J. Agric. Sci. Technol. (2024) Vol. 26 (4): 919-926

RESEARCH NOTES

Exploration and Characterization of Superior Locals Durian in Two Sub-Districts of Malang, East Java, Indonesia

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ABSTRACT

Durian production centers in East Java areas are quite numerous, two of which are Kasembon and Ngantang Subdistricts, Malang District. In these areas, most durian trees are propagated from seeds. This research aimed to determine the genetic diversity by exploration and characterization of superior types, using descriptive method. Determination of samples in the study using a non-probability sampling design with a purposive sampling method. The research was conducted by characterizing the qualitative and quantitative morphological characters from fruit, leaves, and trees. The characters identified are 81. Characterization of the durian types was made based on the guidebook description from Bioversity International. Quantitative data was used for descriptive statistical analysis. Qualitative data analysis was carried out using the Unweighted Pair Group Method with Arithmetic Averaging (UPGMA) method using NTSYS version 2.02 software. The results of the research showed that local superior durians from Kasembon and Ngantang Subdistrict had diverse characteristics. Diversity are in the character of fruits, leaves, and trees. The genetic distance among superior durians was 0.109–0.343. Some of durian accessions observed such as Vodca and Kunir Amad had the potential to be registered as regional assets or as local superior cultivars.

Keywords: Durian morphology, *Durio zibethinus.*

INTRODUCTION

Durian (*Durio zibethinus*) is a climacteric, seasonal tropical fruit of Southeast Asia. The ripe durian fruit owing to its unique taste and aroma is considered locally as the king of fruits (Srianta *et al*., 2012), are high in essential micro and macro nutrients, minerals and vitamins (Ho and Bhat, 2015), provide phytoestrogens, anti-inflammatory, and antioxidants (Zannah *et al*., 2022). Durian is a type of annual plant and evergreen leaves, but it has a period of flushing, which is a period of growing new leaves and, generally, occurs after the fruiting period is over (Ashari, 2017).

Durian production in Indonesia reaches 1.169 million tons annually, East Java being the largest durian producer with 289,000 tons (Kementerian Pertanian, 2019), provides additional income for the community (Matius *et al*., 2018; Prasetyo *et al*., 2018). In Indonesia, there are at least 84 varieties released by the Ministry of Agriculture, based on their morphological characteristics, and origin. The wide variety

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[DOI: 10.22034/JAST.26.4.919]

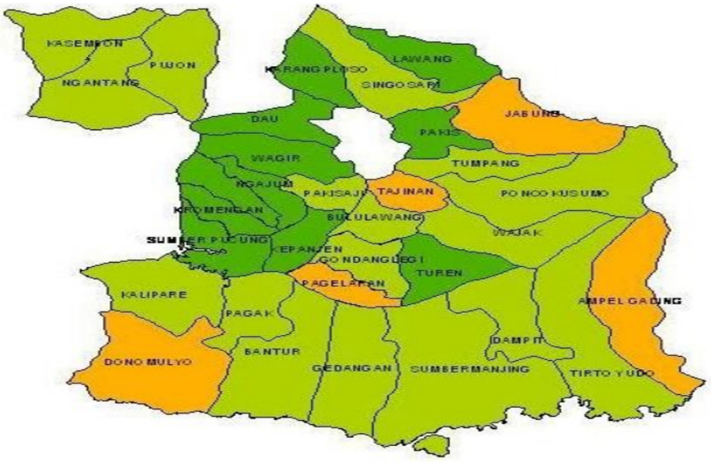

Figure 1. Research map location (Source: http//:www.malangkab.go.id).

of cultivars is an important source of germplasm as selection material for breeding durian and becoming superior local fruit cultivars from each region (Yulita and Nurnianjari, 2010). Efforts to identify superior types of durian from this region to various areas was made through inventory activities and included exploration and identification. This was an out of the field activity to collect data on types of durian in the area, genotype morphology characteristic, expected to reveal potential seed of plant to be developed in another region. It also is used as a reference to introduce all types of durian in this area to a wider scope (Yuniastuti *et al*., 2018; Yuniastuti *et al*., 2018).

