, taste, appearance for further analysis during the experiment to characterize the flowering and fruiting behaviour of germplasm as well as to know the variability among the selected plants. The germplasm with four replications for each observation were analyzed using one way classified data. Analysis of variance (one way classified data) for each parameter was performed using ProcGlm of Statistical analysis System (SAS) Software (Version 9.3). Means separations for different accessions under different parameter were performed using Tukey's Studentized Range (HSD) test ( $P \leq 0.05$ ) (Tukey 1953). The parameters like tree growth habit, branching pattern, crown shape, and trunk surface were recorded following the Litchi Descriptor (as the standard descriptor is not available and the canopy size is similar with litchi) of International Plant Genetic Research Institute (IPGRI), Rome, Italy. The colour of different plant parts were recorded with the help of Royal Horticulture Society Colour Chart (fifth edition). Different bio-chemical properties of fruit were recorded following the methods described by Ranganna (1977).

### Results & Discussion

After the experiment conducted on surveyed population of Burmese grape it was found that the tree growth habit was varied from semi erect to spreading, crown shape of all accession were irregular, branching pattern was erect or irregular or horizontal and trunk surface was rough. Leaf blade shape was elliptic, leaflet base shape was cuneate. It was also observed that the type of phyllotaxy was alternate (Fig. 1b), leaf apex shape varied from acute to acuminate and the bearing habit of Burmese grape was cauliflory (flowers and fruits are directly coming from the stem)[Fig. 1c]. The present investigation revealed that there was significant variation among different Burmese grape accessions from various parameters observed under this study. The height of the male and female accessions varied from 2.59-7.39 m and 4.92-13.06 m respectively. While the length of leaf blade ranged between 16.50 cm (ACC-12) to 19.58 cm (ACC-5) and 18.15 cm (ACC-10) to 25.30 cm (ACC-19) in male and female germplasms, respectively. The breadth of leaf blade varied from 5.00cm (ACC-9) to 6.78 cm (ACC-10) in male and 6.28 cm (ACC-15) to 9.61 cm (ACC-2) in female germplasms, respectively (Table 1). Similarly, the leaf area of male and female Burmese grape germplasms ranged from 16.94 cm<sup>2</sup> (ACC-8) to 19.66 cm<sup>2</sup> (ACC-3)

