

EVALUATION OF BETEL NUT GERmplasm IN BARISHAL REGION

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Abstract

The field evaluation of betel nut germplasm was conducted at Regional Agricultural Research Station, Bangladesh Agricultural Research Institute (BARI), Rahmatpur, Barishal all the year round during three consecutive years of 2019-22 to select suitable entry (ies) for releasing as new variety (ies) for Barishal region. Seven entries of betel nut viz., E₁ (AC Rah-01), E₂ (AC Rah-02), E₃ (AC Rah-03), E₄ (AC Rah-04), E₅ (AC Rah-05), E₆ (AC Rah-06) and E₇ (AC Rah-07) were used as testing materials. The germplasm had been collected from different regions of Bangladesh since 1973. Three years average results showed that significant variations were observed among the evaluated betel nut germplasm. The maximum fresh and dry nut yield with husk (34.48 and 12.07 t/ha, respectively) was obtained from AC Rah-02 that was identical to AC Rah-01 (28.24 and 10.57 t/ha, respectively). Results revealed that the three years average yield performances of AC Rah-02 and AC Rah-01 were higher compared to that of other tested entries. Maturing condition of AC Rah-01 was late but early maturity was observed in AC Rah-02 and other tested entries. Nut shapes of AC Rah-01 and AC Rah-02 were oblong and oval, respectively. The laboratory analyses results revealed that alkaloids that caused oral cancer was less (3.95 mg/g) and the Ferric Reducing Antioxidant Power that cures the disease was higher (10.20 mgAAE/g) in AC Rah-01. The amount of total alkaloids (1.35%) and Arecoline content (4.69 mg/g) that cause cancer in the mouth were lower in AC Rah-02. Considering yield potentiality, maturity condition (late and early), lower incidences of insect-pest and diseases, and biochemical properties (higher Antioxidant power and lower contents of Alkaloids or Arecoline), AC Rah-01 and AC Rah-02 have been selected as promising entries of betel nut towards releasing new varieties for Barishal region of Bangladesh.

Keywords: Betel nut, germplasm, yield, arecoline and Barishal region.

Introduction

Betel nut is commonly referred to as areca palm, areca nut palm, betel palm, betel nut palm, Indian nut, Pinang palm and catechu. It grows well in warm and humid tropical climates and at an altitude of 1000 m above sea level. Betel nut is one of the cash crops of Bangladesh of which 90% of the betel nuts produced in Bangladesh are grown in the southern districts. Annual production of betel nut

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in Bangladesh is about 3.17 lac ton with an area 38.94 hectare. The major growing districts are Laksmipur, Cox's Bazar, Chattogram, Bhola, Sylhet, Pirojpur, Bagerhat Gaibandha, Noakhali, Narail, Barisha, Jhallokati and Khulna (BBS, 2020). Betel nut trees are usually planted around the house or by the side of the pond, canal banks, highlands and orchards. Betel nut is consumed both as a raw or ripe nut, as dried ripe nut and as semi-mature, cut and processed varieties. Each 100 grams of betel has the ability to provide 269 calories of energy.

The alkaloids in betel nut are the main active ingredients in research currently, while arecoline (methyl 1-methyl-3,6-dihydro-2H-pyridine-5-carboxylate) is considered the most important alkaloid in betel nut. The total alkaloid content of betel nut is estimated between 0.3% and 0.7%.

Many germplasm of betel nut had been collected from different regions of Bangladesh by the then Coconut Research Station (presently established as Regional Agricultural Research Station), Bangladesh Agricultural Research Institute (BARI), Rahmatpur, Barishal. The collected germplasm were conserved and evaluated at this station for selecting the superior/promising entry (ies) towards releasing as new variety (ies) for Barishal region of Bangladesh.