Characterization and relationship among them are very important for plant breeding program (Hariyati *et al*., 2013). First select a good character edible fruit, flesh color, water content, attractive flesh aroma, soft aril texture, fair flesh creaminess, sweet and sweet with bitter after-taste flesh. These two subdistricts (Kasembon and Ngantang) are known as centers of local durians in Malang Regency, which have wide diversity of local cultivars with delicious taste and are more expensive than other types, but have not been reported yet. This research was conducted to determine the genetic diversity and characterization of local superior durians in Kasembon and Ngantang Subdistricts.

MATERIALS AND METHODS

The research was conducted in peak season from January to August 2018 in Subdistricts of Kasembon-north: 7° 47′ 02″, east: 112° 18′ 32″ and altitude of 500-721 m asl and Ngantang- north: 7° 51' 23", east: 112° 22' 09" and altitude of 199-539 m asl (Figure1).

Durian is known as an obligate cross pollinated plant (Santoso *et al*., 2016). The way to map the differences in durian plant types is by conducting exploration with farmers who own trees in their yards. Observed plant samples were determined based on the results of interviews through field surveys involving farmers, farmer groups, traders and local agricultural services as well as a durian fruit festival organized by the Government in East Java. Criteria for evaluating the superiority of each identified durian variety using the Durian Assessment Standard Guidelines (Direktorat Budidaya Tanaman Buah, 2010).

Characterization of the durian types was made based on the guidebook description from Bioversity International (Bioversity International, 2007). The characters identified were 81 characters, namely, 48

[DOI: 10.22034/JAST.26.4.919]

fruit characters, 20 leaf characters, and 13 tree characters. The characteristics identified in the organoleptic test were aril texture, aril juiciness, presence of fiber, creaminess, flesh taste flesh aroma, and flesh stickiness.

Qualitative data analysis using the Unweighted Pair Group Method with Arithmetic Averaging (UPGMA) method using NTSYS (Numerical Taxonomy and Multivariate Analysis System) software. Qualitative data of the characters are transformed into binary data and arranged in table form in Ntedit software version 1.07. After that, the data from the Ntedit result is processed with NTSYS version 2.02 software (Handayani and Rahayu, 2017). The results of processing data in this software produce a dendrogram and matrix.

RESULTS AND DISCUSSION

Genetic Variation of Local Durians

In the exploration, there were 18 durian types (Table 1) that were selected based on national durian idiotypes and consumer preference (Santoso *et al*., 2016). Most durian trees in these areas originated from seeds.

Diversity exists in three levels, namely, genetic, species, and ecosystem diversity. Morphological characteristics are based on the appearance of phenotypes, namely, fruit shape, fruit spines, fruit flesh taste, flowers, leaf colour, and other characteristics (Rivero-Guerra, 2011; Sunaryo *et al*., 2015; Sundari *et al*., 2015; Daryono and Maryanto, 2017).

Durian fruit shape is globose (7 of 18 individuals) in general (Figure 2). Characters of shape of the fruit apex are: mammiform, convex, truncate, depressed, and pointed. Shape of the fruit base are: depressed, convex, truncate, and necked. Fruit spine shapes are: convex, concave, pointed concave, and conical. Fruit spine density are: intermediate and sparse. Fruit rind colors are: yellow, yellowish green, greenish yellow, and brown. Flesh colors are: yellow, orange, and white (Figure 3). Local superior durians mostly have intermediate easiness of splitting, thin-rinded durian fruit has a longer shelf life, and has a more edible portion of fruit (Fitmawati *et al*. 2015).

Durian individuals with aborted and immature seeds have the potential to develop as superior durians without seeds and enlarge the edible portion. Durian had seed shape variations (Figure 4), with seed coat color

Table 1. Names and subdistricts of the studied superior durian.

