Morphology characteristic of some local durian from Kulon Progo Daerah Istimewa Yogyakarta

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Abstract. Kulon Progo is one of the regencies in Daerah Istimewa Yogyakarta which has diverse of plant genetic resources, one is durian (Durio zibethinus). Exploration and characterization of durian genetic resources have been carried out. Durian diversity can be determined by characterization and it is also an effort to complete information in registering process of local varieties. Registration and releasing varieties are an effort that must be made to provide legal protection for the status of variety ownership. Characterization was done using descriptor for durian. The aim of this research was to determine some of Kulon Progo local durian diversity based on their morphology characteristic and then analysed it to determine similarity among cultivars by cluster analysis. Method research was exploration. The results showed that there were six local durian from Kulon Progo: Menoreh Kuning, Menoreh Jambon, Promasan, Banjar, Kendil and Cempli. Based on morphological characteristic, there were three groups of Kulon Progo local durian, namely group I consisting of Banjar, Kendil, Cempli and Menoreh Jambon, group II (Promasan) and group III (Menoreh Kuning).

1. Introduction
Durian (Durio zibethinus) is one of Indonesian genetic resources of tropical fruit plants. This tropical fruit known as "the king of fruit" is quite popular because it has a distinctive taste and aroma that is most people favoured. Durian usually grow wild in forests and only a small proportion of durian have been domesticated in yards, both in lowland areas (<1,000 m asl) also in the highlands (> 1,000 m asl). [1-2].

[3] stated that durian distribution in Indonesia can be found in Kalimantan, Sumatra, Sulawesi, Maluku, Java, Bali and its surroundings. [3] Its about 18 species (species) of 20 types of durian, identified to be in Kalimantan. D.carinatus Mast, D.graveolens Becc., D.griffithii (Mast.) Bakh., D.lowianus Scort. ex King, D.malaccensis Planch. and Mast., D.Oxleyanus Griff., and D.zibethinus Murray, are being identified in Kalimantan, as well as identified to be found and well adapted in Sumatra, Sulawesi, Maluku and Java.

Java [3] is one of Durio zibethinus Murray distribution areas. One area in Java which has have genetic resources potential of durian Durio zibethinus Murray is Daerah Istimewa Yogyakarta (D.I.Yogyakarta), especially Kulon Progo Regency. Kulon Progo’s durian production reached about 48,391 quintals or contributed 77.24% of Yogyakarta's durian supply in 2019 [4]. Kalibawang become one of 12 districts in Kulon Progo which is able to provide the largest durian contribution in Kulon Progo [5].
Kalibawang is located in the northern part of Kulon Progo, which has a 52.96 km² area and part of it is Menoreh hills. Kalibawang area is divided into 4.35% in 26 - <100 meters above sea level, 93.5% of the widest area in 100 - <500 m meters above sea level, and the rest or 2.16% area is in 500 - 1,000 m above sea level. Total Kalibawang rainfall reaches 1,754 mm with 108 rainy days [5]. Durian itself is cross-pollinating, so it will have varied genetic characteristics. Interaction between genetic and environmental can affect plant diversity appearance.

The distinguishing factors and similarities in plant appearance can be identified quickly and easily through morphology characteristic identification. In addition, morphology characteristics can be used to determine the relationship between durian cultivars. The more similarities in the morphology characteristic, the closer relationship is and vice versa [6].

This aim of this research was to determine durians diversity and relationships from Kulon Progo based on their morphology characteristic.

2. Methods
The research was carried in Kalibawang, Kulon Progo Regency, Daerah Istimewa Yogyakarta. Genetic material were durians: Menoreh Kuning, Menoreh Jambon, Promasan, Banjar, Kendil and Cempli. The equipment includes digital cameras, scales, measuring instruments, stationery, scissors, colour charts (RHS / Royal Horticulture Society) and 18% grey cloth. The research method is exploration by tracing primary and secondary data from key persons and literature studies [7]. The exploration location range was 200-350 m above sea level. Primary data is obtained through direct observation at the exploration area. Secondary data is obtained from institutions related to the condition of the exploration area. Observations were made on mature, healthy, more than 10 years old tree age, regularly fruiting and having identifiable plant to determine morphology characteristic. Identification of morphology characteristic is carried out referring to the durian guidelines descriptions issued by the international bioversity agency [8]. Identification of morphology characteristic was carried out on each durian cultivar, including tree age, tree height, trunk circumference, trunk colour, trunk growth habit, leaf upper and lower surface colour, leaf blade shape, leaf apex shape, leaf blade length and width, flesh colour, flesh texture, flesh taste, flesh stickiness, flesh aroma, fruit shape and fruit spine shape. The data obtained with descriptive analysed, while to determine relationship between durian cultivars, the analysis was carried out using qualitative and quantitative morphology characteristic data which were converted into binary data by scoring data based on criteria that had been set on each variable. The morphology binary data analysed using the Unweighted Pair Group Method with Arithmetic Means (UPGMA) using the SAS 9.4 software program.

