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Research Article

# Phenotypic Diversity of Super Local Durian (*Durio zibethinus* Murr.) Varieties from South Kalimantan, Indonesia: A Case Study

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**Abstract:** *Durio zibethinus*, known as durian in several Southeast Asian countries, is a prospective horticultural commodity to cultivate and develop. This study aimed to determine the phenotypic diversity and relationship of superior durian varieties from South Kalimantan in Indonesia based on morphological characteristics. Here, 20 varieties of durian (*D. zibethinus*), including an outgroup, were used. Meanwhile, 57 morphological characteristics, comprising 35 qualitative and 22 quantitative, were observed. The Shannon index (H') method was applied for phenotypic diversity, and the relationships were by the UPGMA. The results show that durians of the region have low phenotypic diversity. However, some morphological characteristics show high ones, e.g., crown shape, fruit skin color and thickness, fruit flesh thickness, and fruit spine length, including tree age. In this case, the highest fruit skin and flesh thickness are present in Malutu and Bamban Birin, respectively. In addition, the fruit spine length and tree age are also in 'Malutu'. The UPGMA revealed that the durians were separated into seven clusters and near-corresponding to geographic origin. In this case, 'Gentarbumi Uya' is the closest to 'Taradak Uya', whereas the farthest is 'Malutu' with 'Tapai Idaman'. Thus, this information is essential in promoting the future durian-breeding program in local and global coverages.

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## 1. Introduction

*Durio zibethinus*, known as 'durian' in several Southeast Asia countries, is a very prospective horticultural commodity to cultivate and develop. It is related to the demand for the durian market that continues to increase every year, both for the domestic and foreign markets (Mursyidin et al., 2022). Indonesia, for example, is one of the second largest durian-producing countries in the world after Thailand, which can generate more than 1 million metric tons of durian every year. Even today, this country can export this product to several Asian, European, American, and Middle Eastern countries with a fantastic value of more than 230 thousand USD. However, the Indonesian quality of durian is generally low competitive to such commodities from neighboring countries, i.e., Thailand and Malaysia (Durian Harvests Indonesia, 2021). Thus, the improvement included in the strategic plan of the durian-breeding program is necessary to employ.

Taxonomically, *D. zibethinus* is one of nine durian species whose fruit flesh is edible. Meanwhile, this plant is native to Southeast Asia, especially Malaysia, Thailand, and Indonesia, with tremendous phenotypic diversity. According to Husin et al. (2018), there are 15 varieties of durians registered in Malaysia, such as 'D24', 'D99', 'D123', 'D145', 'D158', and 'D159'. In Thailand, the Thai Agricultural Standard has reported seven commercial varieties of durian, including 'Chanee', 'Karnyao', 'Kradoomthong', 'Longlublae', 'Monthong', 'Nualthongchan', and 'Puangmanee'. In addition, more than 102 durian varieties have been released and registered in Indonesia with different characteristics of fruit flesh, color, aroma, and taste (Bayu and Ashari, 2019).

South Kalimantan is part of the Indonesia region with a high genetic diversity of durian. Unsurprisingly, this region is known as the center of diversity of the durian germplasm of the world. In this region, not only *D. zibethinus* is present, but also several other wild durian species, e.g., *D. dulcis*, *D. excelsus*, *D. kutejensis*, and *D. lowianus* (Mursyidin and Daryono, 2016). This germplasm has beneficial traits to the breeding program, such as a high tolerance to specific environmental conditions and diseases, like acid soils and patch cankers (Mursyidin et al., 2022). This study aimed to determine the phenotypic diversity and relationship of superior local durian varieties from this region based on morphological markers. While these traits have certain disadvantages, such as multigenic inheritance, time-consuming, and strongly influence by environmental parameters (Wu et al., 2021), they are customary to assess the genetic diversity of durian (Sundari et al., 2019; Sihaloho et al., 2021).