and 15.23 cm<sup>2</sup> (ACC-8) to 20.12 cm<sup>2</sup> (ACC-4), respectively. The colour of the upper side of the leaves in both male and female accessions ranged from G 137 A - G 141B shade to G N137 A to G 141 A shades of Royal Horticulture Society Colour Chart (5<sup>th</sup> edition). The colour of the male flowers (Table 2) varied from yellow to green yellow shades while, the colour of female flowers varied from yellow to yellow green and green yellow shades of Royal Horticulture Society Colour Chart (5<sup>th</sup> edition). The flower bud differentiation of male and female germplasms were started from first to mid week of February while the emergence of inflorescence was started from mid to last week of February (Fig. 1e) . The anthesis occurred between first to mid week of March for both the male and female accessions surveyed showed synchronization of flowering leading to good fruit set. The number of sepals and petals were 4-5 and 1, in both male and female germplasms, respectively. The flowering duration varied significantly among the germplasms surveyed. The duration of flowering (Table 2) in male accessions varied from 5 days (ACC-4) to 7.5 days (ACC-1) while in female accessions it was ranged from 6.50 days (ACC-10 and 11) to 9.25 days (ACC-4). The number of flower per panicle in male and female germplasms ranged from 38.00 (ACC-12) to 63.00 (ACC-11) and 24.50 (ACC-13) to 31.50(ACC-7) respectively. The length and diameter of male inflorescence varied from 60.42mm (ACC-5) to 117.99mm (ACC-14) and 1.42mm (ACC-8) to 1.91mm (ACC-2), respectively. Similarly, the length and diameter of female inflorescence varied from 67.90mm (ACC-16) to 141.48mm (ACC-15) and 1.78mm (ACC-1) to 2.54mm (ACC-16), respectively (Table 2). The fruit set in different germplasms were observed during the mid to last week of March. The shape of the fruit was oval or round (Fig 1f, g). The time taken for aril formation after fruit set and maturity of fruits varied from 42 to 51 days and 94.5 to 105.25 days respectively (Table 3). The colour of the aril during maturity varied from white (W N155 A) to grayish white (W NN155 A), while the colour of ripe fruits varied from yellow to yellow orange groups (Y 13 A to YO 14, 15 B and C) of Royal Horticulture Society Colour Chart (5<sup>th</sup> edition). Experimental results showed that the initial fruit set per panicle in Burmese grape ranged from 20.00 (ACC-16) to 25.25 (ACC-9). Similarly the initial fruit set percentage ranged from 69.90% (ACC-16) to 89.47% (ACC-10). However, it was experienced different phases of fruit drop during the course of growth and development phases and finally the fruit retention percent (Table 3) was ranged from 20.40% (ACC-18) to 38.72% (ACC-14). The number of fruits at harvest per panicle was maximum (8.50) in ACC-10 and minimum (4.25) in ACC-18 respectively. The number of fruits harvested per plant was ranged from 567 to 4745 (Table-3). Similarly, yield per tree ranged from 9.97 kg (ACC-12) to 85.36 kg (ACC-14). Experimental results show that the fruit length ranged between 2.81 cm (ACC-3) to 3.80 cm (ACC-9). Similarly, the fruit breadth ranged from 1.39 cm (ACC-15) to 3.04 cm (ACC-20).The fruit weight varied from 12.25g (ACC-8) to 22.95 g (ACC-3). Similarly peel weight was highest in ACC-3 (9.03 g) and lowest in ACC-8 (4.04 g). Similarly, the maximum (65.33%) and minimum (49.82%) pulp percentage was observed in ACC-18 and in ACC-17 respectively. It is evident from the study that the total soluble solids was maximum in ACC-2 (13.10°Brix) and minimum in ACC-12 (9.00°Brix). Similarly, the total sugar was highest (7.22 mg/100 g pulp) and lowest (4.84 mg/100 g pulp) in ACC- 13 and in ACC-2 respectively. Reducing sugar was found to be highest (6.45 mg/100 g pulp) and lowest (3.99 mg/100 g pulp) in ACC-14 and ACC-20 respectively. While, the non-reducing sugar was highest (2.91 mg/100 g pulp) and lowest (0.08 mg/100 g pulp) in ACC-13 and ACC-16, respectively, while acidity and ascorbic acid content was maximum (1.28mg/100g pulp, 57.80mg/100g pulp) and minimum (0.73 mg/100 g pulp, 23.18mg/100 g pulp) in ACC-17, ACC-2 and ACC-16, ACC-4, respectively (Table 4).

The present investigation revealed that, there was significant variation among different Burmese grape accessions. The variation of plant height was observed from 2.59-7.39m and 4.92 to 13.06 m, respectively in male and female germplasms surveyed. Similar observations of

Table 1. Tree Characteristics of male Burmese grape germplasm.

