

MORFOLOGYCAL IDENTIFICATION OF DUKU (*Lansium domesticum* L.) KECANDRAN FROM SALATIGA, CENTRAL JAVA, INDONESIA

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Abstract

Duku Kecandran, which is a local duku originated from Kecandran, Salatiga is a part of Salatiga's local government and public domain. To get legal possession, a certificate of ownership of a local plant is crucial. The primary requirement to get the certificate is morphological identification. The study was carried out in January to March 2021 in Kecandran. Character observed include external appearance of tree (height, growth, tree trunk, canopy, trunk texture, color, branch), leaves (shape, edge, tip, bottom and upper leaf color, type, length, width), flower (petal, stamen, pistil and flower color, position pistil against stamen, flower diameter, tip shape and shape before blooming), fruit (place appear, shape, length, width, skin and flesh color, taste, and weight), seeds and stem of fruits (length, width, shape, color), and general data. The result of the characterization revealed that the sweet and fresh flavor of the fruits is key characteristic. Duku Kecandran had Grey Yellow (162 B) flower, ovate leaf, Green (NN 37) upper leaf, Yellow orange (18 C) skin fruit, and fruit weight of 17.7 g. To get a certificate of ownership of local plant varieties, the morphological characteristics and general data have been noted and organized in the form of a standard blank.

Key words: duku, Lansium, local variety, Kecandran Salatiga

Introduction

Duku (*Lansium domesticum* L.) is one of the most favourite local fruits in Indonesia. The production of duku is high and totally absorbed by the market. In 2020, the production is about 289.598 tons (Center Beareu Statistic 2021). The high and ever-increasing demand of duku should be accompanied by an increase in production, productivity and planted area, unfortunately, production of duku fluctuates every year and tends to decrease. To increase and stabilize the production, improving cultivation methods and marketing systems, and extensification of planting areas should be developed. More over, the empowerment of location-specific duku fruit through identification of local genetic sources would be the most prospective solution to solve the problem. It has been studied that there were many local varieties originated from center of genetic resources of duku in Indonesia (Susilawati *et al.* 2016; Murni *et al.* 2018, and Yulita. 2011) which has valuable characters as tropical edible fruits. Obviously, identification of local duku is a priority as many local duku which genetically high yield and good quality decrease in amount due to land conversion, commodities conversion, and shortage of knowledge of farmer for proper cultivation methods

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Central Java is one of the producers of duku in Indonesia, with total production of 15,000 tons in 2020 (Central Java Center Beaureu Statistic. 2021). In Central Java there are several well-known local duku varieties such as Kecandran originated from Salatiga, Matesih from Karanganyar, and Kalijajar from Purbalingga. Duku Kecandran has the main characteristics of having a sweet fruit taste and high production. Duku Kecandran has developed since the late 19th century and is well adapted to the climate of Kecandran village which has low daily temperature and high humidity (Harahap *et al.* 2018). Kecandran Village has altitude of 544 m a.s.l, annual rainfall of 2,583 mm, and average temperature of $\pm 26^{\circ}$ C. Until now, Duku Kecandran still exists, develops and becomes one of the sources of farmers' income. In 2019, the production of duku, langsep, and kokosan in Salatiga reached 35.50 ton per year, even though there were sharp fluctuations in production every year (Salatiga Center Beaureu Statistic. 2020)

To empower the local genetic resources of duku Kecandran, there are several technical and non-technical constraints. Technical constraints is cultivation methods according to SOPs are not implemented, non technical constrain is this duku Kecandran has not been registered as local variety to protect from illegal trading, and marketing system call “ijon” (Firdaus, 2018; Brilliant, 2017, Irianto. 2016). Other non-technical constraint is the fall fruit will becomes public property. Fallen fruit reaches 20% of the total production (Personal interview. 2021). A certificate of ownership of a local plant varieties such as duku Kecandran is strongly required in trading local fruit commodities. There is profiteering of varietal names, well-known fruit varieties with high quality will be used to name other varieties if the supply of these varieties is running low. This happened to the duku of the Kalijajar whose name was often missused for other varieties of duku, so that the local government of Purbalingga Regency would patent the Kalijajar duku variety.

Morphological character of trees, leaves, flowers, fruits, and general data which have been noted and organized in the form of a standard blank is required to get a certificate of ownership of local varieties from the Ministry of Agriculture. Moreover the data is also as a source of data for Germplasm Management Agency to conserve local genetic resources and to create new varieties. Morphological identification is the first step work in plant breeding program (Sardianto *et.al.* 2016) along with the identification based on DNA sequencing (Hanum *et al.* 2013, Yulita *et al.* 2011). Morphological identification is carried out by observing leaves, stems, flowers, fruits, roots and so on which include plant morphology (Susantidiana *et al.*2009). For duku Kecandran, certificate of local plant varieties is very important to legalize and to promote this variety.