In brief, determining genetic diversity and the relationship of germplasm is critical for plant genetic preservation and breeding program, particularly in developing new superior varieties (Acquaah, 2007). In addition, such studies provide valuable information for understanding the relationship among varieties, evaluating the likelihood of mixing or repetition in germplasm collections (Delfini et al., 2021), and the parental selection of crossbreeding in breeding and preservation programs (Wu et al., 2021). From a global perspective, determining genetic diversity would provide an essential foundation for promoting the future durian-breeding program (Roy et al., 2016). However, on the local scale, such studies will reveal the complicated interaction between the germplasm and the local wisdom of the community (Mursyidin et al., 2019).

## 2. Material and Methods

### 2.1. Plant materials

A total of 20 superior varieties of durian (*D. zibethinus*), including an outgroup (*D. dulcis*), were collected by a purposive sampling method from seven regions of South Kalimantan, Indonesia (Figure 1) and used in this study (Table 1). Generally, naming and selecting varieties based on the shape and taste of the durian fruit in the community, then registering it with the government through the authorized agency. In this case, all sampling locations were characterized by daily temperature and humidity, ranging from 22-31ºC and 65-95%, respectively (BMKG, 2023).

### 2.2. Phenotypic analysis

In total, 57 morphological traits, comprising 35 qualitatives (Table 2) and 22 quantitative (Table 3), were observed and evaluated in determining durian phenotypic diversity. This characterization was followed by the standard durian (*D. zibethinus*) protocol from Bioversity International (2007).

### 2.3. Data analysis

The qualitative and quantitative data were tabulated and converted into multivariate values. Then, all were standardized and analyzed with the assistance of the MVSP ver. 3.1 (Kovach, 2007). The phenotypic diversity was determined by the Shannon diversity index (*H'*) following the equation (Mursyidin and Khairullah, 2020).

$$H' = -\sum_{i=1}^{n} p\mathrm{i}\ \ln p\mathrm{i} \quad (1)$$

Where $H'$ is the diversity index; $p_i$ is the proportional frequency, and ln $p_i$ is the ratio of the natural logarithm. The diversity was categorized into high ($H' > 0.60$), moderate ($0.40 \leq H' \leq 0.60$), or low ($H' < 0.40$) levels (Mursyidin and Khairullah, 2020).

Before further analysis, the distance matrix was proceeded using the Euclidean approach, whereas the phenotypic relationship was by the unweighted pair group with the arithmetic average (UPGMA) and PCA methods. All analyses were employed by a similar software, i.e., MVSP ver. 3.1 (Kovach, 2007).