3. Results and discussion
Kulon Progo local durian exploration was carried out in its original habitat, namely Kalibawang. Kalibawang was chosen because this is the largest contributing area which supplies local durian to Kulon Progo [5].

Kalibawang durian exploration was carried out in Banjaroyo where it produces durian the most. Exploration identified several local durians, as presented in Table 1. These durians cultivar have more than 10 years of tree age, cultivated by local ancestors and never been rejuvenated.
Table 1. Local durian characterized from Kalibawang district, Kulon Progo regency.

| No | Name of accession | Origin/Location |
|----|-----------------|----------------|
| 1  | Menoreh Kuning   | Potronalan, Banjaroyo, Kulon Progo, Yogyakarta |
| 2  | Menoreh Jambon  | Slanden, Banjaroyo, Kalibawang, Kulon Progo, Yogyakarta |
| 3  | Promasan         | Promasan, Banjaroyo, Kalibawang, Kulon Progo, Yogyakarta |
| 4  | Banjar           | Pantog Kulon, Banjaroyo, Kalibawang Kulon Progo, Yogyakarta |
| 5  | Kendil           | Semawung, Banjaroyo Kulon Progo, Yogyakarta |
| 6  | Cempli           | Potronalan RT 27, RW 13 Banjaroyo, Kalibawang, Kulon Progo, Yogyakarta |

Morphology characteristic are used to identify the structure and shape of plants [9], besides that, through morphology characteristic it can be used to determine relationships between plant types [10]. The quantitative results showed different variations (Table 2). The oldest tree age character of Banjaroyo local durian is Menoreh Kuning and the youngest tree age is Menoreh Jambon. The highest tree height character of local durian is Cempli and the shortest is Menoreh Jambon. Generally, durian can live up to more than 200 years with a tree height up to 50 meters [11]. Descriptive analysis showed that standard deviation of tree age, tree height and trunk circumference are 39.62 years, 7.07 meters and 67.97 cm, respectively.

Leaf blade length reaches 20.50 cm (Menoreh Kuning and Promasan), while the shortest leaf blade length is Kendil (15.5 cm). Leaf blade width is 7.50 cm (Kendil) and the smallest is 6.60 cm (Menoreh Jambon), with standard deviation are 2.48 cm (leaf blade length) and 0.34 cm (leaf blade width), respectively. Leaf length and width blade ratio of six local durian cultivars is 2.64 cm.

Table 2. Morphology characteristic of Kalibawang local durian based on quantitative data.

| No | Name of Durian Accession | Tree age (Year) | Tree Height (m) | Trunk circumference (cm) | leaf blade length (cm) | leaf blade width (cm) | Length & width leaf ratio |
|----|--------------------------|----------------|----------------|--------------------------|------------------------|------------------------|--------------------------|
| 1  | Menoreh Kuning           | 156            | 30             | 353.25                   | 20.50                  | 6.80                   | 3.01                     |
| 2  | Menoreh Jambon           | 46             | 20             | 150                      | 18.55                  | 6.60                   | 2.81                     |
| 3  | Promasan                 | 100            | 25             | -                        | 20.50                  | 6.82                   | 3.01                     |
| 4  | Banjar                   | 70             | 25             | 284                      | -                      | -                      | -                        |
| 5  | Kendil                   | 60             | 39             | 150                      | 15.5                   | 7.5                    | 2.07                     |
| 6  | Cempli                   | 70             | 35             | 271                      | 15.6                   | 6.8                    | 2.29                     |

Identification of durian morphology characteristic based on qualitative variables is divided into trunk, leaf and fruit character (Table 3). In trunk characters, there are trunk colour variation. [11] stated that durian trunk has reddish brown colour plank roots ('banir') and bark (pepagan), irregular peel off, elongate and stretch. Durian trunk growth habit particularly has the same character; round and straight. Leaf blade shape has the same elliptic character. Leaf upper surface colour ranges from green to dark green. Leaf lower surface colour has colour variations, from light brown, brown, golden brown to dark brown. Six local durian cultivars showed round to cuneate leaf base shape character. Leaf apex shape shows character variation from acute to acuminate.

Six Kulon Progo local durian have morphology diversity from fruit shape, flesh colour, flesh aroma also flesh texture (Table 3). Fruit shapes include oblong, elliptic, obovoid and oval characters. Identified Kulon Progo local durian have conical and pointed-convex fruits spine shape. Flesh colour character is very diverse from white bone, pale yellow, yellow, bright yellow (butter) to reddish yellow. Flesh aroma has a weak aroma (odorless), mild, moderate and strong (pungent). Aroma is
one of durian characteristics which can attract durian consumers [12-13]. Flesh textures consists of smooth, soft, presence and absence of membrane, and presence and absence of fibre.