Materials and Methods

The study was conducted in Januari-Maret 2021 in Kecandran Village, Sidomukti District, Salatiga Regency using one main parent of cultivar of Duku Kecandran. Observations were made on various duku fruit characters, fresh leaves, flowers, and stems. Fresh leaves and fruits were examined by taking 10 samples. Description format duku plants have been arranged in the form of standard blanks (Direktorat Perbenihan Direktorat Jenderal Hortikultura. 2013). Character observed include external appearance tree (height, growth, tree trunk, canopy, trunk texture, color, branch), leaves (shape, edge, tip, leaf color, type, width, length, number of leaves/stalks, folded leaves), flower (color, stem color, flower stand, diameter, number flower/bunch, petal

color, flowering duration, number of stamens, number of pistils, crown color, stamen color, pistil color, flower stalk length, stalk panicle link shape, and flower tip shape), fruit (shape, length, width, skin color, flesh color, surface wrinkle level, aroma, and weight). Another character who observed in the fruit are seeds and stem of fruits (length, width, shape, color, cross seed), and main characteristic. Plant identification was carried out to determine Genus, Species, Local name, Indonesian name, visual tree health, method of propagation, resistant to pest, plants around, spread, owner, and address. <https://doi.org/10.1051/e3sconf/202130601003> *1st ICADAI 2021*

The plant of duku Kecandran observed has been used as mother plant or source of seeds and material for plant propagation for many years. This plant qualify to be observed due to has more than minimum five seasons production. Production stability of the annual plants mostly based on production for five seasons or more. If the production is stable, the plant is qualify to use as a parental plant. The requirement had been studied by Yuniastuti *et al.* (2018) in durian plant. The observation to determine the color was done by using the Royal Horticulture Society's color chart, while the documentation was make by using camera, paper/cloth background, eraser, and label. The data were taken for morphological character and analyzed descriptively. The data were displayed in the form of a tables and pictures.

Results and discussions

One mother tree was examined for morphometric analysis as the identification of duku diversity can be done through morphological character (Lestari,*et al.* 2011). The general data (Tabel 1) showed that plant of duku Kecandran observed was collected from the garden in rural area of Kecandran Village. This plant has been planted generatively or from seed since more than 150 years ago, and is the only plant in the same generation as the others plants were planted later. The plant observed look healthy, it was not found serius pest and disease, and grow very well (Figure 1f). The plants around is dominated by duku, banana, and cassava. The spread of duku Kecandran is still limited, only spread over Salatiga. It is suggested that Duku Kecandran need more promotion to extend the planting area. The main characteristic of duku Kecandran is the taste of fruits, which is recognized have fresh sweet taste.

Table 1. General and plant data of Duku Kecandran Salatiga

General Data	Description
Method of propagation	Generative
Number of plant collections	1 plant
Where to grow	Garden
Spread	Limited
Selected material	Fixed
Selected parent plant	Selected plant
Sample status	Wild
Other plants/plants around	Banana, Cassava

Visual tree health	Healthy
Owner	Kasiin
Address	Kecandran village, Sidomukti sub District, Salatiga District
<i>Plant data</i>	
Plant height	19.6 m
Plant orientation	Upright
Stem Circumference	310 cm
Header shape	Blunt Pyramid
Header Width	17.7 m WE, 18 m NS
Lateral Branch	Facing Up
Location of the lowest branch	3.1 m
Branch Angle	Sharp
Bark Texture	Coarse
Bark Color	Greyed orange Group (175C)
Resistance to pest and diseases	Less resistance to fruit fly and shedding

The plant data was taken from single mother plant showed in Tabel 1. The plant height is almost 20 m, and the plant orientation is upright. In general, duku plants have a height of 15-20 m depending on the variety (Mayanti, 2009), and has a branching type monopodial which is characterized by a main stem with branches clearly visible. The direction of the growth of the stem is perpendicular and the direction of the growth of the branch is inclined upwards (Oktora, 2015). The Stem Circumference is 310 cm, measured from more than 1 m from land surface. Header shape is blunt pyramide with lateral branch is facing up. This type of canopy has beneficial effect for fruit development. The upright plant orientation promote the sun shine come into canopy and reduce air humidity. It is suitable for fruit development since the fruit of duku located closed to the main stem/branch not in tip of branch. The duku Kecandran has sharp branch angle, and the lowest branch is located on 3.1 m from land surface as the plant is more than 150 years old. Mostly the younger plants have shorter lower branch and plant height. The morphology of bark, texture and colour considered as genetical characteristic of duku. The bark also has medical function. The extract gel of stem bark of duku contain flavonoid, saponin, alkaloid, and triterpenoid effectively against healing of wistar strain rats's ulcers (Miranda, 2020).

Another important morphological characteristic are character of leaves and flowers. Identification through leaf morphology and anatomy is widely used method to distinguish and measure relationship between species and cultivars in the genus of *Lansium* (Anjasasmara *et al.* 2021, Susilawati *et al.* 2017). The leaves and flowers character of Duku Kecandran is presented in Table 2. The duku Kecandran has ovate leaf shape, flat edge, and short tip which is the optimal form for photosynthesis gas exchange (Solomon and Berg (2008). The type of leaves are long round with medium curvature, the leaves are not folded, and the mother arched bones leaf/stalks is straight (Figure 1a). The size of leaves is 21.15 cm x 9.15 cm, leaf stalk length is 0.91 cm. The color of bottom and upper leaves is not the same, the upper leaf surface has darker color than the bottom one (Figure 1b).

