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Inventory of Superior Durian from the Highlands and Lowlands in Fakfak Regency

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ABSTRACT

The purpose of this study is to catalog exceptional durians from both the highlands and the lowlands of Fakfak Regency in West Papua Province. The inventory included both highland and lowland durian accessions. In the highlands, there were 8 durian accessions, whereas in the plains there were seventeen. Fruit size, fruit skin thickness, fruit pulp color, fruit pulp thickness, aroma, sweetness level, fruit pulp fiber, seed size, and seed count were utilized as evaluation criteria. Each criterion tested showed variability. This demonstrates that genotypic variability exists among durian accessions from the Fakfak Regency. According to the characterization results, there were six lowland accessions that could be classified as superior in terms of fruit size, thickness of fruit pulp, level of sweetness, pulp fiber, and aroma: Pahger Nkendik, Katemba, Danaweria2, Brongkendik, Air Besar, Kanantare, and Sakartemin.

Keywords: durian, Fakfak, superior fruit

INTRODUCTION

Durian (*Durio zibenthinus* Murr) belongs to the *Bombacaceae* family and is so popular that it has earned the name *King of The Fruits.* The name durian comes from the Malay word 'duri' (Husin *et al.* 2018) which is a characteristic of durian bark. Durian has high economic value, and apart from its very strong aroma and distinctive taste, durian fruit is rich in important nutrients, such as flavonoids, phenolic acids, tannins, carotenoids, ascorbic acid, and other bioactive compounds (Charoenkiatkul *et al.* 2015; Wisutiamonkul *et al.* 2017; Aziz and Jalil 2019; Ali *et al.* 2020; Arsa *et al.* 2021; Yee 2021).

Indonesia has a very high durian genetic diversity (Belgium *et al.* 2015). Yuniastuti *et al.* (2018) states that durian occupies the 4th position of national fruit with a production of approximately 700 thousand tons per year. Ding *et al.* (2015) reported that durian fruit is suitable for cultivation, and used as a commercial garden, considering the demand and price are quite high compared to other fruits. Thus, according to Hadiati *et al.* (2016), durian fruit must be of good quality according to consumer tastes to meet the future needs of the fruit market. Fakfak Regency is one of the areas with high durian production in West Papua. Data from the Central Statistics Agency (2019) show that the national production of durian in 2016 decreased by 26.14% when compared to 2015. In 2017, the national production of durian increased by 8.13% when compared to 2016, and in 2018, the national production of durian increased by 43.62% when compared to 2017, or there was an increase of four times from 2017. This also happened in West Papua, where there was an increase of 166.67% in 2018 when compared to 2017.

The distribution of durian species in the Fakfak Regency is quite diverse, and the seasonal pattern occurs twice, with the durian season produced from highland areas and coastal locations. Fruit quality might vary depending on the season and the growing location. There is currently no information available on the morphology and quality of durian fruits from the highlands and lowlands of the Fakfak Regency that may be utilized to pick superior durians. Inventory actions can help introduce superior types of Fakfak durian. Inventory is an activity that involves exploring and identifying durian types in a certain region.

Superior seedlings are young plants with superior properties, such as the ability to retain their parents' original nature, a fast production age, high productivity, taste and aroma to meet consumer needs/tastes, thick and soft fruit pulp, small seeds, and resistance to pest and disease attacks (Yuniastuti 2018). If more consumer value is obtained for a single fruit, the fruit's economic value (price) increases. Such a fruit can be considered superior (Ihsan and Indriyani 2019). As a result, an example of how to analyze durian fruit based on consumer-favored fruit look and attributes may be studied, resulting in a list of criteria for analyzing excellent durian fruit. The goal of this study was to

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collect morphological data from numerous superior durian accessions from both the highlands and the lowlands for use as germplasm. The benefits of this germplasm inventory and classification include information for the overall growth of durians.