Accession no.	Branching pattern	Leaflet apex shape	Leaf blade length (cm)	Leaf blade breadth (cm)	Leaf area (cm <sup>2</sup> )	Flower colour	Flowering duration (days)	No. of flower /panicle	Inflorescence Length (mm)	Inflorescence Diameter (mm)
ACC-1	Horizontal	Acuminate	19.58a	5.36a	18.52ba	GY 1 C	7.5a	62.20ba	67.64b	1.80ba
ACC-2	Horizontal	Acuminate	17.80ba	5.45a	18.64ba	GY 1 D	6.5b	57.80bdac	78.13b	1.91a
ACC-3	Horizontal	Acute	17.12ba	6.60a	19.66a	Y 5 D	6b	60.60bac	78.17b	1.62ba
ACC-4	Horizontal	Acuminate	16.74ba	5.89a	19.08ba	Y 5 D	5b	51.20ebdac	79.23b	1.76ba
ACC-5	Erect	Acuminate	19.58a	5.22a	18.32ba	Y 6 D	5.25b	43.80ed	60.42b	1.60ba
ACC-6	Horizontal	Acute	18.86ba	6.37a	18.94ba	Y 6 C	5.25b	47.60ebdac	69.06b	1.57ba
ACC-7	Erect	Acuminate	19.46ba	6.56a	18.58ba	Y 5 D	7.25ba	45.00edc	80.68b	1.44b
ACC-8	Erect	Acuminate	17.32ba	6.22a	16.94b	Y 5 D	6.75ba	46.00ebdc	88.53ba	1.42b
ACC-9	Horizontal	Acuminate	19.10ba	5.00a	18.98ba	Y 5 D	7.25ba	49.40ebdac	72.91b	1.75ba
ACC-10	Horizontal	Acute	18.56ba	6.78a	17.34ba	Y 4 C	7ba	49.20ebdac	71.06b	1.51ba
ACC-11	Horizontal	Acuminate	18.22ba	5.72a	18.98ba	Y 5 D	7.25ba	63.00a	75.51b	1.47ba
ACC-12	Erect	Acuminate	16.50b	5.84a	17.34ba	Y 4 C	7ba	38.00e	72.83b	1.57ba
ACC-13	Erect	Acuminate	18.50ba	6.38a	17.92ba	Y 5 D	7.25ba	58.60bdac	88.27b	1.42b
ACC-14	Erect	Acute	17.92ba	6.22a	18.54ba	Y 4 B	5.25b	52.6ebdac	117.99a	1.66ba
ACC-15	Erect	Acuminate	18.12ba	5.42a	19.08ba	Y 4 B	5.75b	55.6bdac	80.68b	1.47ba
Minimum Significant Difference (MSD)			2.97	1.89	2.39	-	2.44	16.44	29.50	0.46
[Tukey's HSD (P ≤ 0.05)]										

Means in each column with the same letter are not significantly different at  $p \leq 0.05$ .

Table 2. Tree characteristics of female Burmese grape germplasm.

Accession no.	Tree growth habit	Branching pattern	Leaflet shape	leaf blade Length (cm)	leaf blade Breadth (cm)	Leaf area (cm <sup>2</sup> )	Flower colour	Flowering duration (days)	No. of Flower/panicle	Inflo Length (mm)	Dia of inflo (mm)
