

Short communication: Morphological characteristics of flower and fruit in several rambutan (*Nephelium lappaceum*) cultivars in Serang City, Banten, Indonesia

GUT WINDARSIH^{1,✉}, MUHAMMAD EFENDI^{2,✉✉}

¹ Faculty of Education and Teachers Training, Universitas Islam Negeri Sultan Maulana Hasanuddin Banten. Jl. Syech Nawawi Al-Bantani, Andamu'i, Curug, Serang City 42116, Banten, Indonesia. Tel.: +62-254-200-323, ✉email: gut.windarsih@uinbanten.ac.id

² Cibodas Botanic Gardens, Indonesian Institute of Sciences. Jl. Kebun Raya Cibodas, Cipanas, Cianjur 43253, West Java, Indonesia. Tel./fax.: +62-263-512233, ✉✉email: muhammadefendi05@gmail.com

Manuscript received: 9 April 2019. Revision accepted: 28 April 2019.

Abstract. Windarsih G, Efendi M. 2019. *Morphological characteristics of flower and fruit in several rambutan* (*Nephelium lappaceum* L.) *cultivars in Serang City, Banten, Indonesia. Biodiversitas 20: 1442-1449.* Indonesia is one of the centers of diversity of rambutan in the world with 22 species. Compared to other species, *Nephelium lappaceum* L. is mostly cultivated species. This study aimed to identify the generative morphological variation in several rambutan cultivars in the area of Serang City, Banten Province. The plant materials used were five cultivars of rambutan, Parakan, Rapih, Aceh, Sinyonya, wild type, and male trees. In each plant, three bunches of inflorescence were taken, and then the flowers from each bunch were observed when the flowering phase was open (blooming). In addition, 3-5 fruit bunches were taken per plant, and then 3-5 fruits per bunch were observed. Based on the results obtained, it can be concluded that there is monoecious plants of rambutan (Aceh, Rapih, wild type), and dioecious plant (male tree). In a monoecious plant, it produces the hermaphrodite flowers, whereas, in a dioecious plant, it just produces the male flowers. In the hermaphrodite flower, it is composed of pedicel, tepal, stamen, and pistil, while the male flower does not have pistil. The Aceh cultivar has the longest average fruit bunch (22.90 cm), Rapih has highest number of fruit per bunch (15.86 fruits), Parakan has highest spine density (11.64 strands per 1x1 cm²) and longest spine (13.2 mm), Rapih has a shortest average spine (3.4 mm) with a stiff texture, Rapih and Aceh have a thickest of fruit rind (3.3 mm). Aceh has the largest size and weight of fruit with the fruit length 4.62 cm, fruit diameter 3.83 cm, fruit weight 37.42 g, weight of fruit rind 17.51 g, weight of aryl 17.94 g, and thickness of aryl 7.7 mm. From a dendrogram analysis, the five cultivars had a similarity distance coefficient from 40% to 69%. Parakan and Sinyonya had highest similarity distance (69%), while Aceh was separated from other cultivars with a similarity distance 40%.

Keywords: Flower, fruit, morphological characteristic, *Nephelium lappaceum*, rambutan

INTRODUCTION

Nephelium lappaceum L. (Sapindaceae, rambutan family), or better known as rambutan, is included in the tropical fruit with an extensive distribution. Rambutan is expected to originate from Indonesia dan Malaysia regions, with a highest genetic diversity in Kalimantan, and then spread throughout the Southeast Asian region (Siebert 1991; van Balgooy 1998; Kuswandi et al. 2014). The diversity of species in the *Nephelium* genus in the world reaches 22 species, 16 species were found in Indonesia. Nine of them are the species of rambutan that are consumable, namely *N. lappaceum*, *N. cuspidatum* var. *eriopetalum*, *N. junglandifolium*, *N. maingayi*, *N. meduseum*, *N. ramboutan-ake*, *N. melanomiscum*, *N. reticulatum*, and *N. uncimatum*. However, only five species have been cultivated, one of them is *N. lappaceum* (Siebert 1991; Djuita et al. 2017). The high diversity of rambutan is potential to be used as germplasm resources to develop new superior cultivar (Anggraheni and Mulyaningsih 2018).