METHODS

Materials

The materials used in this study were 8 highland durian accessions and 17 lowland durian accessions from Fakfak Regency. Accessions from the highlands were Wargep1, Wargep2, Wargep3, Wargep4, Wargep5, Wargep6, Bahbadan1, and Bahbadan2. Accessions from the lowlands were Pahger Nkendik, Nemewikarya, Unipokpok, Katemba, Danaweria, Danaweria2, Gewepe, Brongkendik, Air Besar, Kanantare, Sakartemin, Sekru Tuware, Mendopma, Raduria, Sekru, Dulanpokpok, and Air Merah

Equipment

The tools used in this study were rulers, scales, knives, and cameras.

Observation Variables

The factors observed met the durian assessment standards (Directorate General of Horticulture 2010), including fruit size, fruit skin thickness, pulp thickness, aroma, pulp color, taste, pulp texture, seed size, and number of wedges. Fruit sizes were classified as small (weighing 1–2 kg), medium (weighing 2–3 kg), large (weighing 3–5 kg), and very large (weighing >5 kg). The thickness of the fruit's skin and pulp was measured in millimeters with a ruler. Scents are divided into three categories: not weak, medium, and strong. The pulp comes in 4 colors: white, yellowish-white (ivory, beige), yellow, and dark yellow. The sweetness level is classified as sticky sweet, sweet, or moderate. Fruit pulp fibers are divided into 3 types: soft (smooth), slightly fibrous, and fibrous. The seeds are divided into three sizes: small, medium, and large (Directorate General of Horticulture 2010).

RESULTS AND DISCUSSION

Durian has gained popularity in recent years due to its high concentration of phytochemical substances such as polyphenols, vitamins, and flavonoids, which function as antioxidants and antimicrobials (Ali et al. 2020; Huang et al. 2020; Kumoro et al. 2020; Arsa et al. 2021; Khaksar et al. 2024). Husin et al. (2018) found that the pulp of durian fruit is high in protein (1.47%), fat (5.33%), fiber (3.1%), and carbohydrates (27%). In addition, durian pulp includes linoleic acid (2.20%), myristic acid (2.52%), oleic acid (4.68%), octadecenoic-10 acid (4.86%), palmitoleic acid (9.50%), palmitic acid (32.91%), and stearic acid (35.93%), all of which are beneficial to the body. Durian provides health benefits such as blood sugar homeostasis, cholesterol reduction, and a probiotic effect (Aziz and Jalil 2019). Durian fruit offers a lot of promise for agriculture due to its high nutrient and phytochemical content.

There are 12 durian producing districts in Fakfak Regency, namely Karas, Fakfak Middle East, Fakfak, Fakfak Tengah, Pariwari, West Fakfak, Teluk Patipi, Kramongmongga, Bomberay, Furwagi, Kayauni and Tomage. Kramongmongga District is the largest producer followed by Fakfak District and West Fakfak District.

Results of Durian Exploration and Characterization in the Highlands

The results of durian investigation in Fakfak Regency's highlands show that durian diversity can be found in Wargep and Bahbadan Villages. Wargep Village is located 362 meters above sea level, whereas Bahbadan Village is 480 meters above sea level. Six durian accessions were taken from Wargep Village, with two from Bahbadan Village. In the highlands of Fakfak Regency, durian trees are commonly paired with nutmeg trees as the main plant, as well as various other cultivated plants in modest amounts such as langsat ((*Lansium domesticum*), rambutan (*Nephelium lappaceum* L), mango, areca nut, guava, orange, and coconut.

Figure 1 depicts the color variance in the pulp of 8 durian accessions collected from Fakfak Regency's highlands. All accessions had pulp ranging in color from white to dark yellow. This color variation shows that the variation is caused by genotype rather than the environment. Carotenoids, particularly alpha- and beta-carotene, are responsible for the color of durian fruit pulp (Charoenkiatkul *et al.* 2015; Ho and Bhat 2015; Wisutiamonkul *et al*. 2017; Mohd *et al*. 2020; Yee 2021). Carotenoids are pigments found in the skin and pulp of red and yellow fruits (Hermanns *et al*. 2020; Arsa *et al*. 2021; Khaksar *et al*. 2024). The fruit pulp turns yellow to dark yellow as the carotenoid content increases (Wisutiamonkul *et al*. 2015).