ACC-1	Semi erect	Erect	Acuminate	20.25bc	9.58a	19.45ba	GY 1 A	6.75bc	27.50ba	96.59ba	1.78c
ACC-2	Semi erect	Erect	Acuminate	19.55bc	9.61a	18.65bac	GY 1 D	7.00bac	28.25ba	121.75ba	2.21bac
ACC-3	Semi erect	Erect	Acuminate	18.55c	9.35ba	18.48bac	YG N14 B	9.00ba	29.75ba	117.36ba	1.92bac
ACC-4	Semi erect	Erect	Acute	22.58ba	9.40ba	20.12a	YG N14 D	9.25a	28.50ba	86.35ba	2.43ba
ACC-5	Semi erect	Erect	Acuminate	19.55bc	8.28bac	18.08bac	YG 154 D	8.75bac	29.50ba	117.38b	1.92bac
ACC-6	Semi erect	Erect	Acuminate	21.10bc	8.05bac	19.43ba	YG 154 B	8.75bac	28.00ba	77.24ba	1.96bac
ACC-7	Semi erect	Irregu.	Acute	19.55bc	9.38ba	18.70bac	Y 3 C	9.00ba	31.50a	86.35ba	1.87bc
ACC-8	Semi erect	Irregu	Acuminate	21.10bc	8.75ba	15.23c	GY 1 C	9.00ba	26.25ba	115.53ba	1.91bac
ACC-9	Spread	Irregu	Acuminate	20.90bc	9.53a	18.30bac	GY 1 B	9.00ba	29.75ba	114.42ba	2.10bac
ACC-10	Spreading	Irregu	Acuminate	18.15c	9.23ba	19.20ba	GY 1 B	6.50c	27.75ba	83.25ba	2.37bac
ACC-11	Semi erect	Erect	Acuminate	20.97bc	7.18bc	19.20ba	GY 1 B	6.50c	27.50ba	98.34ba	2.23bac
ACC-12	Semi erect	Erect	Acute	19.60bc	8.73ba	17.93bac	GY 1 B	7.50bac	27.50ba	111.02ba	2.31bac
ACC-13	Spreading	Irregu	Acuminate	21.30bc	8.05bac	17.45bac	GY 1 B	7.25bac	24.50b	111.78ba	2.02bac
ACC-14	Spreading	Irregu	Acuminate	21.18bc	9.55a	16.98bac	YG 154 D	7.25bac	26.75ba	137.59a	2.03bac
ACC-15	Spreading	Irregu	Acuminate	22.85ba	6.28c	18.58bac	YG 145 B	6.75bc	29.25ba	141.48a	2.33bac
ACC-16	Spreading	Irregu	Acute	21.23bc	8.80ba	16.58bc	Y 2 C	8.50bac	28.75ba	67.90b	2.54a
ACC-17	Spreading	Irregu	Acuminate	20.30bc	8.18bac	17.48bac	GY 1 B	7.75bac	28.75ba	93.55ba	2.41ba
ACC-18	Spreading	Irregu	Acuminate	21.75bac	8.56ba	17.48bac	GY 1 B	7.00bac	27.75ba	126.94ba	1.99bac
ACC-19	Spreading	Irregu	Acuminate	25.30a	8.29bac	17.88bac	GY 1 B	7.50bac	25.25ba	139.46a	1.87bc
ACC-20	Spreading	Irregu	Acute	22.55ba	7.90bac	19.43ba	GY 1 B	7.00bac	25.00b	84.18ba	1.85bc
Minimum Significant Difference(MSD)				3.99	2.25	3.50	-	2.37	6.30	65.88	0.64
[Tukey's HSD (P≤0.05)]											