The fruit of rambutan is utilized for consumption, such as fresh fruit, canned fruit, juice, jellies, or jam

(Sirisompong et al. 2011). The fruit flesh that can be consumed is aryl. The fruits contain carbohydrates, fat, protein, ash, mineral, and vitamin C, while seeds contain fat, protein, fiber, carbohydrate, ash, and mineral (Harahap et al. 2012; Manaf et al. 2013). Fruit is used as stomachic and anthelmintic, and potential to against diarrhea and dysentery (Suganthi and Josephine 2016). The fruit rind contains alkaloid, saponin, tannin, flavonoid, and phenolic acids which are potential as antibacterial and antioxidant ingredients (Fidrianny 2015; Thitilertdecha et al. 2010; Sun et al. 2012; Widowati et al. 2015), antidiabetic or antiglycemic agent (Palanisamy et al. 2011; Muhtadi et al. 2016), antihypercholesterolemic, anti-obesity (Lestari et al. 2013), anticancer (Khonkarn et al. 2010), protect cell damage of alveolar lung exposed to cigarette smoke (Lisdiana et al. 2017), and manufacture of soap (Suganthi and Josephine 2016). The geraniin isolated from fruit rind has antiviral activity which effective against dengue virus type-2 (DENV-2) (Sukmandari et al. 2017). The seeds contains chemicals, such as arachidic and oleic acids (Manaf et al. 2013), which beneficial as antioxidant and anti-hyperglycemic agents (Palanisamy et al. 2011; Soeng et al.), analgesic, anti-inflammatory (Morshed et al. 2014),

and remedy for hypertension (Singh et al. 2017), while the seed oil can be used to make candle and soap (Suganthi and Josephine 2016). The trunk can be used as wood for raw materials of construction and firewood (Middleton 2000). The leaves are potential in medicine of headache and produce a dye. The root is utilized as a febrifuge. The bark is used as medicine for thrush (Suganthi and Josephine 2016).

The fruit of rambutan has been widely cultivated by community. More than 30 rambutan accessions are spread across Sumatra, Java, and Kalimantan (Napitupulu and Simatupang 2000). In Kalimantan Island, for example, the center of diversity of rambutan, there are no less than 15 rambutan cultivars that been planted by people in Mekarjaya village, Sambas District, West Kalimantan (Siregar 2006). Around 29 rambutan accessions have been conserved in the Experimental Garden of Aripin, the Experimental Garden of Subang, and the Experimental Garden of Cipaku (Kuswandi et al. 2014).

The introduction of rambutan cultivar has been carried out through the morphological and genetic markers. The molecular approach to the rambutan cultivars has been carried out by Kuswandi et al. (2014), Napitu et al. (2016), Anggraheni and Mulyaningsih (2018), and Manggabarani et al. (2018). However, the morphological approach is relatively easier to be applied in field and relatively cheaper compared to the molecular approach (Napitu et al. 2016; Kuswandi et al. 2016). The morphological marker can be used to determine the diversity of plant based on the phenotype on vegetative or generative phases. Therefore, in this study, it was conducted to identify the morphological characteristic variation in flower and fruit on several rambutan (*Nephelium lappaceum* L.) cultivars found in the area of Serang City, Banten Province, Indonesia.

MATERIALS AND METHODS

Samples collection

The plant materials used as sample were the rambutan plants found in the area of Serang City, Banten Province. The number of plants observed was 14 plants of five cultivars, consists of Parakan cultivar (1 plant), Rapih (1 plant), Aceh (7 plants), Sinyonya (1 plant), wild type (2 plants), dan male tree (2 plants).

Observation of flower morphology

In each plant found, the three bunches of inflorescence were selected, then the flowers from each bunch were observed for the morphological characteristics when the flowering phase was open (blooming). The observation of flower morphology was carried out by using a microscope. The flower morphology characteristics observed included in type of inflorescence, size of inflorescence, structure of flower, number of tepals, number of stamens, number of anther, number and type of ovary, and number of stigmas.

Observation of fruit morphology

In each plant, 3-5 fruit bunches were taken, which were perfectly ripe with reddish fruit peel and reddish fruit spine. Then, 3-5 fruits of each bunch were taken to be observed for the morphological characters of fruit. The observation of morphological characteristics of fruit was conducted according to the *Descriptor of Rambutan* (IPGRI 2003). The fruit morphology observation included in 20 characters, consist of length of bunch, number of fruit per bunch, length of fruit stalk, fruit shape (globose, ovoid, oblong), color of fruit rind, uniformity of color on fruit surface, color of spine, spine density, length of spine, texture of spine (soft, stiff), length of fruit, diameter of fruit (low [≤ 3.30 cm], medium [3.31-3.75 cm], high [≥ 37.6 cm]), fruit weight, thickness of fruit rind, fruit rind weight, aryl weight, thickness of aryl, taste of aryl (tasteless, sour, sweet-sour, sweet), color of aryl, texture of aryl (soft, hard, crunchy; less water content, more water content), adhesion of aryl to seed coat (less attached, medium attached, attached, very attached), seed shape (roundish, obovoid, obovoid elongated, oblong [cylindrical]), seed weight, length of seed, width of seed (small [≤ 1.30 cm], medium [1.31-1.55], big [≥ 1.56 cm]), and thickness of seed.

Data analysis

The data were analyzed descriptively by comparing the flower and the fruit to determine morphological characteristics among cultivars. In addition, it was also compared to the morphological characteristics of flowers between the hermaphrodite flower and the male flowers found in this study. Meanwhile, the data of morphological characteristics of fruit were converted into binary data, and then analyzed using UPGMA (Unweighted Pair Group Method with Arithmetic Means) through the NTSYS Program version 2.02 (Rohlf 1998).