Materials and Methods

The evaluation of the betel nut germplasm was conducted at Regional Agricultural Research Station, BARI, Rahmatpur, Barishal during three consecutive years of 2019-20, 2020-21 and 2021-22 to select the suitable line/entries for releasing new variety (ies) for Barishal region. The experimental site under the agro-ecological zone (AEZ-13) of 'Ganges Tidal Floodplain'. The experimental sites are situated in the latitudes and longitudes of 22°47'23.06872''N and 90°17'37.65059''E; and 22°47'22.93429''N and 90°17'39.44634''E. The soil type is medium high land with loamy soil texture. The experiment was laid out in randomized complete block design with three replications. Seven entries of betel nut viz., E₁ = AC Rah-01, E₂ = AC Rah-02, E₃ = AC Rah-03, E₄ = AC Rah-04, E₅ = AC Rah-05, E₆ = AC Rah-06, and E₇ = AC Rah-07 were used as testing materials. The germplasm had been collected from different regions of Bangladesh since 1973 (Table 3). It can be mentioned that the entries E₁ and E₂ were collected from Rangpur and Bagerhat (Mongla) districts, respectively. On the other hand, E₃, E₄, E₅, E₆ and E₇ had been collected from Barishal region. The collected germplasm had been conserved and seedlings planted with spacing row to row distance was 2.5 m and plant to plant distance was 2.5 m. The balanced dose of fertilizers had been applied for proper growth of the plant after planting as follows (Table 1).

Table 1. Rate of compost and chemical fertilizers of betel nut by age of tree

Age of tree (year)	Rate of fertilizers/tree					
	Compost (kg)	Urea (g)	TSP (g)	MP (g)	Gypsum (g)	Zinc sulphate (g)
0-2	10	100	100	120	15	10
3-4	12	130	120	160	25	20
5-6	14	160	140	200	35	30
6-7	17	190	160	240	45	40
9-10	18	230	160	260	55	50
> 10	20	250	200	300	60	50

Chemical fertilizers had been divided into two parts and applied twice a year at the base of the tree, the first time in September and the second time in February. The first stage of application of fertilizer was to make a ditch 50-65 cm apart, 15-25 cm deep and keeping 20-30 cm free from the base of the tree in a circle around the tree. Compost and chemical fertilizers were applied in the ditch and mixed well with the soil of the ditch. Fertilizers were applied in the same way in the second phase. Organic fertilizer (compost) was applied one month before application of chemical fertilizers. Different intercultural operations (irrigation, weeding, mulching, plant protection etc.) were done as and when necessary. Mulching was done by providing irrigation after application of fertilizer. Ten plants were selected randomly from each germplasm for recording the yield parameters and yields of betel nut. After planting betel seedlings with proper care, the yield starts coming within 4-5 years. Then, the yield gradually increases with advancement of years. From the age of ten years the tree begins to bear full fruit. It took 9-10 months for the fruit to ripen after flowering. Betel nuts were collected in the fully ripe stage. At the time of fruit collection, betel nuts were tied with rope and taken down. The fresh matured betel nut samples of four entries (AC Rah-0, AC Rah-02, AC Rah-03 and AC Rah-04) were collected randomly and were sent to the Central Laboratory, Research Wing, BARI, Gazipur for determining their biochemical compositions in 2021-22. Data were collected both on quantitative (yield contributing parameters and yields) and qualitative (source of collection, flowering season, harvesting season, maturing condition, nut shape, incidences of insect-pest and diseases and yield potentiality) traits of the tested betel nut germplasm during all the three studied years. The evaluations of the germplasm were made based on different parameters such as yield and yield contributing characters, maturity time, adaptability, size and shape of betel nut, quality, amount of Alkaloids causing carcinogenesis, attractiveness, disease and insect tolerance, bio-chemical compositions (like 50% insulation concentration, ferric reducing antioxidant power, antioxidant ability to cure disease, total phenolic content, total flavonoid content, ascorbic acid equivalent, gallic acid equivalent, tannic acid equivalent and chatacin) etc. Data were analyzed statistically by using computer software of

Statistics 10 version and then the mean differences were adjudged with Duncan's Multiple Range Test (DMRT).