No.	Durian name	Initials	Origin subdistrict
1.	Kendi	KD	Ngantang
2.	Kunir Amad	KA	Ngantang
3.	Vodka	VK	Ngantang
4.	Manalagi Kuning	MK	Ngantang
5.	Duri Tajam	DT	Ngantang
6.	Getuk	GT	Ngantang
7.	Ranti	RT	Ngantang
8.	Selaput Udang	SU	Ngantang
9.	Toni	TN	Ngantang
10.	Aroma Kweni	AK	Ngantang
11.	Joko	JK	Ngantang
12.	Tarum	TR	Ngantang
13.	Ketan	KT	Ngantang
14.	Gipat	GP	Ngantang
15.	Klenting Kuning	KK	Kasembon
16.	Lima Ratus	LR	Kasembon
17.	Duri In	DI	Kasembon
18.	Brojo	BJ	Kasembon

[DOI: 10.22034/JAST.26.4.919]

Figure 2. Fruit shape: (a) Globose, (b) Oblate, (c) Star, (d) Obovoid, (e) Oval, (f) Oblong, and (g) Ovoid.

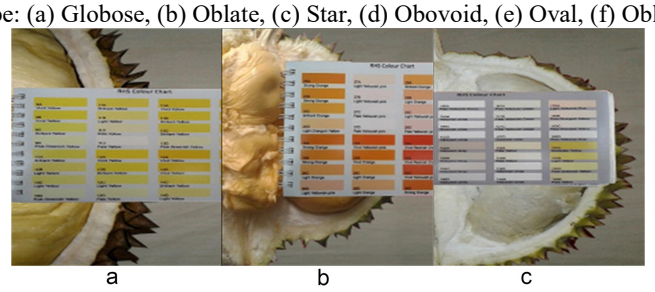

Figure 3. Flesh color: (a) Yellow, (b) Orange, and (c) White.

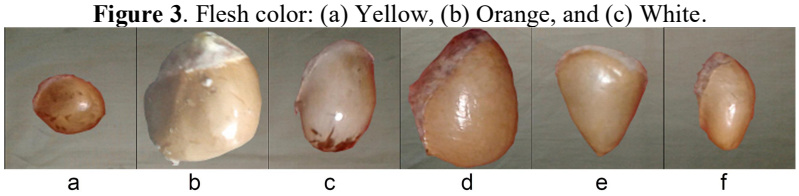

Figure 4. Seed shape: (a) Spheroid, (b) Ellipsoid, (c) Oblong, (d) Ovoid, (e) Obovoid, and (f) Irregular.

intensity light and dark.

The 18 durian types varied in leaf form, although, generally, leaf blade shape is elliptic (16 of 18 individuals). Most of the leaf attitude is drooping at 45° (17 of 18 individuals), the crown shape of the tree was 2, its growth habit variants of the durian tree were 3, (erect, intermediate, and spreading) most of the tree growth habit is intermediate (15 of 18 individuals). Durian tree age range from 11 until there are more than 100 years. Tree height range between 10-30 meters.

The organoleptic test showed that most of the local durians had moderate flesh aroma, soft aril texture, non-juicy aril, medium presence of fibre, fair flesh creaminess, slightly sticky flesh, sweet and sweet with bitter after-taste flesh with total sugar range between 34.96± 0.33 – 48.38± 0.46%. It is caused by genetic differences, environmental factors and the possibility of fruit ages at different harvest times (Hadiati *et al*., 2016), the sweetness level is influenced by the level of fruit maturity and water content (Belgis *et al*. 2016)

Propagation by seeds will produce offsprings that vary with the properties of the parent plant, because durian is a cross pollinating plant (Bumrungsri *et al*., 2009). According to Indriyani *et al*. (2012), maternal parent influence the character of fruit (length, skin thickness, number of seeds, seed weight per fruit) and percentage of aborted seeds. There are many hybrids that are suitable for selection because durian is an open pollination plant (Prihatini *et al*., 2016), this is consistent with the results of this study. Exploration results for local durians in the two sub-districts show a high level of diversity as most durians grow from seeds that are the result of crossing different combinations of parent trees. This increases the genetic diversity of durian plants, giving us the opportunity to obtain superior accession with high heterosis to use as mother trees and develop through vegetative propagation. However, the consequences of seed propagation will make the durian

[DOI: 10.22034/JAST.26.4.919]

population heterogeneous, resulting in individual inferior phenotypes that are less profitable for farmers.