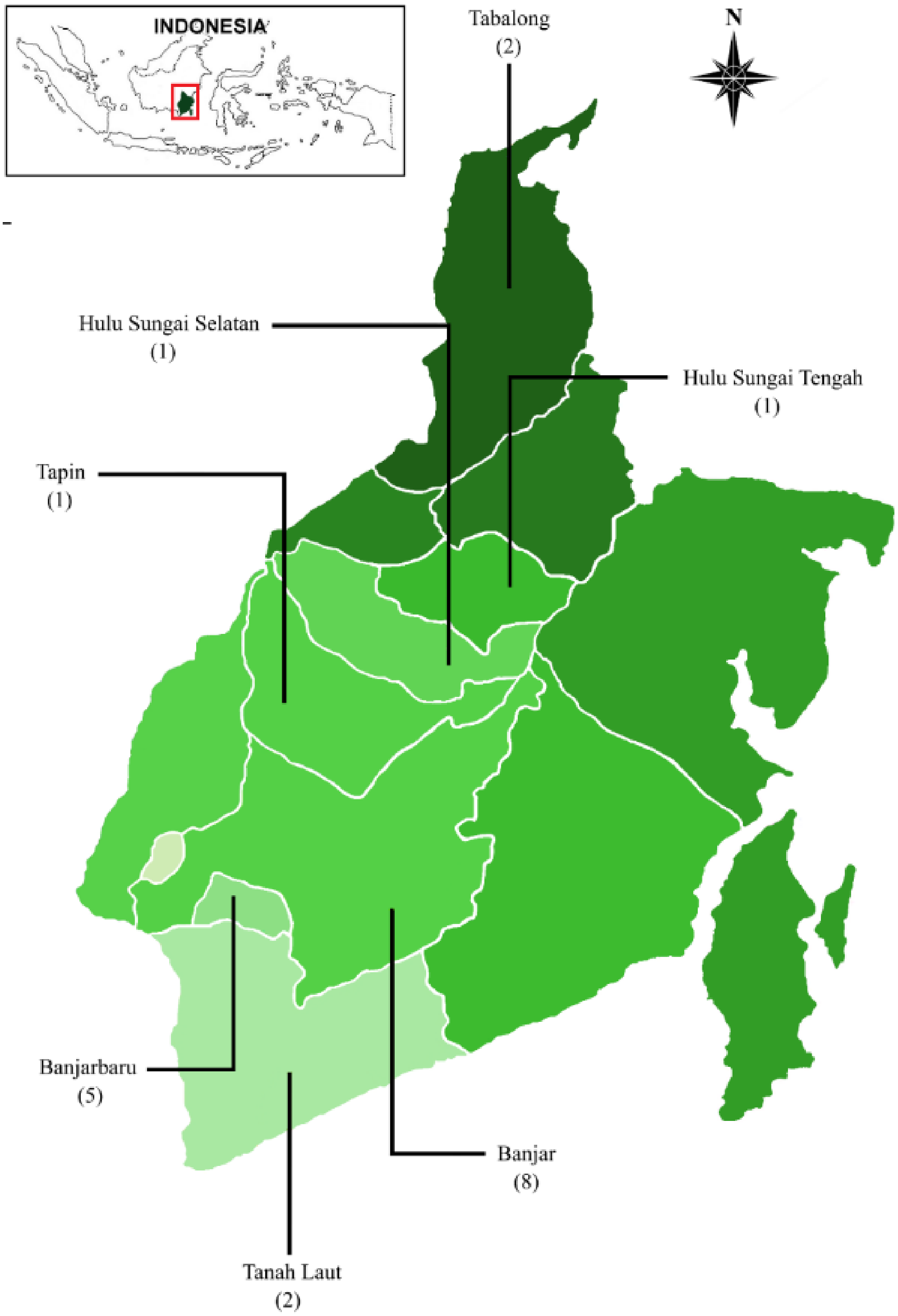


Figure 1. Map of South Kalimantan in Indonesia, showing seven sampling locations where 20 varieties of superior local durian (*D. zibethinus*) were sampled and used in this study.

Table 1. List of superior local durian (*D. zibethinus*) varieties, including an outgroup (*D. dulcis*), used in this study and their origin

| Name of cultivar | Origin (village, district, regency) | Geographic ordinate |
|---|---|---|
| **'Coklat'** | Alat, Hantakan, Hulu Sungai Tengah | 2º37'44.55"S; 115º28'44.69"E |
| **'Lunas'** | Alam Subur, Bati-Bati, Tanah Laut | 3º34'26.83"S; 114º50'11.13"E |
| **'Nonong'** | Suato Baru, Salam Berbaris, Tapin | 3º03'55.05"S; 115º11'30.77"E |
| **'Penganten'** | Beruntung Jaya, Cempaka, Banjarbaru | 3º33'10.92"S; 114º50'57.69"E |
| **'Siput'** | Bentok Darat, Bati-Bati, Tanah Laut | 3º35'42.88"S; 114º52'12.07"E |
| **'Tapai Idaman'** | Beruntung Jaya, Cempaka, Banjarbaru | 3º33'10.92"S; 114º50'57.69"E |
| **'Bamban Birin'** | Biih, Karang Intan, Banjar | 3º24'05.50"S; 114º58'52.86"E |
| **'Taradak Uya'** | Lumbang, Muara Uya, Tabalong | 1º55'18.87"S; 115º39'25.51"E |
| **'Dodol Mascinta'** | Balau, Karang Intan, Banjar | 3º24'02.77"S; 115º00'07.76"E |
| **'Gading Abirau'** | Abirau, Karang Intan, Banjar | 3º24'24.99"S; 115º01'00.36"E |
| **'Panyangat Kuning'** | Biih, Karang Intan, Banjar | 3º24'05.50"S; 114º58'52.86"E |
| **'Gantang 88'** | Biih, Karang Intan, Banjar | 3º24'05.50"S; 114º58'52.86"E |
| **'Garuda Idaman'** | Sei Abit, Cempaka, Banjarbaru | 3º31'26.20"S; 114º54'04.12"E |
| **'Gentarbumi Uya'** | Lumbang, Muara Uya, Tabalong | 1º55'18.87"S; 115º39'25.51"E |
| **'Hadangan Idaman'** | Sei Abit, Cempaka, Banjarbaru | 3º31'26.20"S; 114º54'04.12"E |
| **'Hintalu Biih'** | Biih, Karang Intan, Banjar | 3º24'05.50"S; 114º58'52.86"E |
| **'Idangan Biih'** | Biih, Karang Intan, Banjar | 3º24'05.50"S; 114º58'52.86"E |
| **'Kuning Janar'** | Biih, Karang Intan, Banjar | 3º24'05.50"S; 114º58'52.86"E |
| **'Dino Banjarbaru'** | Gunung Kupang, Cempaka, Banjarbaru | 3º28'45.62"S; 114º51'59.14"E |
| **'Malutu'*** | Malutu, Padang Batung, Hulu Sungai Selatan | 2º52'43.50"S; 115º16'40.19"E |