Table 2. Leaves and flowers character of Duku Kecandran Salatiga.

Group determination	Description
<i>Leaves</i>	
Shape	Ovate
Edge	Flat
Tip	Short
Bottom color	Green (143 C)
Upper color	Green (NN 37)
Type	Long round
Corvature	Medium
Width	9.15 cm
Length	21.15 cm
Folded leaves	Not fold
Mothers's arched Bones Leaf /stalks	Straight
Leaf Stalk Length	0.91 cm
	.
<i>Flowers</i>	
Flower color	Grey Yellow Group (162 B)
Stem color	No stem
Flower stand	Stick on the stem
Flower diameter	0,46 cm
Petal color	Yellow Green Group (154 A)
Stamen color	Yellow Group (8A)
Pistil color	Yellow Group (4 C)
The position of the pistil against the stamen	Pistil higher than stamens
Flower shape before blooming	Round
Flower tip shape	Round

The flower of duku is stick on the main stem or branch, arranged in sequence in one stem and has small size and round tip (Picture 1e). Overall the duku flower has yellow color but in different grade. The corolla has grey yellow (group 162 B color), thick and stable. While the petal has Yellow Green Group (154 A) color, the stamen and the pistil has Yellow Group (8A), and Yellow Group (4C).

Table 3. Fruits and seeds character of Duku Kecandran Salatiga.

Group determination	Description
<i>Fruits</i>	
Place of Fruit Appear	Stem
Outer Fruit Skin Color	18 C (Yellow Orange Group)
Inner Fruit Skin Color	158 B (Yellow White Group)
Fruit Flesh Color	N 155 C (White Group)
Fruit tip	Round
Fruit base shape	Round
Fruit taste	Fresh sweet
Basin on the fruit stem	None
Peddicle shape/Fruit stalk	Cone

Fruit shape	Globose
Fruit Surface Wrinkle Rate	None/smooth
Fruit Length	3.91 cm
Fruit width	3.43 cm
Seed shape	Oval
Seed Cross Section	Oval
Seed flesh color	N 155 B (White Group)
Seed epidermis color	144 C (Strong Yellow Green/Yellow Green Group)
Fruit weight	17.7 g (medium)
Main character	Sweet taste and fresh of fruit

Fruit character such as fruit size and fruit skin color are important characters in identifying cultivars in the genus of *Lansium*. Paull (2014) used fruit characters to distinguish between duku and Langsat. While Hanum *et al* (2013) and Yee *et al* (1993) in Hanum *et al* (2013) also successfully identified duku, langsat, kokosan using fruit, leaf, and flower characters. Therefore fruit character of duku Kecandran also had been measured, including fruit shape, fruit size, fruit skin color, and seeds (Table 3). The fruits of duku Kecandran appear in the stem with globose fruit shape, round fruit tip and round fruit base (Figure 1 c). The fruit color is attractive with outer fruit skin color is yellow orange (18C), and inner fruit color is yellow white (158 B)(Figure 1d). The fruit size and fruit weight of duku Kecandran is categorized as medium compared to other varieties. The fruit taste is sweet and fresh and becoming main character of duku Kecandran.



(a)



(b)



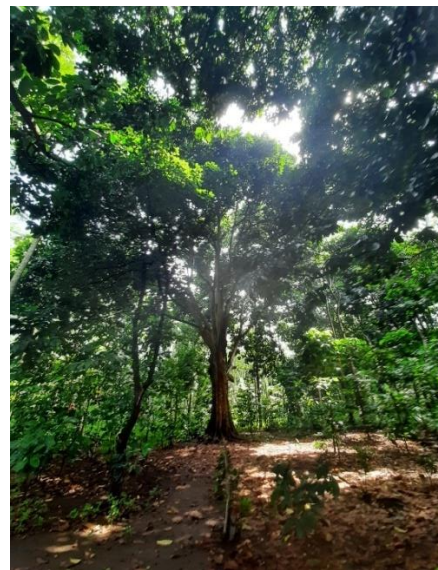
(c)



(d)



(e)



(f)

Figure 1. Leaf (1a, 1b), fruit (1c, 1d), flower (1e), plant (1f) of duku Kecandran

Conclusion

This research concludes that duku Kecandran grows in Salatiga Regency have unique and distinctive as duku local variety, such as sweet and fresh taste, grey yellow (162 B) flower, ovate leaf, Green (NN 37) upper leaf, yellow orange (18C) skin fruit, and fruit weight of 17.7 g. The morphological character of trees, leaves, flowers, fruits, and general data have been noted and organized in the form of standard blank to get a certificate of local varieties in order to increase the economic value.

Thank-you note

To the Central Java AIAT extension team, Diperta Salatiga regency, farmers/plant owners

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