Means in each column with the same letter are not significantly different at P ≤ 0.05. (Inflo=Inflorescence, Dia=Diameter, Irregu=Irregular)

Table 3. Fruiting behaviour of Burmese grape germplasm.

Accession no.	Fruit shape	Anil form ation (days)	Ripen fruit colour	Fruit maturity period (Days)	fruit set No/panicle	Fruit set percentage	Fruit retention percentage	fruits harvest/panicle	Fruits harvest (No.) / tree	Yield (kg/ tree)
ACC-1	Round	42d	Y 13 A	96bd	20.50a	74.80(60.015)bac	32.27(34.22)a	6.50ba	598	10.35
ACC-2	Round	46bc	Y 13 A	102.25ba	21.25a	75.20(60.133)bac	30.86(33.55)a	6.50ba	612	10.46
ACC-3	Round	44dc	Y 13 B	96.5bdc	23.25a	78.07(62.125)bac	35.30(36.39)a	8.25ba	1025	23.52
ACC-4	Round	42d	Y 13 B	94.5d	22.50a	79.18(63.2)bac	28.54(32.04)a	6.25ba	1203	16.43
ACC-5	Round	42d	Y 13 A	96.25bdc	22.50a	76.52(61.08)bac	22.53(30.70)a	5.00ba	1254	23.35
ACC-6	Oval	42d	Y 13 A	94.75dc	20.75a	75.32(52.878)c	36.39(36.94)a	7.00a	1980	33.26
ACC-7	Round	42d	Y 13 A	95.25bdc	24.00a	76.46(61.173)bac	33.67(35.35)a	8.00ba	2649	46.12
ACC-8	Round	46bc	Y 13 A	102bac	22.00a	83.32(66.34)bac	27.44(31.32)a	6.25ba	2012	24.65
ACC-9	Oval	49ba	Y 13 A	105.25a	25.25a	84.96(67.423)ba	24.35(28.69)a	6.00ba	781	13.64
ACC-10	Round	49ba	YO 14 B	104.5a	24.75a	89.47(70.918)a	34.42(35.88)a	8.50a	4213	73.56
ACC-11	Oval	49ba	Y 13 B	105a	22.50a	82.55(5.803)bac	34.85(36.14)a	7.75ba	782	14.04
ACC-12	Round	47ba	Y 13 B	104.75a	22.75a	82.83(66.143)bac	36.45(37.09)a	8.25ba	567	9.97
ACC-13	Round	47bc	Y 13 B	99.5bdac	21.25a	86.57(68.705)ba	32.88(34.85)a	7.00ba	3516	61.35
ACC-14	Oval	47bc	Y 13 B	99.75bdac	21.50a	80.82(64.725)bac	38.72(38.41)a	8.25ba	4745	85.36
ACC-15	Oval	47bc	YO 15 C	102bac	23.50a	80.62(64.08)bac	32.92(34.87)a	7.75ba	4219	71.72
ACC-16	Round	47bc	YO 14 B	99.25bdac	20.00a	69.90(56.79)bc	32.36(34.61)a	6.50ba	1234	20.26
ACC-17	Round	47bc	YO 14 B	96.25bdc	22.25a	77.29(61.39)bac	22.52(28.18)a	5.00ba	1237	17.69
ACC-18	Round	51a	YO 15 C	100.25bdac	20.75a	74.84(59.973)bac	20.40(26.76)a	4.25b	983	16.93
ACC-19	Round	49ba	YO 15 C	104.25a	20.75a	82.26(65.205)bac	31.29(33.96)a	6.50ba	2034	35.25
ACC-20	Round	49ba	YO 15 C	101.5bdac	20.75a	83.33(66.14)bac	26.69(31.05)a	5.50ba	752	12.69
MSD [Tukey's HSD (P≤0.05)]		3.59	-	7.45	NS	14.05	NS	4.20	-	-