RESULTS AND DISCUSSION

Morphological characteristics of flower

Inflorescence

Based on the results of observation, it showed that rambutan can be grouped into monoecious plant (Aceh, Rapih, wild type), and dioecious plant (male tree). A monoecious plant produces the hermaphrodite flowers, whereas a dioecious plant produces male flowers only. Aceh, wild type, and male tree have the type of inflorescence that is consistently panicle with many branches, the panicle length ranging between 16.9 cm and 29.5 cm, the abundance of flowers in the inflorescence is profuse, and the color of inflorescence in those cultivars is light green. The Aceh cultivar has an average panicle length 24.28 ± 4.64 cm, wild type has a panicle length of 22 cm, while a male tree has a panicle length of 27.00 ± 3.54 cm. The position of inflorescence in Aceh and wild type is axillary, while in male tree is terminal. The shape of inflorescence in Aceh and wild type is obtriangular, while in male tree is conical (Figures 1-3).

Structure of flower

Based on the results obtained, it can be seen that the cultivars of Aceh, Rapih, and wild type (Figure 2.A-C) are the monoecious plants and produce the hermaphrodite flower, in which a flower has stamen and pistil at once. The hermaphrodite flower in rambutan is composed of pedicel, petal, stamen, pistil, and ovarium (Figure 2.A).

The hermaphrodite flower is zygomorphous or actinomorphous; the flower base is in the form of a disc, flat, hypogene; petal likes calyx (calycinus), greenish, 4-6 blades, attached to the base, zygomorphous or actinomorphous, star-shaped; the stamens sit on the base of flower, 5-8 stamens, composed of filament and anther, the anther consists of two theca, each filament sits separately above the base of flower; the pistil consists of ovarium, stylus, and stigma; the ovarium is superus, consists of two lobes (binoculars) or three lobes (triloculars); the stylus has two or three branches according to the number of ovarium; thread-shaped stigma; has a nectarium in shaped like a disc on the base of flower functioning to attract bees.

Meanwhile, the male three just has male flower, where the flower just has stamen without pistil (Figure 2.D). The male flower is zygomorphous or actinomorphous; the base of flower in the form of a disc, flat, the petal likes calyx (calycinus), greenish, 4-6 blades, attached to the base,

zygomorphous or actinomorphous, star-shaped; the stamen sits on the base of flower, 5-7 stamens, is composed of filament and anther, the anther consists of two theca, each filament sits separately above the base of flower; has no pistil.

Based on the results of observation, it showed that the characteristic of flower structure on Aceh, Parakan, and wild type are relatively similar, except for the number of ovarium in Rapih cultivar that is only bilocular, while in other cultivars is bilocular or trilocular. Likewise the number of stigmas (Tables 1-2).



Figure 3. The comparison of structure of hermaphrodite flower (A) and male flower (B). 1. stigma, 2. stylus, 3. ovarium, 4. stamen, 5. petal like calyx, 6. pedicel.

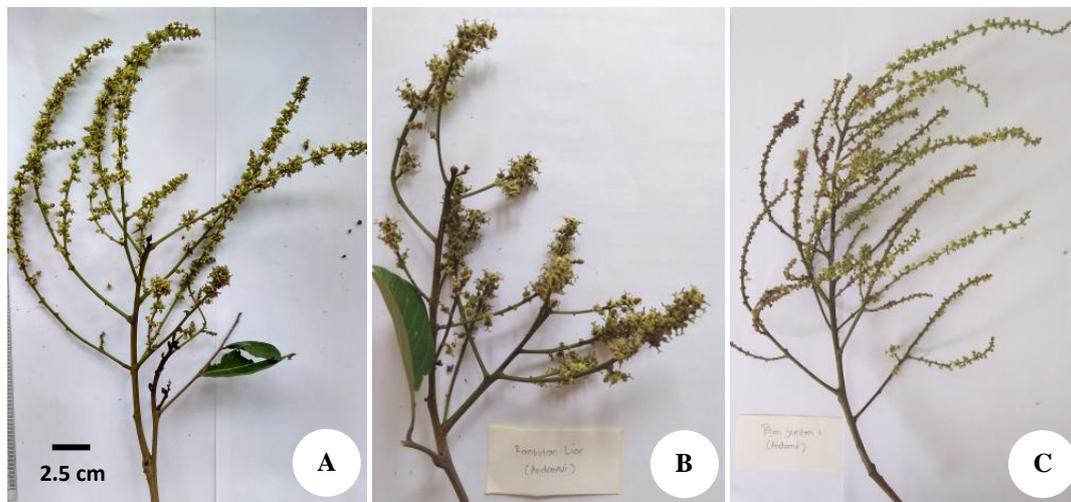


Figure 1. Inflorescence on several rambutan cultivars. A. Aceh, B. Wild type, C. Male tree