Durian flesh character become one of consumers preferences. For consumers or durian's lover, sweet flesh is a must. The sweetest durian to bitter sweet tendency is a sign that it has a high alcohol and sugar content. Identification of local durian morphology, in addition to know durian cultivar biophysical character, it can also be used as a reference for breeders to select durian cultivars to be developed in breeding and selecting superior cultivars [12].

Table 3. Morphology characteristic of Kalibawang durian based on observations of qualitative data.

| Qualitative character | Name of durian accession |
|-----------------------|--------------------------|
|                       | Banjar | Kendil | Cempli | Menoreh Jambon | Menoreh Kuning | Promasan |
| Trunk colour          | Brownish orange | Light brown | Reddish brown | Light brown | Light brown | Reddish brown |
| Trunk growth habit    | Round & straight | Straight | Straight | Round | Cylindrical | Straight |
| Leaf blade shape      | Elliptic | Elliptic | Elliptic | Elliptic | Elliptic | Elliptic |
| leaf upper surface colour | Green | Green | Dark green | Dark green | Dark green | Green |
| Leaf lower surface colour | Yellowish brown | Brown | Light brown | Golden brown | Golden brown | Dark brown |
| Leaf base shape       | Round | Oblong | Round | Round | Round | Round |
| Leaf apex shape       | Acute | Middle acute | Acute | Acuminate | Acuminate | Acuminate |
| Fruit shape           | Oblong | Elliptic | Ellipsoid | Oval | Oval | Oblong |
| Fruit spine shape     | Pointed-convex | Pointed convex | Pointed convex | Conical | Conical | Other: small pointed |
| Flesh colour          | 8 B light | pale yellow | 4D | pale yellow | reddish yellow | bright yellow | white bone |
| Flesh creaminess      | fair | strong | strong | intermediate | fair | fair |
| Flesh texture; presence of fibre | medium | low | low | medium | medium | low |
| Flesh aroma           | strong | strong | very strong (pungent) | strong | sweet & pungent | odourless (mild) |
| Fruit resistance when falling | not easily broken | not easily broken | not easily broken | hard | hard | easily broken |
| Flesh taste           | bitter sweet | sweet | sweet with bitter after taste | sweet | sweet | Bitter sweet |

Morphology characteristic can be used to determine the relationship between local durian cultivar. Dendrogram analysis based on Kulon Progo local durian morphology characteristic is presented in Figure 1. There are three major groups of clusters dendogram. Cluster 1, there are 4 accessions (Banjar, Kendil, Cempli and Menoreh Jambon), whereas other consist only one accession, is Promasan.
in Cluster II and Menoreh Kuning in Cluster III. This indicates that there are variations between durian accessions, which can be due to genetic factors or environmental conditions.

Grouping similarity based on morphology characteristic, it can be seen that cultivars that are in one group (cluster) will have the same or nearly the same morphology characteristic traits or have close similarity so that they can provide information in the selection of crossing parents representing the group.

Name of Observation or Cluster

![Dendrogram grouping of durian morphology characteristic by using the SAS 9.4 software program.](image)

**Figure 1.** Dendrogram grouping of durian morphology characteristic by using the SAS 9.4 software program.

In order to provide legal law for local cultivars as an identity for regional ownership and to avoid biopiracy, Kulon Progo has registered its six local varieties at the ICPVPAL (Indonesian Center for Plant Variety Protection and Agriculture Licensing) Ministry of Agriculture. Currently two cultivars Menoreh Kuning [14] and Menoreh Jambon [15] have been released as local superior varieties from Kulon Progo based on Indonesia Minister of Agriculture Decree in 2007. Four other cultivars have been registered as Kulon Progo durian cultivars (Table 4).

| Name of durian accession       | Register number          |
|--------------------------------|--------------------------|
| Menoreh Kuning*                | 316/Kpts/SR.120/5/2007   |
| Menoreh Jambon*                | 317/Kpts/SR.120/5/2007   |
| Promasan                       | 347/PVL/2017             |
| Banjar Abu                     | 1453/PVL/2020            |
| Kendil                         | 1454/PVL/2020            |
| Cempli Salimin                 | 1455/PVL/2020            |

**Table 4.** Registration of durian cultivars into ICPVPAL.

Note: Subscription * = those accession has been released as local superiority variety by the Indonesian Ministry of Agriculture
4. Conclusion
Six of Kulon Progo local durian have a variety of morphology characteristic. Dendrogram analyses based on morphology characteristic are in 3 clusters of kinship, cluster 1 consisting of durian Banjar, Kendil, Cempli and Menoreh Jambon. Cluster 2 Promasan and cluster 3 are Menoreh Kuning.

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