Means in each column with the same letter are not significantly different at P ≤ 0.05

MSD: Minimum Significant Difference

Table 4. Fruit physico-chemical parameters of Burmese grape germplasm

Accession no.	Fruit length (cm)	Fruit breadth (cm)	Fruit weight (g)	Peel weight (g)	Pulp %	T.S.S (°Brix)	Total sugar*	Reducing sugar*	Non-Redu <sup>1</sup> sugar*	Acidity*	Ascorbic acid*
ACC-1	3.45bac	1.91bdac	17.30cbd	4.64ced	63.91	12.00ba	6.58b	4.35ikj	2.12bcd	0.85de	44.06ba
ACC-2	3.33bac	1.88bdc	17.09cebd	5.76cebd	57.58	13.10a	4.84i	4.81ifheg	0.12ji	0.85de	57.80a
ACC-3	2.81c	1.65dc	22.95a	9.03a	54.12	11.60ba	5.49fe	4.03k	1.38fe	0.85de	43.45bc
ACC-4	3.15bac	1.89bdc	13.66ef	5.55cebd	57.21	12.15ba	6.11c	4.39iklj	1.64ed	1.15bac	23.18d
ACC-5	3.11bc	2.14bdac	18.62b	6.66b	56.11	12.30a	6.66b	4.6550ifhijg	1.90cd	1.03bdac	41.65bc
ACC-6	3.23bac	2.24bdac	16.80cebd	6.51cb	50.43	11.65ba	5.32fg	4.91feg	0.39hgi	0.80de	54.37ba
ACC-7	3.24bac	2.30bdac	17.41cbd	5.60cebd	59.83	11.60ba	5.50fe	4.87fheg	0.59hg	0.78de	45.31bac
ACC-8	3.06bc	2.12bdac	12.25f	4.04e	55.12	11.10ba	5.56e	4.33ikj	1.17fe	0.78de	40.13bc
ACC-9	3.80a	2.29bdac	17.46cbd	5.46cebd	60.12	11.20ba	5.29fg	5.48cbd	0.18hgi	0.93dec	47.27bac
ACC-10	2.99bc	2.18bdac	17.46cefd	5.55cebd	51.54	11.60ba	6.20c	4.45ikhjg	1.66ed	0.98dec	37.99c
ACC-11	3.04bc	1.89bdc	17.95cb	6.38cb	56.00	12.50a	6.64b	5.95b	0.65hg	1.00bcd	36.40dc
ACC-12	3.10bc	2.10bdac	17.59cbd	6.65b	53.72	9.00b	5.82d	4.74ifheg	1.03fg	1.25ba	45.44bac
ACC-13	3.35bac	2.22bdac	17.45cbd	5.39cebd	60.58	11.95ba	7.22a	4.15k	2.91a	0.85de	36.09dc
ACC-14	3.50ba	2.68bac	17.99cb	7.02b	53.86	12.00ba	5.02hi	6.45a	1.37fe	1.25ba	37.21de
ACC-15	2.99bc	1.39d	17.00cebd	5.78cebd	57.22	12.70a	5.81d	5.65bc	0.16hgi	0.85de	40.31bc
ACC-16	3.08bc	1.97bdac	16.42cebd	6.25cebd	52.62	12.00ba	5.17hg	5.25ced	0.08j	0.73de	48.44bac
ACC-17	3.13bc	1.78bdc	14.30efd	5.78cebd	49.82	12.15ba	4.95i	5.61bc	0.63hg	1.28a	44.47bac
ACC-18	3.11bc	2.61bac	17.22cebd	4.35ed	65.33	12.75a	6.14c	5.08fed	1.00fg	1.03bdac	41.55bc
ACC-19	3.12bc	2.81ba	17.33cbd	6.55cb	53.29	11.90ba	6.48b	4.19kj	2.18bc	0.88de	35.34dc
ACC-20	3.25bac	3.04a	16.87cebd	5.26cebd	60.10	12.05ba	6.62b	3.99k	2.50ba	0.95dec	38.83c
MSD	0.65	1.13	3.64	1.97	15.86	3.21	0.21	0.50	0.51	0.26	14.34