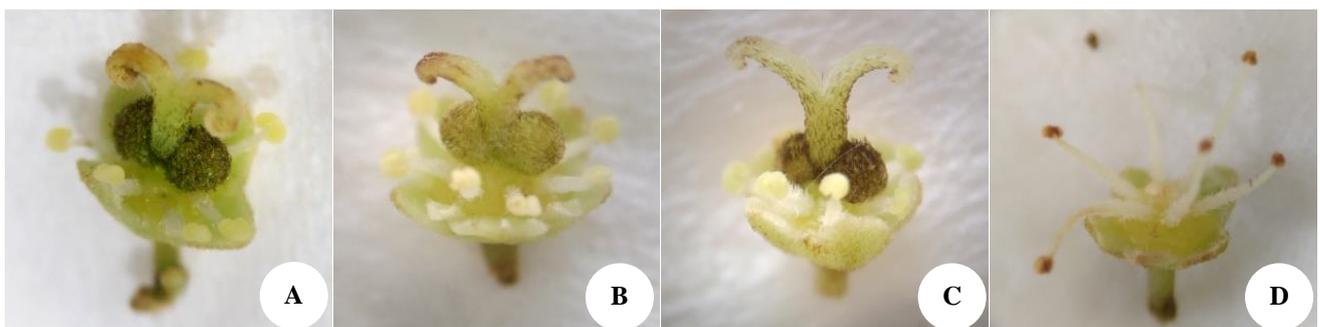


Figure 2. The structure of hermaphrodite flower and male flower in rambutan. A. Aceh, B. Rapih, C. wild type, D. male tree

Table 1. The comparison of morphological characteristic of rambutan flower in Aceh, rapih, and wild type cultivars, and male tree

Cultivars	Petal Num.	Stamen Num.	Anther Num.	Ovary Num.	Stigma Num.
Aceh	4-6	5-8	2	2-3	2-3
Rapih	4-5	5-8	2	2	2
Wild type	4-6	5-8	2	2-3	2-3
Male tree	4-6	5-7	2	-	-

Morphological characteristic of fruit

Structure of fruit and seed

Based on the results of observation in five cultivars, the fruit of rambutan is ovoid, single-seeded berry (one fruit contains one seed), the surface of fruit is greenish when still young, then becomes to be yellowish to reddish when ripe. The fruit rind can be divided into three parts, namely exocarp, mesocarp, and endocarp. The surface of exocarp is covered by spines as the fleshy pliable spines that can be soft or stiff, with a bent at its end (van Balgooy 1998). The endocarp is whitish and covers fruit flesh. The fruit flesh is translucent, whitish, contains a lot of water or less water,

can be eaten, sweet to sour tastes. The fruit flesh is actually a salute of seed, or called as the aryl. The aryl can easy to peel off or hard to peel off. The seed is wrapped in aryl and the seed coat is thin woody (Figures 4-6).



Figure 5. The structure of rambutan fruit. 1. Exocarpium, 2. spine, 3. mesocarpium, 4. aryl, 5. seed coat, 6. seed, 7. endocarpium