Clustering of Local Durians

Cluster analysis was carried out based on qualitative data and showed that morphological similarity value of 18 durian species was 0.657–0.891 (Figure 5). Local superior durians in Kasembon and Ngantang Sub-districts based on the qualitative characters of fruit, leaves and trees, are divided into 2 Main Clusters, Ranti's accession was identified as the only individual with the lowest similarity coefficient (0.657) with the other 17 accessions, so, it split from the two main cluster that formed, as it bears little morphological resemblance to other accessions. Grouping between accessions is not always related with origin: first group consists of various accessions originating from both sub-district, Kendi and Duri In, and are the two accessions that show the highest morphological similarity (0.891). Grouping occurs because these accessions have similarities in morphological characters that can be caused by natural cross pollination of durian plants with the help of bats, birds and several species of beetles (Sritongchuay *et al*., 2016; Stewart and Dudash, 2017; Wayo *et al*., 2018). The highest similarity value was found between Kendi and Duri In durian (0.891), while the lowest similarity value was found between durian Ranti and 17 other durians (0.657), so, it has not been identified. This is in accordance with the results of the study Santoso *et al*. (2017) and Sundari *et al*. (2021) the lower the similarities and similarity value, the greater the kinship distance (difference). Based on morphological observations (leaf and tree characters), genetic distance between

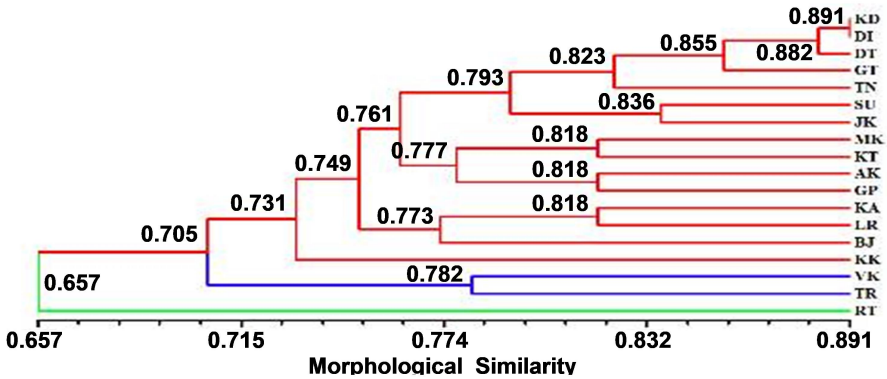

Figure 5. The dendrograms of local superior durian Kasembon and Ngantang Sub-districts.

	KD	KA	VK	MK	DT	GT	RT	SU	TN	AK	JK	TR	KT	GP	KK	LR	DI	BJ
KD	1.000																	
KA	0.745	1.000																
VK	0.673	0.655	1.000															
MK	0.727	0.782	0.673	1.000														
DT	0.873	0.800	0.745	0.800	1.000													
GT	0.873	0.745	0.691	0.691	0.836	1.000												
RT	0.636	0.673	0.600	0.655	0.691	0.655	1.000											
SU	0.818	0.691	0.636	0.782	0.782	0.782	0.618	1.000										
TN	0.800	0.800	0.636	0.764	0.818	0.800	0.709	0.782	1.000									
AK	0.800	0.709	0.636	0.745	0.764	0.745	0.655	0.818	0.818	1.000								
JK	0.800	0.673	0.673	0.673	0.745	0.764	0.618	0.836	0.800	0.764	1.000							
TR	0.782	0.764	0.782	0.745	0.818	0.782	0.636	0.709	0.764	0.727	0.691	1.000						
KT	0.727	0.745	0.691	0.818	0.727	0.709	0.691	0.745	0.818	0.800	0.727	0.764	1.000					
GP	0.745	0.800	0.618	0.782	0.764	0.709	0.673	0.745	0.818	0.818	0.709	0.691	0.782	1.000				
KK	0.764	0.727	0.636	0.764	0.745	0.709	0.618	0.745	0.691	0.727	0.673	0.673	0.764	0.764	1.000			
LR	0.745	0.818	0.636	0.727	0.782	0.764	0.709	0.727	0.818	0.800	0.727	0.782	0.727	0.764	0.691	1.000		
DI	0.891	0.764	0.709	0.764	0.891	0.855	0.655	0.836	0.873	0.836	0.818	0.764	0.782	0.836	0.764	0.782	1.000	
BJ	0.782	0.818	0.636	0.673	0.727	0.745	0.673	0.745	0.764	0.727	0.727	0.764	0.709	0.745	0.709	0.727	0.764	1.000
	KD	KA	VK	MK	DT	GT	RT	SU	TN	AK	JK	TR	KT	GP	KK	LR	DI	BJ