## 3. Results and Discussion

In this study, the superior durians of South Kalimantan, Indonesia, have low phenotypic diversity following morphological traits, both quantitative and qualitative traits. It is pointed out by diversity index values of 0.389 and 0.324, respectively (Tables 2 and 3). Such level of diversity was also reported by Sihaloho et al. (2021) from durian varieties of Central Tapanuli Regency, North Sumatra, Indonesia, and from Sawang and Langkahan of North Aceh, Indonesia (Handayani and Ismadi, 2018). According to Gao et al. (2017), this case may be due to natural selection, the founder effect, genetic isolation, including inbreeding.

However, although the durians have a low level of diversity, several others show a high, such as branching density (0.79), crown shape (0.982), petal color (0.921), fruit skin color (0.83), and fruit flesh texture (0.692) (Table 2). Quantitatively, four traits also presented a high diversity, i.e., fruit skin thickness (0.754), fruit flesh thickness (0.785), fruit spine length (0.636), and tree age (0.624) (Table 3). In general, the fruit characteristics are commonly used, as a marker, to differentiate durian varieties (Susila et al., 2021). However, these traits could only be applied precisely when the plant reaches a minimum of 8 years old, particularly by seed propagation (Retnoningsih et al., 2016). Figure 2 shows morphological differences among durian varieties of South Kalimantan, Indonesia.

According to Sawitri et al. (2019), the superior durian has several criteria, such as: (1) the fruit shape is an ellipse and regular; (2) the flesh fruit is smooth, fluffy, dry, thick, and sweet; (3) the fruit spine is large and pyramid-shaped. For domestic consumers, durians with a sweet taste, medium to strong scent, attractive yellow color, thick flesh, and high fruit productivity are favorable. Meanwhile, foreign consumers prefer durian with an unscented, sweet taste, slightly bitter, thick flesh, and yellowish flesh color (Susila et al., 2021). Following our results, the 'Malutu' is durian with the highest value of fruit skin (2 cm), fruit spine length (1.9 cm), and tree age (100 years). Meanwhile, flesh thickness by 'Bamban Birin', is 1.95 cm (Table 3).

Conceptually, the high diversity level of durian is due to the self-incompatibility or cross-pollination events (Handayani and Ismadi, 2018). In other words, plants with a cross-pollination mechanism (like durians) are derived from natural crosses and are very difficult to obtain with potentially superior character (Kurniadinata et al., 2019). In this context, plant breeders utilize this aspect to assemble new-improved varieties with desired traits, particularly for abiotic and biotic stress adaptation, including consumer-preferred (Swarup et al., 2021; Mursyidin, 2022). In addition, only populations with high genetic diversity can adapt rapidly to environmental changes (Lloyd et al., 2016).

Thus, tasks in expanding the genetic diversity of durians are essential and can be achieved by several approaches, e.g., hybridization, introgression, mutagenesis, or transgenic (Allier et al., 2020).