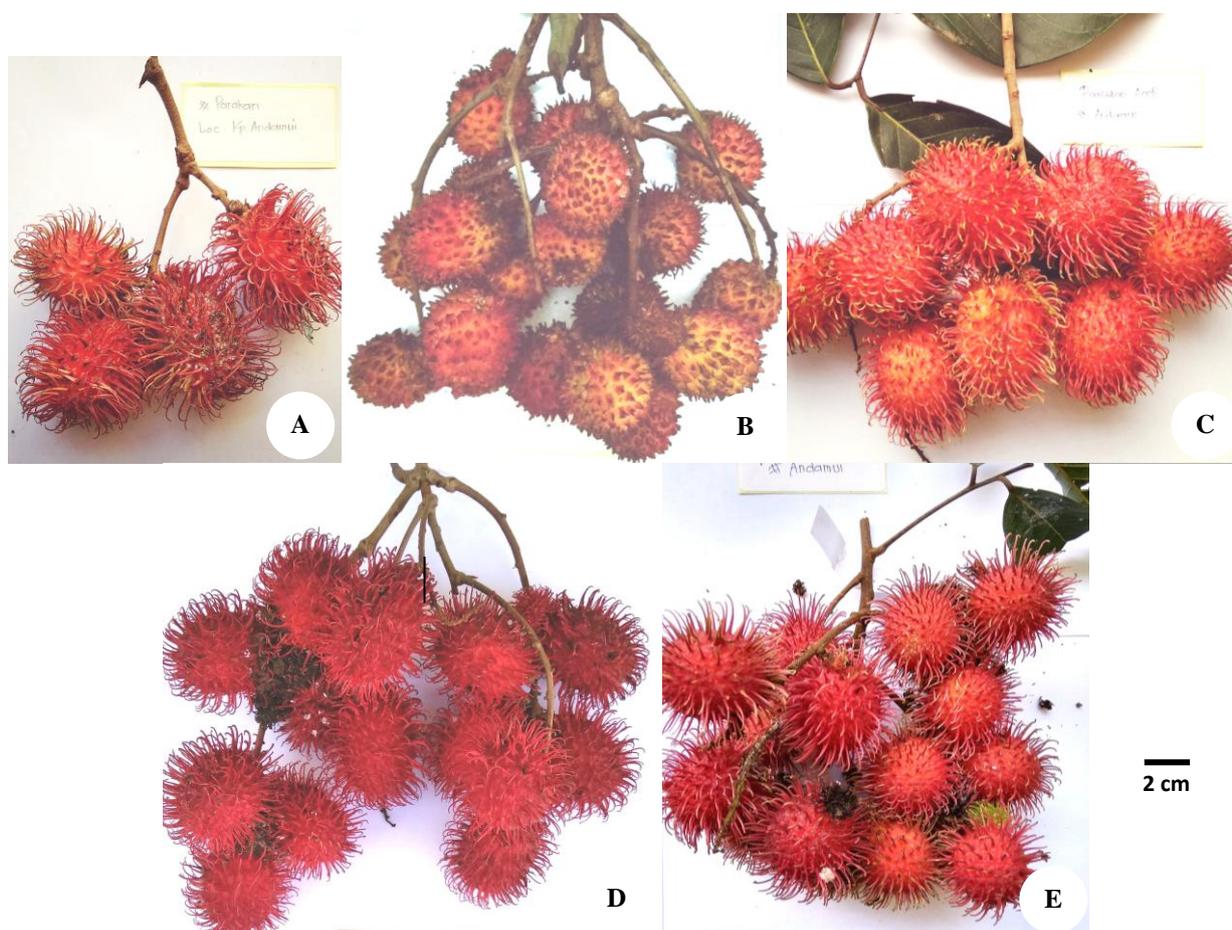
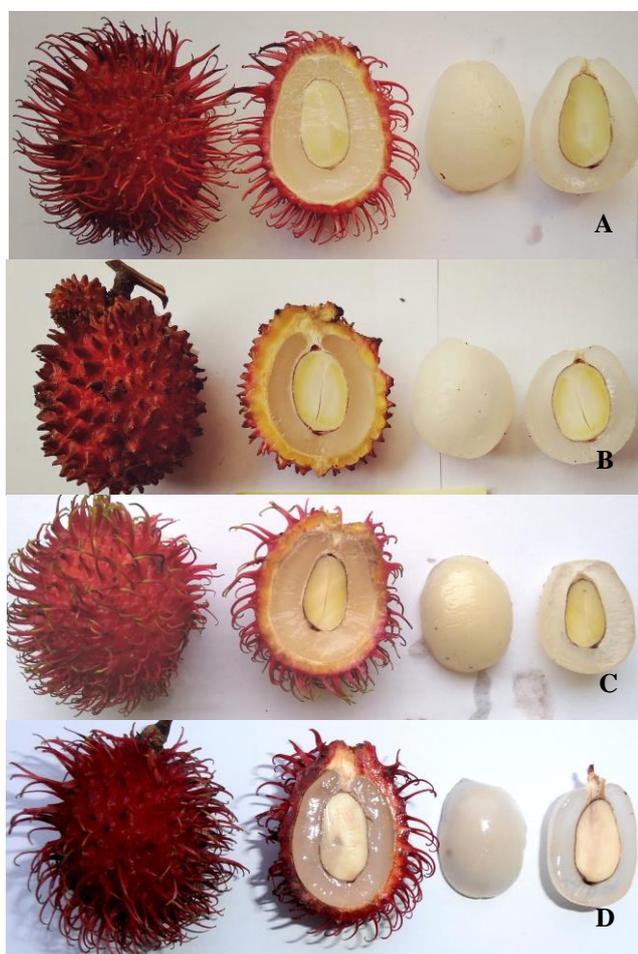


Figure 4. The fruit bunches of various rambutan cultivars. A. Parakan, B. Rapih, C. Aceh, D. Sinyonya, E. Wild type