Figure 6. The resemblance matrix of local superior durian characters in Kasembon and Ngantang Sub-districts.

[DOI: 10.22034/JAST.26.4.919]

durians is 0.109–0.343.

Differences and similarities in the emergence of outside morphology of a plant species can be used to determine the proximity of kinship. Environmental factors also influence the expression of these characteristics, even if they are only temporary (Hafizah *et al*., 2018).

CONCLUSIONS

The results of the research showed that local superior durians from Kasembon and Ngantang had diverse characters of fruits, leaves and trees. The genetic distance between 18 durian accessions is 0.109–0.343 on the fruit, leaf and tree characters. Some of durian accessions observed, such as Vodca, and Kunir Amad, have the potential to be registered as regional assets or as local superior cultivars. This research was carried out observing agro-morphology and organo-leptics, so, the results are still influenced by the environment.

ACKNOWLEDGEMENTS

Thanks are conveyed to Brawijaya University and durian farmers in the Ngantang and Kasembon sub-districts for their permission to characterize the existing durian plants.

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کاوش و شناسایی ویژگی (میوه) دوریان (Durian) محلی برتر در دو ناحیه فرعی مالانگ، جاوه شرقی، اندونزی

س. اشعری، ا. م. بایو، ا. فیدیاواتی، و. ماکارتی ماهایو، ت. سودارینو، و س. پورنما

چکیده

مراکز تولید دوریان در نواحی جاوه شرقی بسیار زیاد است که دو مورد آنها در مناطق Kasembon و Ngantang در ناحیه Malang هستند. در این مناطق بیشتر درختان دورین از بذر تکثیر می شوند. این تحقیق با هدف تعیین تنوع ژنتیکی با کاوش و شناسایی تیپ های برتر به روش توصیفی انجام شد. تعیین نمونه ها در پژوهش با استفاده از طرح نمونه گیری غیر احتمالی با روش نمونه گیری هدفمند. این تحقیق با تعیین ویژگی‌های ریخت‌شناسی کمی و کیفی از میوه، برگ و درختان انجام شد. ۸۱ مورد ویژگی‌های شناسایی‌شد. ویژگی‌های انواع دوریان بر پایه توضیحات کتاب راهنما از Bioversity International انجام شد. برای تجزیه و تحلیل آماری توصیفی از داده های کمّی استفاده شد. تجزیه و تحلیل داده های کیفی با استفاده از روش گروه زوج وزنی با روش میانگین حسابی (UPGMA) با استفاده از نرم افزار NTSYS نسخه 2.02 انجام شد. نتایج تحقیق نشان داد که دوریان های محلی برتر از منطقه Kasembon و Ngantang بوده و دارای ویژگی های متنوعی هستند. تنوع در ویژگی میوه ها، برگ ها و درختان بود. فاصله ژنتیکی بین دوریان برتر۰.۳۴۳- ۰.۱۰۹ بود. برخی از الحاقات (accessions) دوریان مشاهده شده مانند Vodca و Kunir Amad پتانسیل ثبت شدن به عنوان دارایی های منطقه ای یا کولتیوارهای برتر محلی را داشتند.

[DOI: 10.22034/JAST.26.4.919]