Results and Discussion

Plant characters of betel nut as influenced by different germplasm

Statistically significant variations were observed among the evaluated betel nut germplasm in terms of stem diameter of middle portion, number of compound leaf/tree, nut/bunch, nut/tree, nut length with husk, nut diameter with husk, nut length without husk, nut diameter without husk, single fresh nut weight with husk, single dry nut weight with husk, single fresh nut weight without husk, single dry nut weight without husk, and fresh and dry nut yields with husk (Table 2). Stem diameter of middle portion became the maximum (39.22 cm) in AC Rah-02, which was at par to that of AC Rah-06 (36.20 cm), AC Rah-01 (36.12 cm) and AC Rah-03 (35.77 cm). The entry AC Rah-07 showed the lowest diameter (34.45 cm). The entry AC Rah-02 showed the maximum number of compound leaf/tree (10.00) which was identical to that of AC Rah-01 (9.00) and AC Rah-04 (8.33). The lowest number of leaf/tree was recorded in AC Rah-07 (6.00). Similarly, AC Rah-02 produced the maximum number of nut/bunch (195) followed by AC Rah-01 (176). The lowest number of nut/bunch was found in AC Rah-05 (137). The entry AC Rah-02 exhibited the higher number of nut/tree (741) but at par to AC Rah-01 (656). The lowest number of nut/tree was recorded in AC Rah-05 (376). The highest nut length with husk (54.69 mm) was recorded in AC Rah-01 followed by AC Rah-02 (48.58 mm). The entry AC Rah-07 gave the lowest nut length with husk (44.85 mm). On the other hand, AC Rah-02 showed the highest nut diameter with husk (44.99 mm) but breadths for AC Rah-04 and AC Rah-01 were 40.12 and 37.51 mm, respectively. Nut length without husk was the highest (13.87 mm) in AC Rah-01 followed by AC Rah-02 (12.50 mm). The entry AC Rah-07 gave the lowest length of nut without husk (9.67 mm). Nevertheless, AC Rah-02 showed the maximum diameter of nut without husk (8.33 mm), which was similar to that of AC Rah-01 and AC Rah-04 (7.00 mm). The lowest diameter of nut without husk (5.67 mm) was recorded in AC Rah-07. The results indicated that the nut shape of AC Rah-01 was elongated in nature as compared to other evaluated germplasm. The entry AC Rah-02 produced the highest weight of single fresh nut with husk (40.00 g) followed by AC Rah-01 (35.67 g). The lowest single fresh nut weight was 26.67 g in AC Rah-07. The highest single dry nut weight with husk was recorded in AC Rah-02 (14.07 g) followed by AC Rah-01 (13.54 g) and AC Rah-04 (13.13 g) but it was the lowest (11.57 g) in AC Rah-05. AC Rah-02 exhibited the maximum ratio (2.84) of fresh and dry nut with husk closely followed by AC Rah-01 (2.63) and the lowest value (2.21) in AC Rah-04. Percentage of moisture content of nut with husk was found the highest (64.83%) in AC Rah-02 followed by AC AC Rah-01 (62.04%) but the lowest (54.71%) in AC Rah-04. The entry AC Rah-02 also provided the maximum weight of single fresh nut without husk (13.87 g) followed by AC Rah-01 (12.50 g) and the lowest

weight (9.67 g) from AC Rah-07. Likewise, the maximum single dry nut weight without husk (7.25g) was found in AC Rah-02 which was statistically identical to AC Rah-01 (6.94 g) and the lowest weight (5.53 g) in AC Rah-07. Results also showed that fresh and dry nut ratio without husk of the betel nut germplasm were ranged from 1.68 to 1.91. Moisture content of nut without husk was the highest (47.72%) in AC Rah-02 while AC Rah-01 exhibited the moisture content of 44.51%. The lowest moisture content (40.61%) of nut without husk was found in AC Rah-03. It was observed that all the tested plant characters of betel nut like number of compound leaf/tree, nut/bunch, nut/tree, nut length, nut diameter, single fresh and dry nut weights of AC Rah-01 and AC Rah-02 showed more values as compared to that of other tested germplasm that contributed to achieve higher yields of the promising entries (AC Rah-01 and AC Rah-02).