Table 2. The characteristics of fruit morphology in five rambutan cultivars

Morphological characteristics	Cultivars				
	Parakan	Rapiah	Aceh	Sinyonya	Wild type
Length of bunch (cm)	15.22±0.84	15.08±4.81	22.90±2.10	15.43±3.79	13.65±3.48
Number of fruits per bunch	3.20±0.45	15.86±5.96	9.95±3.72	8.33±4.93	13.30±3.64
Length of fruit stalk (mm)	5.4±0.3	4.8±0.6	4.6±0.3	5.8±0.8	4.2±0.7
Fruit shape	ovoid	ovoid	ovoid	ovoid	ovoid
Color of fruit rind	reddish	reddish	reddish	reddish	reddish
Color of spine	reddish	reddish	reddish	reddish	reddish
Uniformity of color on fruit surface	uniform	not-uniform	not-uniform	uniform	uniform
Spine density (1x1 cm ²)	11.64±1.00	7.60±1.07	6.66±0.92	8.90±0.78	9.27±0.78
Spine length (cm)	1.32±0.07	0.34±0.03	1.06±0.06	1.10±0.06	0.99±0.06
Texture of spine	soft	stiff	soft	soft	soft
Fruit size :					
- Length (cm)	4.49±0.14	3.82±0.24	4.62±0.22	4.08±0.04	3.45±0.17
- Diameter (cm)	3.19±0.18*	3.18±0.16*	3.83±0.18**	3.02±0.06*	3.02±0.22*
Fruit weight (g)	24.97±3.24	20.17±2.07	37.42±4.32	19.81±1.24	19.00±3.30
Thickness of fruit rind (mm)	2.0±0.0	3.3±0.4	3.3±0.6	2.4±0.1	2.0±0.1
Fruit rind weight	10.76±1.42	10.46±1.50	17.51±2.80	9.58±0.50	8.84±1.14
Aryl weight	11.97±0.21	8.27±0.09	17.94±1.91	8.48±0.17	8.12±0.14
Thickness of aryl (mm)	6.3±0.4	5.4±0.4	7.7±0.4	5.6±0.2	5.0±0.1
Taste of aryl	sweet	sweet	sweet-sour	sweet	sour
Color of aryl	withish, translucent	withish, translucent	withish, translucent	withish, translucent	withish, translucent
Texture of aryl	soft, has less water content	soft, has more water content	soft, has more water content	soft, has more water content	soft, has more water content
Adhesion of aryl to seed coat	less viscid, easy to peel off	less viscid, easy to peel off	less viscid, easy to peel off	viscid, hard to peel off	viscid, hard to peel off

Note: *Low, **high

**Figure 6.** The fruit morphology in various rambutan cultivars. A. Parakan, B. Rapiah, C. Aceh, D. Sinyonya, E. wild type

Parakan

The morphological characteristics of fruit are length of bunch 15.22 cm, number of fruits per bunch 3.20 fruits, length of fruit stalk 5.4 mm, ovoid-shaped fruit, reddish fruit rind and spine, uniform color on fruit surface, 11.64 strands of spine per 1x1 cm², 1.32 cm length of spine, soft texture of spine, 4.49 cm length of fruit which belongs to low category with a diameter of 3.19 cm, 24.97 g of fruit weight, 2.0 mm thickness of fruit rind, 10.76 g of fruit rind weight, 11.97 g of aryl weight, 6.3 mm thickness of aryl, sweet taste of aryl, soft withish translucent aryl which is less viscid to seed coat or easy to peel off, less water content of aryl.

Rapiah

The morphological characteristics of fruit are 15.08 cm length of bunch, 15.86 fruits per bunch, 4.8 mm length of

fruit stalk, ovoid-shaped fruit, reddish fruit rind and spine, not-uniform color on fruit surface, 7.60 strands of spine per 1x1 cm², 3.4 mm length of spine, stiff texture of spine, 3.82 cm length of fruit which belongs to low category with a diameter of 3.18 cm, 20.17 g of fruit weight, 3.3 mm thickness of fruit rind, fruit rind weight 10.46 g, 8.27 g of aryl weight, 5.4 mm thickness of aryl, sweet taste of aryl, soft withish translucent aryl which is less viscid to seed coat or easy to peel off, more water content of aryl.

Aceh

The morphological characteristics of fruit are 22.90 cm length of bunch, 9.95 fruits per bunch, 4.6 mm length of fruit stalk, ovoid-shaped fruit, reddish fruit rind and spine, not-uniform color on fruit surface, 6.66 strands of spine per 1x1 cm², 1.06 cm of length of spine, soft texture of spine, 4.62 cm length of fruit which belongs to high category with a diameter of 3.83 cm, 37.42 g of fruit weight, 3.3 mm thickness of fruit rind, 17.51 g of fruit rind weight, 17.94 g of aryl weight, 7.7 mm thickness of aryl, sweet-sour aryl, withish translucent soft aryl which is less viscid to seed coat or easy to peel off, more water content of aryl.

Sinyonya

The morphological characteristics of fruit are 15.43 cm length of bunch, 8.33 fruits per bunch, 5.8 mm length of fruit stalk, ovoid-shaped fruit, reddish fruit rind and spine, uniform color on fruit surface, 8.90 strands of spine per 1x1 cm², 1.10 cm length of spine, soft texture of spine, 4.08 cm length of fruit which belongs to low category with a diameter of 3.02 cm, 19.81 g of fruit weight, 2.4 mm thickness of fruit rind, 9.58 g of fruit rind weight, 8.48 g of aryl weight, 5.6 mm thickness of aryl, sweet taste of aryl, soft whitish translucent aryl which is viscid to seed coat or hard to peel off, more water content of aryl.