The results of exploration and observation of the size of local durian fruits in the Fakfak Plateau show that 7 durian accessions have medium fruit sizes, while one accession has a large fruit size. One of the criteria for superior durian fruit is to have a large size; thus, accession to Wargep4 can be grouped as superior durian based on fruit size (Table 1). Durian fruits in the highlands of Fakfak Regency have skin thicknesses ranging from 0.6 cm to 1.0 cm. Durian fruit is categorized as superior if it has thin fruit skin. Based on this, the accessions of Wargep1 and Wargep5 can be grouped into superior durian because they have a skin thickness 0.6 cm lower than other accessions.

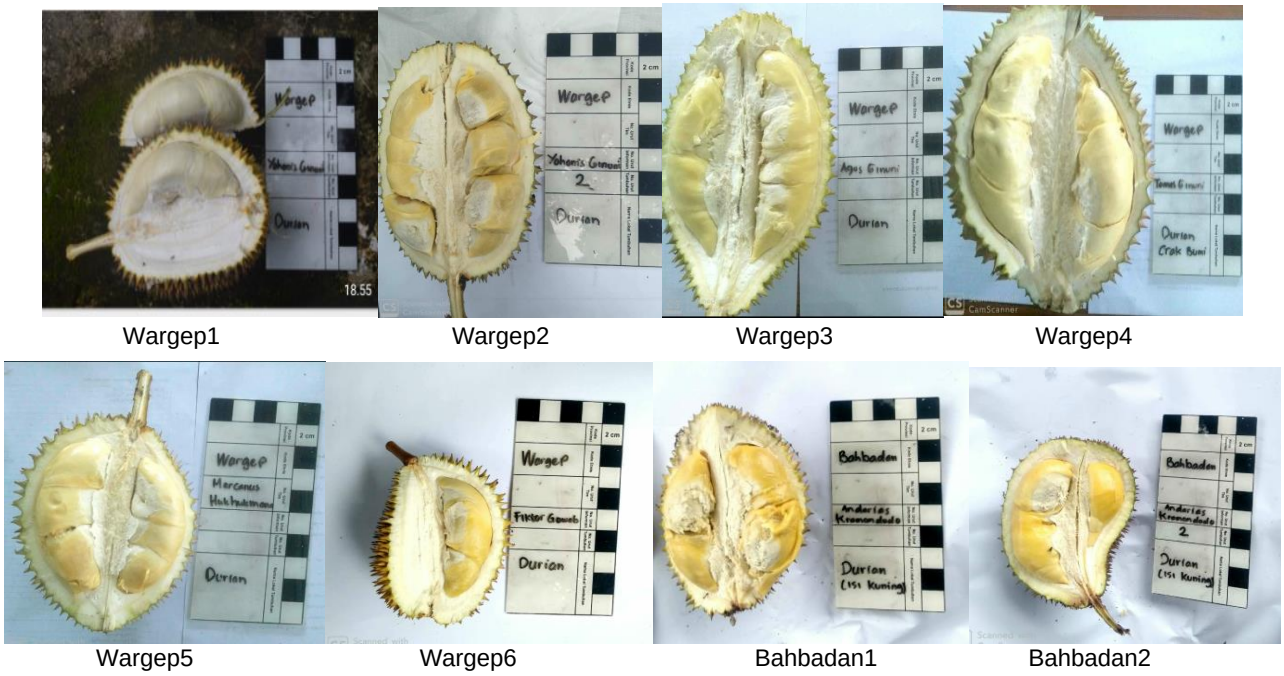

Figure 1 Various color of durian pulp in Kampung Wargep and Kampung Bahbadan.