Table 2. Phenotypic diversity of superior local durian (*D. zibethinus*) varieties for qualitative characters

| Character | Code | *H'* Index | Category of Diversity |
|---|---|---|---|
| **Tree growth habit** | A | 0.432 | Moderate |
| **Bark color** | B | 0.445 | Moderate |
| **Branching density** | C | 0.790 | High |
| **Branching position** | D | 0.537 | Moderate |
| **Crown shape (canopy)** | E | 0.982 | High |
| **Trunk surface** | F | 0.707 | High |
| **Bark shape** | G | 0.000 | None |
| **Leaf upper surface color** | H | 0.000 | None |
| **Leaf lower surface color** | I | 0.354 | Low |
| **Leaf-blade shape** | J | 0.432 | Moderate |
| **Arrangement of leaf** | K | 0.356 | Low |
| **Leaf apex shape** | L | 0.512 | Moderate |
| **Leaf-blade margin** | M | 0.432 | Moderate |
| **Leaf texture** | N | 0.432 | Moderate |
| **Flower clustering habit** | O | 0.432 | Moderate |
| **Flower bud shape** | P | 0.138 | Low |
| **Flower bud apex shape** | Q | 0.432 | Moderate |
| **Petal color** | R | 0.921 | High |
| **Sepal color** | S | 0.256 | Low |
| **Stigma color** | T | 0.140 | Low |
| **Anther color** | U | 0.102 | Low |
| **Time of flowering** | V | 0.432 | Moderate |
| **Time of harvesting** | W | 0.432 | Moderate |
| **Fruit shape** | X | 0.221 | Low |
| **Fruit skin color** | Y | 0.830 | High |
| **Fruit spine shape** | Z | 0.127 | Low |
| **Fruit flesh color** | AA | 0.123 | Low |
| **Seed shape** | AB | 0.145 | Low |
| **Seed color** | AC | 0.507 | Moderate |
| **Fruit flesh taste (level of sweetness)** | AD | 0.421 | Moderate |
| **Fruit flesh taste (fatty)** | AE | 0.109 | Low |
| **Fruit flesh taste (sugarless)** | AF | 0.238 | Low |
| **Fruit flesh texture (fiberless)** | AG | 0.692 | High |
| **Fruit flesh texture (moisture)** | AH | 0.135 | Low |
| **Fruit aroma** | AI | 0.357 | Low |
| **Average** | | **0.389** | **Low** |

In South Kalimantan, Indonesia, durians are not planted in monoculture but in polyculture. In concept, polyculture is the cultivation practice or model where more than one crop species is grown in a similar location and time. It attempts to mimic the diversity of natural ecosystems (Altieri, 1999). Due to climate change, polyculture is popular in more developed countries and has a beneficial impact on certain aspects, for example, controlling the improvement of some pests, weeds, and diseases while reducing the need for pesticides (Iverson et al., 2014). However, polyculture has a limitation, particularly in reducing crop yields due to competition among species for light, water, or nutrients (Capinera, 2008). It also makes management complex because different species have different growth rates, maturation times, and yield requirements (Loomis, 2022).

Table 3. Phenotypic diversity of superior local durian (*D. zibethinus*) varieties for quantitative characters