Wild type

The morphological characteristics of fruit are 13.65 cm length of bunch, 13.30 fruits per bunch, 4.2 mm length of fruit stalk, ovoid-shaped fruit, reddish fruit rind and spine, uniform color on fruit surface, 9.27 strands of spine per 1x1 cm², 9.9 mm length of spine, soft texture of spine, 3.45 cm length of fruit which belongs to low category with a diameter of 3.02 cm, 19.00 g of fruit weight, 2.0 mm thickness of fruit rind, 8.84 g of fruit rind weight, 8.12 g of aryl weight, 5.0 mm thickness of aryl, sour taste of aryl, soft withish translucent aryl which is viscid to seed coat or hard to peel off, more water content of aryl.

Among the five cultivars of rambutan, Parakan has highest spine density (11.64 strands per 1x1 cm²) and longest spine (13.2 mm). Rapih has shortest spine (3.4 mm) with stiff texture. Rapih and Aceh have thick fruit rind (3.3 mm). Aceh has the largest size and weight of fruit with a length of 4.62 cm, a diameter of 3.83 cm, fruit weight of 37.42 g, fruit rind weight of 17.51 g, aryl weight of 17.94 g, and aryl thickness of 7.7 mm.

The aryl of Parakan, Rapih, and Aceh are easy to peel off from the seed coat, while the aryl of Sinyonya dan wild type are hard to peel off. The aryl of Parakan has less water content than others. While Parakan, Rapih, and Sinyonya

produce fruit with a sweet taste, Aceh has a sweet-sour fruit, and wild type fruit is sour. This result is contradictory to the results obtained by Singh et al. (2017) explained that the fruit sizes of sour fruits are larger as compared to sweet fruits.

Based on the results of study, it can be seen that the size of bunches and the number of fruits per bunch varies among cultivars, and it also showed the different fruit densities. The Aceh cultivar has a longest average bunch size (22.90±2.10 cm), but the fruit production is just 9.95±3.72 cm, while the Rapih cultivar, with the average length of bunch 15.08±4.81 cm, has relatively more dense of fruits (15.86±5.96 fruits), likewise, in the wild type (Table 2). The number of fruits per bunch is assumed also to be related to the fruit size, as found in betel nut (Miftahorrahman and Nur 2013).

Some characteristics of fruit morphology, such as taste, fruit size, thickness of fruit flesh, texture of aryl, and spine density determine the performance and the people's preference for consuming rambutan. Most people prefer sweet to sweet-sour fruits than sour fruits, or the fruit with the rarer spines than that with denser spines, so Aceh cultivar is more found in research sites. However, the people's preference for fruit of rambutan may be influenced by other factors, including in aryl water content and cravings reason. The fruits having less water content can be one of preferred Parakan factor. The cravings pregnant mothers tend to prefer acidic fruit of wild type. On the other hand, the characteristics of fruit peel become the important parameter in the fruit durability. The rambutan cultivars with the thick fruit rind, such as in Rapih and Aceh, allow themselves to be stored for a longer time than the cultivars with the thin fruit rind (Kuswandi et al. 2016).

The morphological characteristic of seed

Based on the data, the morphological characteristic of seed showed variation among cultivars, both shape, size, and seed weight (Figure 7). The shapes of seed in Parakan and Sinyonya are oblong, in Aceh is obovoid elongated, while in Rapih and wild type is roundish. Based on the size and weight of seed, Parakan has the largest seed size and weight. In contrast, the Rapih cultivar has the smallest seed size and weight. According to the seed width, two cultivars can be grouped into small (Rapih, Sinyonya) and three cultivars into medium (Parakan, Aceh, wild type).

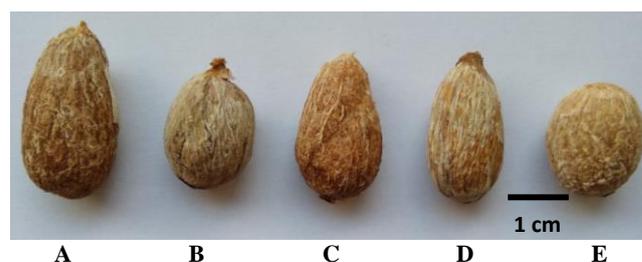


Figure 7. The variation of seed shape and size in various rambutan cultivars. A. Parakan, B. Rapih, C. Aceh, D. Sinyonya, E. Wild type

Table 4. The characteristics of seed morphology in various rambutan cultivars

Cultivars	Shape of seed	Seed weight (g)	Size of seed (cm)		
			Length	Width	Thickness
Parakan	Oblong	2.24±0.21	2.45±0.11	1.30±0.08 ^{1*}	1.06±0.03 ^{3*}
Rapiah	Roundish	1.43±0.09	1.79±0.06	1.24±0.07 ^{2*}	0.94±0.04 ^{4*}
Aceh	Obovoid elongated	1.98±0.11	2.22±0.06	1.37±0.05 ^{1*}	0.98±0.04 ^{4*}
Sinyonya	Oblong	1.75±0.17	2.18±0.03	1.17±0.05 ^{2*}	0.98±0.05 ^{4*}
Wild type	Roundish	2.05±0.14	1.97±0.04	1.42±0.03 ^{1*}	1.09±0.07 ^{3*}