Table 2. Plant characters of betel nut as influenced by different germplasm at RARS, Rahmatpur, Barishal (Pooled of 3 years)

Entry	Tree height at 50 years age (m)	Stem diameter of different portions (cm)			Compound leaf/tree (no.)	Nut bunch/tree (no.)	Nut/bunch (no.)
		Top	Middle	Bottom			
AC Rah-01	10.77	32.23	36.12ab	50.83	9.00ab	3.77	176b
AC Rah-02	10.83	36.27	39.22a	55.60	10.00a	3.83	195a
AC Rah-03	11.13	33.23	35.77ab	55.40	8.00b	3.17	149cd
AC Rah-04	10.13	32.12	35.43b	56.32	8.33ab	3.53	155c
AC Rah-05	9.65	31.45	35.58b	55.18	7.33bc	3.00	137d
AC Rah-06	9.83	32.21	36.20ab	54.43	8.00b	2.83	142cd
AC Rah-07	10.33	30.36	34.45b	54.72	6.00c	2.67	140d
CV (%)	9.70	6.49	5.54	7.55	11.95	19.78	12.16

Table 2. Contd.

Entry	Nut/tree (no.)	Nut length with husk (mm)	Nut diameter with husk (mm)	Nut length without husk (mm)	Nut diameter without husk (mm)	Single fresh nut weight with husk (g)	Single dry nut weight with husk (g)
AC Rah-01	656ab	54.69a	37.51b	13.87a	7.00ab	35.67b	13.54ab
AC Rah-02	741a	48.58b	44.99a	12.50b	8.33a	40.00a	14.07a
AC Rah-03	466cd	47.06b	39.76b	11.00b	6.33b	28.67c	12.07bc
AC Rah-04	547bc	48.28b	40.12b	11.33b	7.00ab	29.00c	13.13a-c
AC Rah-05	414cd	45.71b	36.36b	10.33c	6.00b	27.33c	11.57c
AC Rah-06	408cd	45.67b	39.58b	10.00c	6.00b	28.00c	12.16bc
AC Rah-07	376d	44.85b	38.53b	9.67d	5.67c	26.67c	11.77bc
CV (%)	16.94	6.75	5.97	11.71	15.93	7.32	8.03

In a column, mean values with the same letter (s) or without letter do not differ significantly whereas mean values with dissimilar letter differ significantly as per DMRT.

Table 2. Contd.

Entry	Fresh and dry nut wt. ratio with husk	Moisture content of nut with husk (%)	Single fresh nut weight without husk (g)	Single dry nut weight without husk (g)	Fresh and dry nut wt. ratio without husk	Moisture content of nut without husk (%)
AC Rah-01	2.63	62.04	12.50ab	6.94a	1.80	44.51
AC Rah-02	2.84	64.83	13.87a	7.25a	1.91	47.72
AC Rah-03	2.38	57.91	11.00bc	6.53ab	1.68	40.61
AC Rah-04	2.21	54.71	11.33bc	6.60ab	1.72	41.76
AC Rah-05	2.36	57.68	10.33bc	6.05ab	1.71	41.45
AC Rah-06	2.30	56.57	10.00c	5.57b	1.80	44.33
AC Rah-07	2.27	55.88	9.67c	5.53b	1.75	42.76
CV (%)	-	-	11.67	10.91	-	-

In a column, mean values with the same letter (s) or without letter do not differ significantly whereas mean values with dissimilar letter differ significantly as per DMRT.