Means in each column with the same letter are not significantly different at  $P \leq 0.05$ , \*(mg/100g pulp)MSD= Minimum Significance Difference [Tukey's HSD ( $P \leq 0.05$ )]. <sup>1</sup>Non reducing Sugar.



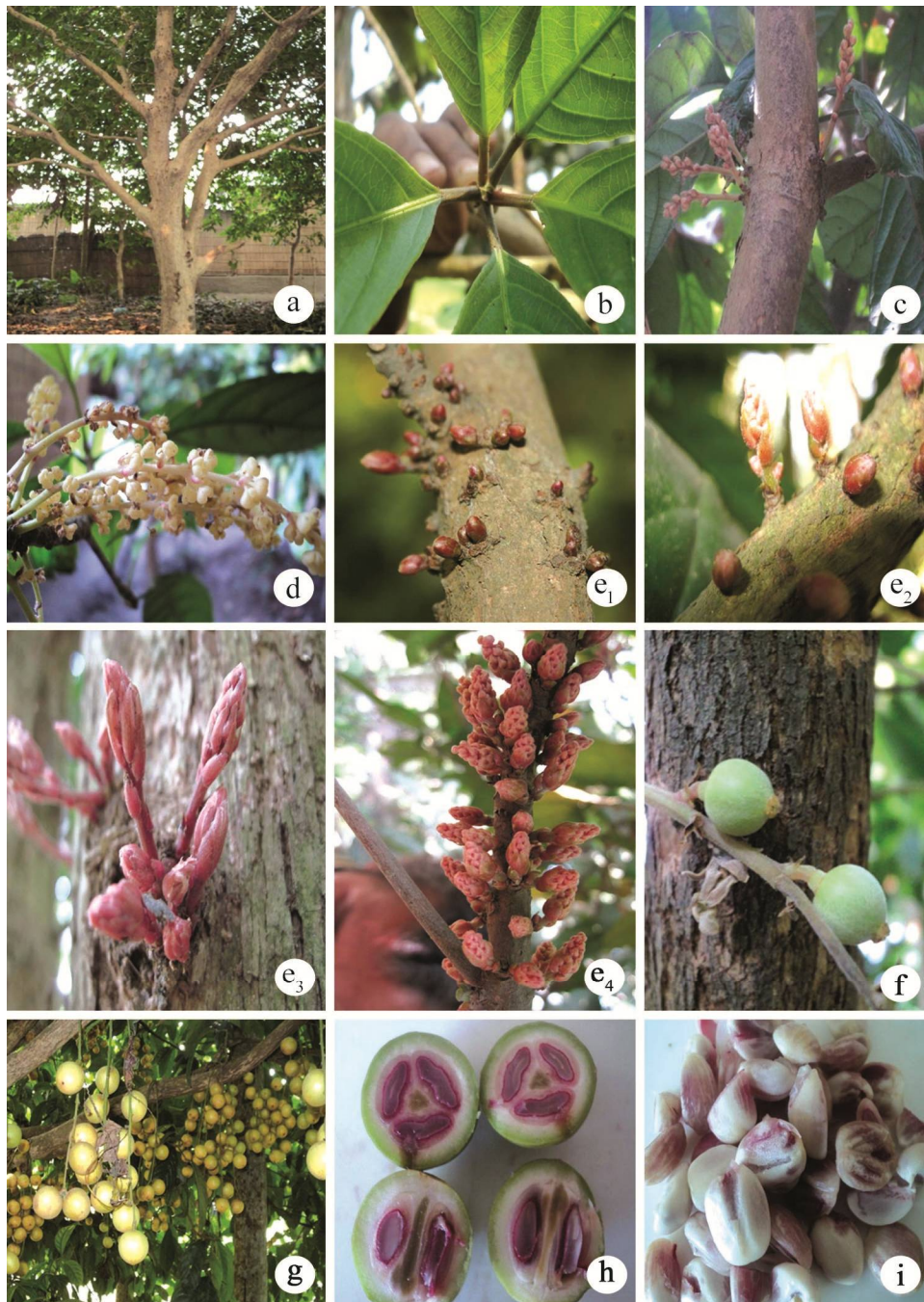


Fig. 1. Some relevant pictures: a) Burmese grape plant, b) Phyllotaxy of leaves, c) Cauliflory bearing habit (female flower), d) Male Flower, e) Stages of Flower bud differentiation (female), f) Immature fruits, g) Mature fruits, h) Immature pulp and i) Mature Pulp



variation of plant height of 5-25 m were also reported by previous workers (Abdullah *et.al.* 2005, Chakrabarty and Gangopadhyay 1997) from different parts of world. The variation presence in leaf colour, leaf sizes revealed from the present study confirms the differences among the germplasms. The previous workers also reported that the leaves of Burmese grape were simple, alternatively arranged with petiole and oblong or elliptic in shape (Anon. 2012; Chakrabarty and Gangopadhyay 1997). Anon. (2012) reported that the inflorescence is tomentose and appears on branches and the length of inflorescences of the Burmese grape is similar with the present experiment and the variation of number of flowers present in a panicle may be due to the genetic differences of the germplasms surveyed. Time of flowering observed in this investigation is with the same line as reported by Bhowmick (2009) during March-April. Chakraborty and Gangopadhyay (1997) reported that the flowers are clauiflorous in nature and are 10 to 40 cm long. The variation of flowering duration of male and female germplasms was noted in the present investigation and it was also observed by Sundriyal and Sundriyal (2004). The high fruit set percentage may be due to the synchronization of anthesis of male and female flowers as well as abundance of pollinating agent. The shape of the fruit was oval or round and the aril colour during maturity varied from white to grayish white, while the colour of ripe fruits varied from yellow to yellow orange groups of Royal Horticulture Society colour chart (5<sup>th</sup> edition). Bhowmick (2009) also observed that the fruits were roundish to oval and yellow to yellowish brown in colour when matured. The findings regarding germplasm variation showed that the fruits of *Baccaurea* were sub-globose, ovoid, ellipsoid or obovoid in shape and are 15 - 30 mm long and 15 to 25 mm broad are having similar trends reported by Chakraborty and Gangopadhyay (1997). The colour variation of different fruit crops due to germplasm variability was also observed by several scientists (Dhillon and Dhillon 2008, Shyamali *et al* 2009). The highest yield in ACC-14 may be due to highest fruit retention percent (38.72%); as well as high number of fruits at harvest. The variation of fruit physio-chemical properties, yield parameters on different germplasm confirms the differences of germplasms which may be due to highly heterozygous in nature of Burmese grape in the present experimental areas. This variation is also supported by the earlier workers in different other fruit crops (Sanyal and Maity,1989; Sundriyal and Sundriyal 2001, Anila and Radha 2003, Babu *et al.* 2007, Pal *et al.* 2008, Dhillon and Dhillon 2008; Rekha *et al.* 2011).

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