| Character | Code | Lowest value | Durian cultivar | Highest value | Durian cultivar | *H'* Index | Category of diversity |
|---|---|---|---|---|---|---|---|
| **Leaf blade length (cm)** | AJ | 11.45 | ‘Panyangat Kuning’ | 17.05 | ‘Hadangan Idaman’ | 0.331 | Low |
| **Leaf blade width (cm)** | AK | 3.60 | ‘Panyangat Kuning’ | 11.35 | ‘Lunas’ | 0.200 | Low |
| **Tree height (m)** | AL | 15.00 | ‘Kuning Janar’ | 59.00 | ‘Coklat’ | 0.125 | Low |
| **Tree trunk (first branching of the stem) (m)** | AM | 1.50 | ‘Siput’ | 17.00 | ‘Bamban Birin’, ‘Malutu’ | 0.109 | Low |
| **Crown/canopy diameter (m)** | AN | 9.00 | ‘Gantang 88’ | 22.00 | ‘Malutu’ | 0.240 | Low |
| **Trunk circumference (cm)** | AO | 90.00 | ‘Gantang 88’ | 242.00 | ‘Coklat’ | 0.262 | Low |
| **Bark diameter (cm)** | AP | 28.70 | ‘Gantang 88’ | 77.00 | ‘Coklat’ | 0.259 | Low |
| **Number of flowers/cluster** | AQ | 8.50 | ‘Kuning Janar’ | 25.00 | ‘Malutu’ | 0.107 | Low |
| **Number of fruit/cluster** | AR | 1.00 | ‘Tapai Idaman’, ‘Dodol Mascinta’ | 3.00 | ‘Gentarbumi Uya’ | 0.506 | Moderate |
| **Fruit length (cm)** | AS | 12.00 | ‘Gantang 88’ | 26.00 | ‘Idangan Biih’ | 0.236 | Low |
| **Fruit diameter (cm)** | AT | 9.50 | ‘Gading Abirau’ | 58.20 | ‘Idangan Biih’ | 0.336 | Low |
| **Fruit spine length (cm)** | AU | 0.40 | ‘Dino Banjarbaru’ | 1.90 | ‘Malutu’ | 0.636 | High |
| **Number of seeds per fruit (unit)** | AV | 2.50 | ‘Kuning Janar’ | 25.00 | ‘Panyangat Kuning’ | 0.354 | Low |
| **Fruit weight (kg)** | AW | 0.60 | ‘Gading Abirau’ | 2.40 | ‘Idangan Biih’ | 0.108 | Low |
| **Fruit skin thickness (cm)** | AX | 0.35 | ‘Coklat’ | 2.00 | ‘Malutu’ | 0.754 | High |
| **Number of fruit segment** | AY | 4.00 | ‘Gading Abirau’ | 5.00 | Most of durian | 0.135 | Low |
| **Number of fruit flesh** | AZ | 4.00 | ‘Gading Abirau, ‘Dodol Mascinta’ | 25.00 | ‘Panyangat Kuning’ | 0.172 | Low |
| **Seed length (mm)** | BA | 15.15 | ‘Hadangan Idaman’ | 52.18 | ‘Coklat’ | 0.208 | Low |
| **Fruit flesh thickness (cm)** | BB | 0.65 | ‘Hintalu Biih’, ‘Siput’, ‘Penganten’, ‘Kuning Janar’, ‘Idangan Biih’ | 1.95 | ‘Bamban Birin’ | 0.785 | High |
| **Fruit production per plant (unit)** | BC | 110.00 | ‘Hintalu Biih’ | 600.00 | ‘Panyangat Kuning’ | 0.454 | Moderate |
| **Storability at room temperature (day)** | BD | 3.00 | ‘Penganten’, ‘Tapai Idaman’ | 5.00 | ‘Coklat’ | 0.187 | Low |
| **Tree age (year)** | BE | 20.00 | ‘Gantang 88’, ‘Hadangan Idaman’, ‘Dodol Mascinta’, ‘Dino Banjarbaru’ | 100.00 | ‘Malutu’ | 0.624 | High |
| **Average** | | | | | | **0.324** | **Low** |


Figure 2. Morphological fruit differences among (11 of 20) superior local durian (*D. zibethinus*) varieties of South Kalimantan in Indonesia.

The UPGMA revealed that the durians were separated into seven clusters (Figure 3). In this case, the clustering or grouping is near-correspond to geographic origin. Such a study have reported by Wallace et al. (2015) in the *Echinochloa colona* population. Dwivedi et al. (2020) stated that geographic origin does not commonly correspond to the emergence of genetic diversity. It implies that samples coming from the same area are not always grouped or clustered together. In concept, however, a region can be viewed as a cluster, where all members should have a close similarity (Rey et al., 2020). In this case, durian 'Gentarbumi Uya' has very closely related to 'Taradak Uya' at a coefficient of 0.92, whereas the farthest by 'Malutu' with 'Tapai Idaman' (0.56) (see Figure 4). Following a qualitative trait, all durian have sweet flesh tastes, except for 'Gentarbumi Uya' with a high amount of fruit per cluster (Table 3). Yet, this knowledge is crucial for advancing the durian-breeding program in the future, especially in assessing the phenotypic diversity of the progeny (Acquaah, 2007).