Fresh and dry nut yields of betel nut as influenced by different germplasm

In all the three years, entry AC Rah-02 gave the highest yields of fresh and dry nut (Table 3). However, AC Rah-01 gave slightly lower yields (fresh and dry nut) than that of AC Rah-02 in all the years. The highest fresh nut yield with husk (34.48 t/ha) was obtained from AC Rah-02 that was at par to AC Rah-01 (28.24 t/ha) and the lowest yield in AC Rah-07 (12.09 t/ha). Fresh nut yields were obtained from AC Rah-04, AC Rah-03, AC Rah-06 and AC Rah-05 were 19.18, 16.14, 13.87 and 13.78 t/ha, respectively. Similarly, the maximum yield of dry nut with husk (12.07 t/ha) was found in AC Rah-02 followed by AC Rah-01 (10.57 t/ha). Besides, dry nut yields of AC Rah-04, AC Rah-03, AC Rah-05 and AC Rah-06 were 7.44, 6.55, 5.68 and 5.38 t/ha, respectively while it was the lowest in AC Rah-07 (5.10 t/ha). Results further revealed that the average yield performances of AC Rah-02 and AC Rah-01 were higher as compared to that of other tested entries of betel nut. The higher values of yield contributing characters (number of nut/bunch, nut/tree, nut length, nut diameter, single fresh and dry nut weights) of the promising entries of betel nut germplasm (AC Rah-02 and AC Rah-01) led to produce higher yields. It can be noted that after planting betel seedlings, if taken care of properly, the yield starts coming within 4-5 years. Then, with age, the yield gradually increases. From the age of ten years the tree begins to bear full fruit and continues till the age of 60 years. Then the yield gradually decreases. It takes 8-10 months for the fruit to ripen after flowering. Trees can continue fruiting for 30-60 years (www.pfaf.org). Betel nuts are collected in fully ripe, semi-ripe or raw state. The collecting betel nut depends on how it is used and how it is processed.

Table 3. Year-wise fresh and dry nut yields with husk of the evaluated germplasm of betel nut at RARS, Rahmatpur, Barishal

Entry	Fresh nut yield with husk (t/ha)				Dry nut yield with husk (t/ha)			
	2019-20	2020-21	2021-22	Pooled	2019-20	2020-21	2021-22	Pooled
AC Rah-01	26.86b	29.28b	28.58b	28.24ab	9.87a	10.62b	11.22a	10.57ab
AC Rah-02	31.37a	37.25a	34.82a	34.48a	11.37a	12.86a	11.98a	12.07a
AC Rah-03	14.36d	17.71c	16.34cd	16.14c	5.74c	7.15c	6.76bc	6.55bc
AC Rah-04	19.53c	17.81c	20.21c	19.18b	7.75b	6.79c	7.77b	7.44b
AC Rah-05	12.12d	15.16cd	14.06de	13.78cd	4.81c	6.82c	5.41cd	5.68cd
AC Rah-06	13.35d	15.21cd	13.05de	13.87cd	5.30c	5.81c	5.02d	5.38e
AC Rah-07	13.14d	12.06d	11.06e	12.09d	5.21c	5.83c	4.25d	5.10e
Mean	18.68	20.64	19.73	19.68	7.15	7.98	7.49	7.54
CV (%)	10.42	10.61	12.94	12.39	15.65	11.59	12.83	10.55

In a column, mean values with the same letter (s) or without letter do not differ significantly whereas mean values with dissimilar letter differ significantly as per DMRT.

Climatic condition for betel nut cultivation

The previous five years annual total rainfalls at RARS, Rahmatpur, Barishal were 2425, 1475, 1677 and 1756 mm in the years of 2017, 2018, 2019, 2020 and 2021, respectively (Fig. 1). It was noted that the annual rainfall requirement for betel nut cultivation above 1250 mm. As the rainfall per annum at the experimental area remained above the critical level during the previous five years (2017-2021) was ranged from 1475 to 2425 mm, which helped in achieving the higher yield of nut. On the other hand, the existing monthly average air temperatures (average of previous five years) were ranged from 18.33 to 33.61°C in the study area (Fig. 2). It was also reported that ideal temperature for betel nut cultivation is 18-35°C (Banglapedia, 2021). At lower or higher temperatures the yield decreases. The results further revealed that the experimental region is quite suitable for betel nut cultivation in terms of climatic condition.