Table 1 Characteristics of several accessions of durian from the Fakfak highlands based on superior durian criteria

Accession	Sweetness level	Pulp thickness (cm)	Seed size	Pulp color	Pulp fiber	Fruit size	Aroma	Peel thickness (cm)	Number of locules
Wargep 1	Medium	0.5	Medium	White	Soft	Medium	Medium	0,6	5
Wargep 2	Medium	0.1	Medium	Yellow	Soft	Medium	Medium	1,0	5
Wargep 3	Sticky sweet	1.0	Medium	Ivory	Soft	Medium	Strong	1,0	5
Wargep 4	Sticky sweet	0.8	Medium	Yellow	Soft	Large	Medium	1,0	5
Wargep 5	Sticky sweet	0.3	Medium	Yellow	Soft	Medium	Medium	0,6	5
Wargep 6	Sweet	0.9	Medium	Ivory	Soft	Medium	Medium	1,0	5
Bahbadan 1	Sweet	0.4	Medium	Yellow	Soft	Medium	Medium	0,9	5
Bahbadan 2	Sweet	1.0	Medium	Dark yellow	Soft	Medium	Medium	1,0	5

Results of Durian Exploration and Characterization in the Lowlands

The results of durian exploration in the lowlands of Fakfak Regency show that the diversity of durian is found in 16 villages located at an altitude of 34 to 217 m above sea level. Durian trees in the lowlands of Fakfak Regency generally have the same association pattern as the highlands, namely association with nutmeg trees as the dominant plant and several other cultivated plants in small quantities including *langsat*, *rambutan*, mango, areca nut, guava, orange, and coconut.

Figure 2 shows the variation in the pulp color of 17 durian accessions from the lowlands of the Fakfak Regency. All accessions showed a color of pulp that varied from white to dark yellow. This color variation indicates that there is variation caused by genotype and not by the environment.

Morphology of Fakfak Lowland Durian

The main trait group indicated that durian fruits were grouped into superior traits. Some of the characteristics that show the advantages of durian are the taste of the pulp, the thickness of the pulp, the size of the seeds, the color of the pulp, the texture of the meat, the size of the fruit, the aroma, the peel of the fruit, and the number of wedges (Table 2). Santoso *et al.* (2008) stated that the criteria for durian fruit that consumers prefer are medium fruit size (1.6–2.5 kg/fruit), sweet taste, fluffy texture, and thick pulp. The results of the exploration show that there are three categories of sweetness levels in durian pulp from the lowlands of Fakfak

Figure 2 Various color of durian pulp in 16 lowland villages of Fakfak Regency.

Regency, namely moderate, sweet, and legit sweet. Accessories from the villages of Pahger Nkendik, Katemba, Brongkendik, Air Besar, Kanantare, and Sakartemin have a sweet and sticky (*legit*) level of sweetness of the fruit pulp so that it is included in the criteria for superior durian based on the taste of the fruit.

Based on studies of the pulp of 17 durian accessions, the fruit pulp was both thin and thick. Mendopma, Raduria, Sekru, Dulanpokpok, Air Merah, Pahger Nkendik, Nemewikarya, Unipokpok, Danaweria2, Gewepe, Brongkendik, Air Besar, Kanantare, and Sakartemin were the 14 lowland durian accessions with thick fruit pulp, while the others have thin fruit pulp. Pahger Nkendik and Kanantare were the only two accessions with deflated seeds, while the other 15 contained both small and large seeds. The size of the deflated seeds indicates that the durian accession has a thick pulp, implying that it is classified as superior durian.

Based on the pulp color, there were two accessions with superior parameters: durian from Pahger Nkendik and Air Besar with dark yellow pulp (Table 2). One of the distinguishing features of outstanding durian is its appealing pulp color. So far, little is known about the carotenoid content of durian from the Fakfak Regency; therefore, identifying carotenoid content in the pulp of durian from the Fakfak Regency is important. Some accessions have a yellow pulpy tint, which is among the colors desired by durian enthusiasts. The texture of the fruit pulp reveals four accessions with a smooth (soft) texture: Danaweria2, Gewepe, Dulanpokpok, and Air

Table 2 Characteristics of several durian accessions from the lowlands of Fakfak Regency based on superior durian criteria