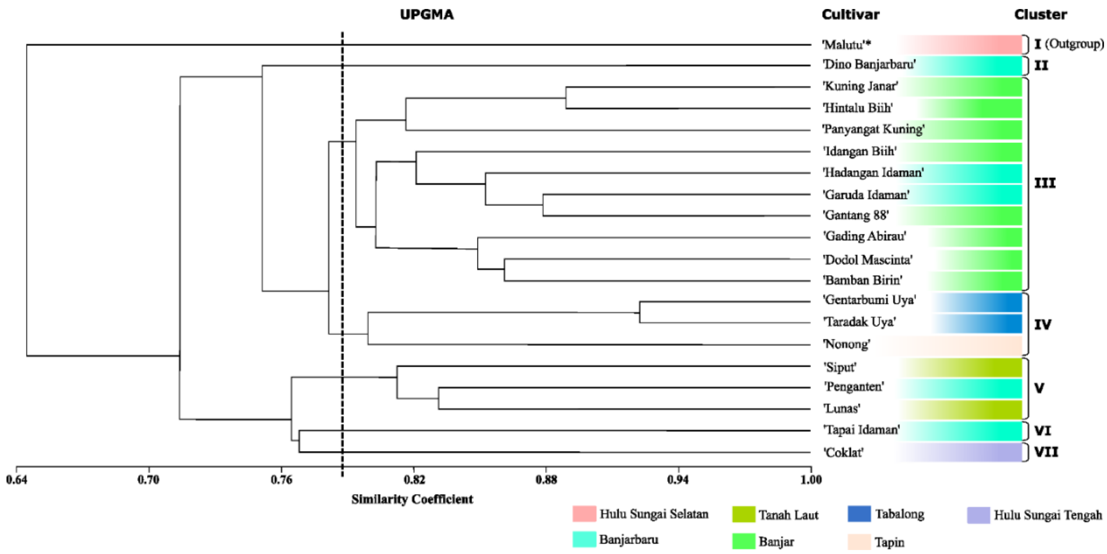


Figure 3. The phenotypic relationship of superior local durian (*D. zibethinus*) varieties revealed by morphological characters. The box color next to the cultivar's name indicates the origin of the samples (see Table 1 for details).