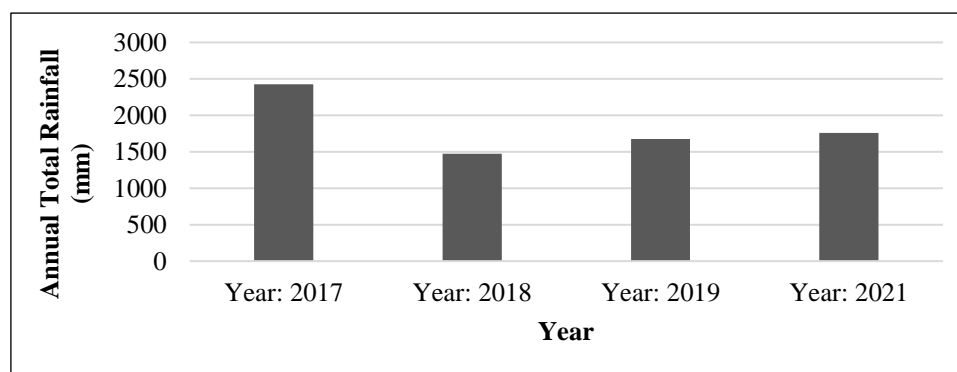


Fig. 1. Annual total rainfall by year at RARS, Rahmatpur, Barishal.

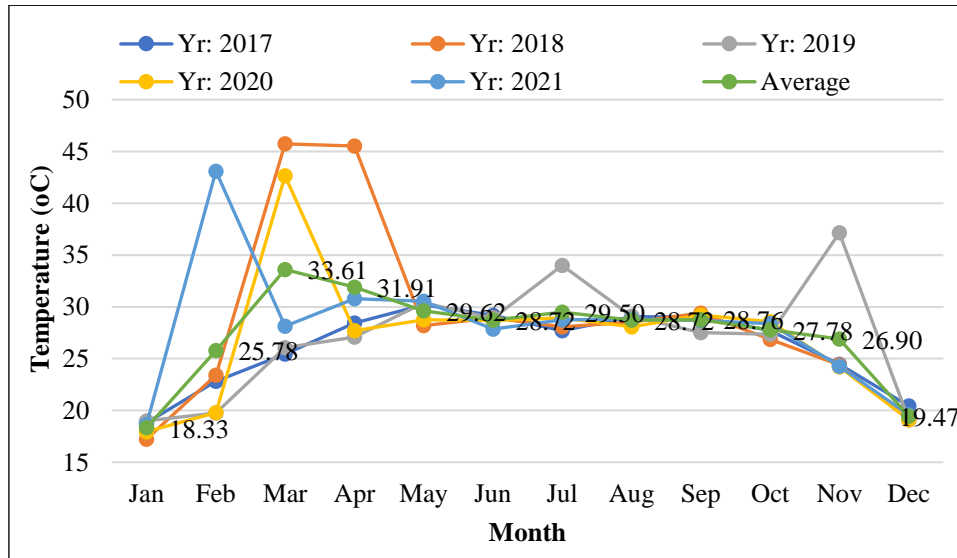


Fig. 2. Monthly temperature of by year at RARS, Rahmatpur, Barishal.