Note: Seed width: ^{1*}Medium width, ^{2*}small; thickness of seed: ^{3*}medium thickness, ^{4*}thin

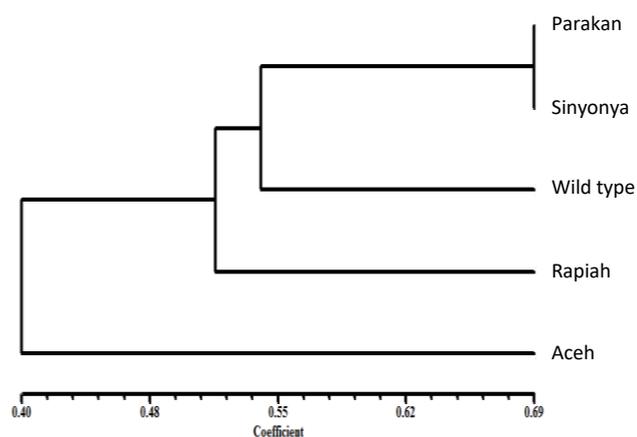


Figure 8. Dendrogram of 5 rambutan cultivars collected from Serang City, Banten, Indonesia based on morphological characteristics of fruit and seed

Meanwhile, based on the thickness of seed, they can be grouped into thin (Rapiah, Aceh, Sinyonya) and medium (Parakan, wild type) seeds. These results are not appropriate with the results obtained by Singh et al. (2017) stated that the seed size of sweet fruit is smaller than acidic fruit. Aside as being a taxonomic marker, the characteristics of seed also influence the physiological processes. The size and weight of seeds correlate with the water content and endosperm, so that they influence the drying process, the seed retention, and the germination ability (Soetisna and Zebua 2005).

Morphological analysis among rambutan cultivar based on fruit and seed characteristic

The similarity index of morphological characteristics of fruit and seed showed a kinship relationship to five cultivars of rambutan. Based on the analysis by using UPGMA through the NTSYs Program version 2.02, the results showed a high diversity of fruit and seed morphology among five cultivars. From a dendrogram obtained, it was seen that the five cultivars had a similarity distance coefficient from 40% to 69%. The five cultivars were divided into two groups, group I consisted of Parakan, Sinyonya, and wild type, while group II included in Rapiah. Group I was divided into two small groups, sub-group A including Parakan and Sinyonya, and sub-group B

including wild type. Parakan and Sinyonya had a highest similarity distance (69%), while Aceh was separated from other cultivars with a similarity distance of 40% (Figure 8).

In general, the generative morphology can be used as a marker among rambutan cultivars, especially in fruit size, fruit weight, and seed shape, while the characteristic of flower is difficult to be used as a marker because there are overlapping characters. Based on the results, it can be concluded that rambutan can be differentiated into monoecious plant (Aceh, Rapiah, wild type), and dioecious plant (male tree). Meanwhile, based on the results of observation on the morphological characteristics of fruit, it can be concluded that the Aceh cultivar has a longest average fruit bunch (22.90 cm), while Rapiah has highest number of fruit per bunch (15.86 fruits). Parakan has highest spine density (11.64 strands per 1x1 cm²) and longest spine (13.2 mm). Rapiah has shortest spine (3.4 mm) with a stiff texture. Rapiah and Aceh have the thickest fruit rind (3.3 mm). Aceh has the largest size and weight of fruit with fruit length of 4.62 cm, fruit diameter of 3.83 cm, fruit weight of 37.42 cm, fruit rind weight of 17.94 g, aryl weight of 17.94 g, and aryl thickness of 7.7 mm. The aryl in Parakan, Rapiah, and Aceh is easy to peel off from the seed coat, but it is hard to peel off in Sinyonya and wild type. The aryls are sweet in Parakan, Rapiah, and Sinyonya, but sweet-sour in Aceh, and sour in wild type. Among five cultivars, Parakan has highest seed weight (2.24 g). From dendrogram analysis, the five cultivars had a similarity distance coefficient from 40% to 69%. Parakan and Sinyonya had highest similarity distance (69%), while Aceh was separated from other cultivars with a similarity distance of 40%. In the future, the DNA-based molecular marker can be applied for the identification of genotype variation.

ACKNOWLEDGEMENTS

We would like to thank Nur, a resident of Serang City, Banten, Indonesia and Dina Indriana of the State Islamic University Sultan Maulana Hasanuddin, Banten, who provided the samples of rambutan flowers and fruits for this study.

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