| OTUs (Cultivar) | | D-1 | D-2 | D-3 | D-4 | D-5 | D-6 | D-7 | D-8 | D-9 | D-10 | D-11 | D-12 | D-13 | D-14 | D-15 | D-16 | D-17 | D-18 | D-19 | D-20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 'Durian Coklat' | D-1 | 1.00 | | | | | | | | | | | | | | | | | | | |
| 'Durian Lunas' | D-2 | 0.76 | 1.00 | | | | | | | | | | | | | | | | | | |
| 'Durian Nonong' | D-3 | 0.67 | 0.76 | 1.00 | | | | | | | | | | | | | | | | | |
| 'Durian Penganten' | D-4 | 0.78 | 0.83 | 0.81 | 1.00 | | | | | | | | | | | | | | | | |
| 'Durian Siput' | D-5 | 0.75 | 0.81 | 0.72 | 0.82 | 1.00 | | | | | | | | | | | | | | | |
| 'Durian Tapai Idaman' | D-6 | 0.77 | 0.73 | 0.67 | 0.80 | 0.77 | 1.00 | | | | | | | | | | | | | | |
| 'Durian Bamban Birin' | D-7 | 0.66 | 0.71 | 0.76 | 0.69 | 0.72 | 0.72 | 1.00 | | | | | | | | | | | | | |
| 'Durian Taradak Uya' | D-8 | 0.70 | 0.74 | 0.81 | 0.74 | 0.77 | 0.69 | 0.84 | 1.00 | | | | | | | | | | | | |
| 'Durian Dodol Mascinta' | D-9 | 0.67 | 0.72 | 0.79 | 0.74 | 0.73 | 0.77 | 0.86 | 0.80 | 1.00 | | | | | | | | | | | |
| 'Durian Gading Abirau' | D-10 | 0.63 | 0.70 | 0.74 | 0.69 | 0.70 | 0.71 | 0.86 | 0.77 | 0.84 | 1.00 | | | | | | | | | | |
| 'Durian Panyangat Kuning' | D-11 | 0.73 | 0.76 | 0.75 | 0.75 | 0.74 | 0.63 | 0.79 | 0.80 | 0.77 | 0.73 | 1.00 | | | | | | | | | |
| 'Durian Gantang 88' | D-12 | 0.66 | 0.75 | 0.79 | 0.75 | 0.72 | 0.68 | 0.82 | 0.82 | 0.82 | 0.83 | 0.77 | 1.00 | | | | | | | | |
| 'Durian Garuda Idaman' | D-13 | 0.69 | 0.77 | 0.83 | 0.80 | 0.76 | 0.71 | 0.80 | 0.83 | 0.81 | 0.82 | 0.81 | 0.88 | 1.00 | | | | | | | |
| 'Durian Gentarbumi Uya' | D-14 | 0.69 | 0.69 | 0.79 | 0.72 | 0.76 | 0.69 | 0.80 | 0.92 | 0.76 | 0.73 | 0.78 | 0.79 | 0.80 | 1.00 | | | | | | |
| 'Durian Hadangan Idaman' | D-15 | 0.63 | 0.70 | 0.75 | 0.72 | 0.77 | 0.65 | 0.80 | 0.80 | 0.77 | 0.80 | 0.77 | 0.83 | 0.87 | 0.77 | 1.00 | | | | | |
| 'Durian Hintalu Biih' | D-16 | 0.66 | 0.73 | 0.78 | 0.74 | 0.75 | 0.66 | 0.82 | 0.79 | 0.83 | 0.82 | 0.82 | 0.82 | 0.83 | 0.76 | 0.81 | 1.00 | | | | |
| 'Durian Idangan Biih' | D-17 | 0.68 | 0.76 | 0.80 | 0.76 | 0.74 | 0.64 | 0.79 | 0.81 | 0.78 | 0.80 | 0.80 | 0.81 | 0.85 | 0.77 | 0.81 | 0.79 | 1.00 | | | |
| 'Durian Kuning Janar' | D-18 | 0.63 | 0.72 | 0.74 | 0.73 | 0.75 | 0.66 | 0.81 | 0.77 | 0.80 | 0.81 | 0.82 | 0.76 | 0.77 | 0.73 | 0.80 | 0.89 | 0.77 | 1.00 | | |
| 'Durian Dino Banjarbaru' | D-19 | 0.71 | 0.74 | 0.75 | 0.77 | 0.76 | 0.73 | 0.75 | 0.75 | 0.77 | 0.74 | 0.73 | 0.73 | 0.83 | 0.72 | 0.76 | 0.76 | 0.72 | 0.76 | 1.00 | |
| 'Durian Malutu' | D-20 | 0.61 | 0.64 | 0.63 | 0.60 | 0.63 | 0.56 | 0.70 | 0.69 | 0.65 | 0.62 | 0.72 | 0.63 | 0.67 | 0.68 | 0.63 | 0.68 | 0.68 | 0.66 | 0.57 | 1.00 |

Genetic Distance

Figure 4. Phenotypic distance among superior local durian (*D. zibethinus*) varieties based on morphological characters. Colors indicate a relationship: dark color = strong relationship; light color = low relationship.

## 4. Conclusion

In conclusion, although the superior local durian (*D. zibethinus*) germplasm of South Kalimantan in Indonesia has low phenotypic diversity, several morphological characteristics show high ones, e.g., crown shape, petal color, and fruit skin color. Further, the UPGMA revealed that the durians were separated into seven clusters and near-corresponding to geographic origin. In this case, 'Gentarbumi Uya' has very closely related to 'Taradak Uya,' whereas the farthest by 'Malutu' is with 'Tapai Idaman.' Thus, this information is essential in promoting the future durian-breeding program, particularly in developing new superior varieties.

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