Qualitative traits of the betel nut germplasm (2021-22)

Actually all the evaluated germplasm of betel nut had been collected from different parts of Bangladesh since 1973. The entry AC Rah-01 attained at the flowering stage comparatively in late condition (March-April) than that of other entries (AC Rah-02, AC Rah-03, AC Rah-04, AC Rah-05, AC Rah-06 and AC Rah-07). In AC Rah-01, the harvesting stage was also appeared in January-February. However, other entries flowered earlier (October-November). Maturity of AC Rah-01 was late but early maturity was observed in other entries. Nut shapes of AC Rah-01 and AC Rah-02 were oblong and oval, respectively. Nut shapes of other tested entries (AC Rah-03, AC Rah-04, AC Rah-05, AC Rah-06 and AC Rah-07) were almost round. Incidences of insect-pest and diseases in AC Rah-01 and AC Rah-02 were comparatively low as compared to other entries. Yield potentiality of AC Rah-01 and AC Rah-02 were higher as compared to other entries. However, moderate to low yield potentialities were observed in AC Rah-03, AC Rah-04, AC Rah-05, AC Rah-06 and AC Rah-07.

Biochemical compositions of selected betel nut germplasm (2021-22)

The results of the laboratory analyses tested samples of betel nut germplasm revealed that total fat was the highest (14.80%) in AC Rah-03 but it was the lowest (11.30%) in AC Rah-02 (Table 5). Besides, the entry AC Rah-01 showed moderate value of total fat (13.15%). The maximum total alkaloid 1.82% was found in AC Rah-03 followed by AC Rah-02 and AC Rah-01 with 1.35 and 1.51%, respectively. The entry AC Rah-04 showed the lowest alkaloid (1.13%)

content. Free radical scavenging activity (DPPH-RSA) and 50% inhibitory concentration (IC₅₀) was recorded the highest (14.11 µg/ml) in AC Rah-03 but lower in AC Rah-01 and AC Rah-02 (10.49 and 12.15 µg/ml, respectively). AC Rah-01 showed the highest values (10.20 mg AAE/g and 4.03 mg GAE/g, respectively) of Ferric Reducing Antioxidant Power (FRAP) and AC Rah-02 exhibited the FRAP values of 9.08 mg AAE/g and 3.62 mg GAE/g. The lowest FRAP (8.93 mgAAE/) was recorded in AC Rah-04. The maximum total Antioxidant Capacity (TAC) (34.54 mgAAE/g) was found in AC Rah-04 followed by AC Rah-01 and AC Rah-02 of 30.95 and 28.75 mg AAE/g, respectively. The highest total Phenolic Content (TPC) (101.18 mg GAE/g) was found in AC Rah-01 followed by AC Rah-02 of 90.36 mg GAE/g. The lowest TPC (81.13 mgGAE/g) was obtained from AC Rah-03. Tanin content of AC Rah-01 was the highest (91.86 mgTAE/g) followed by AC Rah-02 (82.28 mg TAE/g). The lowest content of Tanin (73.79 mg TAE/g) was found in AC Rah-03. Total Flavonoid Content (TFC) was comparatively higher in AC Rah-01 (237.98 mg CE/g) than AC Rah-02 (217.53 mg CE/g). The TFC were lower in AC Rah-03 (199.62 mg CE/g) and AC Rah-04 (203.21 mg CE/g). Arecoline Contents were higher in AC Rah-03 (5.90 mg/g) followed by AC Rah-04 (5.31 mg/g) while it was lower in AC Rah-01 (3.95 mg/g) and AC Rah-02 (4.79 mg/g). Results revealed that alkaloids that caused oral cancer was less (3.95 mg/g) and the Ferric Reducing Antioxidant Power that cures the disease was higher (10.20 mg AAE/g) in AC Rah-01. The content of total alkaloids (1.35%) and Arecoline content (4.69 mg/g) that cause cancer in mouth were lower in AC Rah-02. Considering the biochemical compositions of the selected betel nut germplasm, AC Rah-01 and AC Rah-02 were selected as promising entries of betel vine. Arecoline is an important ingredient in betel nut, has been regarded as a possible carcinogen for human beings by the International Cancer Research Institute (Dave *et al.*, 1992). It is speculated that betel nut contains arecoline, which acts as cholinergic alkaloids that stimulates the dose-related bronchocontraction (Taylor *et al.* 1992). As chewing of betel nut can induce oral submucosal fibrosis and oral cancer due to the presence of alkaloids, therefore, lower content of Alkaloids or Arecoline in the promising entries (AC Rah-01 and AC Rah-02) may reduce the risk of oral cancer in human body. On the other hand, the higher ferric reducing antioxidant power may protect the human body from different diseases like malaria, ascariasis, arthritis, enterozoic abdominalgia, stagnation of food, diarrhea, edema, and beriberi (Peng, 2017). The betel nut plant, mainly cultivated for nut or seed production, which is an essential part of betel pepper has important medicinal values as well (Nath and Karmakar 2001; Staples and Bevacqua, 2006). Researchers reported that important and useful chemical ingredients present in the areca nut which made it a basic element of betel quid and enhanced its commercialization (Gupta and Warnakulasuriya 2002).