Accession	Sweetness level	Pulp thickness (cm)	Seed size	Pulp color	Pulp fiber	Fruit size	Aroma	Peel thickness (cm)	Number of locules
Pahger Nkendik	Sticky sweet	1.0	Flat	Dark yellow	Fibrous	Large	Faint	0,5	5
Nemewikarya	Sweet	1.0	Large	White	Slightly fibrous	Large	Faint	0,9	5
Unipokpok	Medium	1.0	Large	White	Slightly fibrous	Medium	Faint	0,4	5
Katemba	Sticky sweet	0.5	Small	White to yellow	Slightly fibrous	Small	Faint	0,5	6
Danaweria	Sweet	0.4	Large	Yellow	Soft fibrous	Large	Faint	0,6	5
Danaweria2	Sweet	0.9	Large	Yellow	Soft	Large	Faint	0,6	5
Gewepe	Medium	1.0	Large	White To yellow	Soft	Large	Faint	0,8	5
Brongkendik	Sticky sweet	0.8	Large	Yellow	Slightly fibrous	Large	Faint	0,5	5
Air Besar	Sticky sweet	0.9	Large	Dark yellow	Slightly fibrous	Large	Faint	0,5	5
Kanantare	Sticky sweet	1.0	Small flat	Yellow	Slightly fibrous	Large	Faint	0,5	5
Sakartemin	Sticky sweet	1.0	Large	Yellow	Fibrous	Large	Faint	0,6	5
Sekru Tuware	Sweet	0.6	Large	White	Fibrous	Small	Faint	0,6	5
Mendopma	Sweet	1.0	Small	Yellow	Fibrous	Small	Faint	0,5	5
Raduria	Sweet	1.0	Small	Yellow	Fibrous	Small	Medium	0,4	5
Sekru	Sweet	0.9	Small	White	Fibrous	Small	Medium	0,8	4
Dulanpokpok	Sweet	1.0	Large	Yellow	Soft	Large	Strong	0,6	3
Air Merah	Sweet	1.0	Large	Yellow	Soft	Medium	Strong	1,0	4

Merah. The silky texture demonstrates the superiority of a durian that is in demand in the market and business.

The large size of the fruit is a requirement for superior durian (Santoso *et al*. 2008), as the larger the durian, the more seeds it contains, and vice versa. The observation revealed that the fruit sizes of Pahger Nkendik, Nemewikarya, Danaweria, Danaweria 2, Gewepe, Brongkendik, Air Besar, Kanantare, Sakartemin, and Dulanpokpok were enormous, while the others were medium to tiny. According to the observation results, there were two accessions with a strong aroma: Dulanpokpok and Red Water. The outstanding durian has a strong aroma, which attracts and interest's durian fans. Other accessions have a faint to medium scent.

The exploration results suggest that most of the durians in the Fakfak Regency's lowlands had thin fruit skins, but others were thick. Accessories with thin fruit skins included Pahger Nkendik, Unipokpok, Katemba, Danaweria, Danaweria2, Brongkendik, Air Besar, Kanantare, Sakartemin, Sekru Tuware, Mendopma, Raduria, and Dulanpokpo. The number of wedges per durian fruit ranged from 3 to 6. The criteria for the superior durian group are to have several wedges ranging from 5–6. The accession that is classified as having a wedge number of 5–6 is Pahger Nkendik, Nemewikarya, Unipokpok, Katemba, Danaweria, Danaweria 2, Gewepe, Brongkendik, Air Besar, Kanantare, Sakartemin, Sekru Tuware Mendopma, and Raduria. Katemba has 6 accessions, which is more than the other accessions.

CONCLUSION

Based on the results of the durian commodity inventory in the Fakfak Regency, it is possible to conclude that the durian commodity in the Fakfak Regency is naturally distributed from the Lowlands to the Highlands, with a 25-accessions variation. Six accessions from the lowlands were selected as superior, including Pahger Nkendik, Katemba, Danaweria2, Brongkendik, Air Besar, Kanantare, and Sakartemin, based on fruit size, pulp thickness, sweetness level, pulp fiber, and scent. These 6 accessions are considered local durians and have a higher commercial worth than other accessions. These accessions can be used as germplasm to develop excellent Fakfak Regency durians. Further examination is required in the following production season to determine the character's stability.

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