Table 4. Qualitative traits of the evaluated betel nut germplasm at RARS, Rahmatpur, Barishal

Entry	Source of collection	Flowering season	Harvesting season	Maturing condition	Nut shape	Incidences of insect-pest and diseases	Yield potentiality
AC Rah-01	Rangpur	Mar-Apr	Jan-Feb	Late	Oblong	Low	Higher
AC Rah-02	Mongla (Bagerhat)	Feb-Mar	Nov-Dec	Early	Oval	Low	Higher
AC Rah-03	Barishal region	Feb-Mar	Oct-Nov	Early	Round	Moderate	Moderate
AC Rah-04	Barishal region	Feb-Mar	Oct-Nov	Early	Round	Moderate	Moderate
AC Rah-05	Barishal region	Feb-Mar	Oct-Nov	Early	Round	Moderate	Moderate
AC Rah-06	Barishal region	Feb-Mar	Oct-Nov	Early	Round	Moderate	Low
AC Rah-07	Barishal region	Feb-Mar	Oct-Nov	Early	Round	Moderate	Low

Table 5. Biochemical compositions of selected betel nut germplasm (2021-22)

Betel nut germplasm	Dry weight basis				
	Total fat (%)	Total alkaloid (%)	DPPH-RSA IC50 ($\mu\text{g/ml}$)	FRAP (mgAAE/g)	FRAP (mgGAE/g)
AC Rah-01 (Proposed)	13.15	1.51	10.49	10.20	4.03
AC Rah-02 (Proposed)	11.30	1.35	12.15	9.08	3.62
AC Rah-03 (Local)	14.80	1.82	14.11	9.54	3.78
AC Rah-04 (Local)	13.10	1.13	12.63	8.93	3.56

Table 5. Contd.

Betel nut germplasm	Dry weight basis				
	TAC (mgAAE/g)	TPC (mgGAE/g)	Tanin (mgTAE/g)	TFC (mgCE/g)	Arecoline Content (mg/g)
AC Rah-01 (Proposed)	30.95	101.18	91.86	237.98	3.95
AC Rah-02 (Proposed)	28.75	90.36	82.28	217.53	4.79
AC Rah-03 (Local)	29.46	81.13	73.79	199.62	5.90
AC Rah-04 (Local)	34.54	86.98	79.17	203.21	5.31

Source: Central Laboratory, Research Wing, BARI, Gazipur

Note: DPPH-RSA = 2,2-diphenyl-1-picrylhydrazyl Free Radical Scavenging Activity; IC50 = 50% Inhibitory Concentration; FRAP = Ferric Reducing Antioxidant Power; TAC = Total Antioxidant Capacity; TPC = Total Phenolic Content; TFC = Total Flavonoid Content; AAE = Ascorbic Acid Equivalent; GAE = Gallic Acid Equivalent; TAE = Tannic Acid Equivalent; CE = Chatechin Equivalent.

Conclusion

Considering higher yield potentiality, maturity condition (late and early), lower incidences of insect-pest and diseases, and biochemical properties (higher Antioxidant power and lower contents of Alkaloids or Arecoline), AC Rah-01 and AC Rah-02 have been selected as promising entries of betel nut towards releasing as new varieties for Barishal region of Bangladesh.

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