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# THE IDENTIFICATION OF MANGO MORPHOLOGY AND ANATOMY (*MANGIFERAINDICA* L) AT WEST TOBOLI AND POMBALOWO VILLAGE, PARIGI MOUTONG.

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## ABSTRACT

Mango (Mangiferaindica L.) is a type of tropical fruit which is favored by people in the world and becomes a commodity trade between countries. According to the information, known as mango The Best Loved-Tropical, accompany the popularity of durian as the King of Fruit. The main product of the mango is its thatis usuallyconsumed in fresh or processed products. But in addition to the fruit,,other components that also played an important role were the mangoes leaves than can be benefit from medicinal plants as an alternative. This research aimed to obtain a diversity of mango tree based on morphological and anatomical analysis of plant the mango in the West Toboli village and Pombalowo Regency, Parigi Moutong Regency. This research was carried out in the village of West Toboli, District Toboli Parigi North and the village of Pombalowo sub-district of Parigi, Parigiranga Reddy District and Laboratory Science (FMIPA), the University of Tadulako conducted in July to August 2016. This research method using exploratory, as for a character that observed was the height of the plant (m), diameter (cm), the shape of the canopy, the long strands of leaves (cm) width (cm) leaf blade, petiole length (cm). Cluster analysis results in the village there were three groups of Western Toboli diverse namely TBB12, TBB14 and TBB11, in the village of Pombalowo there were three diverse groups namely PBL1, PBL5 and PBL8. Whereas in the second the village obtained a combined five diverse groups namely TBB12, TBB14, TBB2, PBL1 and TBB11. Characters that distinguished the selected accessions were the height of plants, and the diameter of the rod.

**Keywords**: Anatomy, Cluster, Mango, Morphology.

## INTRODUCTION

Mango *(Mangifera indica* L.*)* is a kind of tropical fruit that is favored by people in the world and become a commodity trade between countries. Mango fruit commodity has good prospect if developed intensively and in agribusiness scale. From year to year demand for tropical fruits in the country and abroad increasingly, both in the form of fresh and processed (Rukmana, 1997).

The number of mango production in Indonesia in 2013 was 1,796,396 tons (BPS Jakarta, 2014), in Central Sulawesi Province in 2014 was 174,726 tons (Central Sulawesi BPS, 2015). Parigi Moutong Regency in 2012 reached 40,293 tons (BPS of Parigi Moutong Regency, 2013), Donggala Regency reached 196,875 tons (BPS of Donggala Regency, 2015), while Sigi Regency regency 46,935 tons. Based on the amount of mango fruit production, in Parimo Regency showed the average production is still low. This is due to the cultivation is still cultivated on a scale with simple technology and not cultivated on a large scale for example in the form of plantations, another problem is the occurrence of fruit loss at each stage of the fruit development (Prahasta, 2009).

The main product of mango plant is the fruit that is usually consumed in the form of fresh or various processed products.

But besides the fruit, other components that also play an important role is the mango leaves that can be utilized as an alternative medicinal plant.

Mango has diversity, it can be morphologically studied on leaves, flowers, and fruits that have shape, size and color vary. The fruit has a thick meat, taste and a distinctive aroma.

Naming the type of mangoes is still ambiguous because it is not yet accurately identified, for example, Arumanis mango and Gadung mango, there are called the types.

An apple mango is one name but it was found in different shapes and colors, so it is necessary to conduct accurate research based on overall morphological properties.

To study the diversity of a plant can be performed by direct analysis of the nature or character of plant morphology, the weakness of this marker is based on the nature of phenotypes and influenced by environmental factors.

Parigi Regency, especially in North Parigi Sub District, West Toboli Village and Parigi Sub-district, Pombalowo Village, have good potential to support the productivity of local mango fruit of Central Sulawesi. Local mango in Sulawesi is known by the name of Dodor mango, this mango was used as research sample because it has various advantages besides having big trees and long life (up to tens) year, mango dodor plant stems can also be utilized in the field of carpentry industry.

Based on these advantages then, Dodor mango plant research becomes important, in order to obtain the diversity of trees that later can be used for genetic analysis and obtain the main tree. To support this goal, the mango tree must have morphological and anatomical characteristics that are diverse and true (true to type).

The obtained main tree based on morphological, anatomical and genetic analysis is expected to be a producer of seed, superior mango of Central Sulawesi in the future.

## RESEARCH METHODS

This research was conducted in West Toboli Village, North Parigi Sub-district and Pombalowo Village, Parigi Sub-district, Parigi Moutong Regency and Biotechnology Science Laboratory (FMIPA), Tadulako University and this research was conducted from July to August 2016.

The tools used in this research were meter roll, light microscope type Carton Software V micro USB, digital camera, cool box, GPS type Montana 650, SYSTAT Standard Version 8.0 and stationery. The ingredients used were mango plants, paper labels, alcohol, tissues, distilled water, and plastic samples.

This research used direct survey method to the location of research sample. The determination of the location was purposively selected, with consideration that the area has a more dominant mango plant population than any other area in Parigi Regency.

Determination of this location was based on information from the Department of Agriculture, community and direct survey results that have been done in West Toboli Village Parigi North Subdistrict and Pombalowo Village Parigi Subdistrict Parigi Moutong Regency.

The next activity was to establish 30 accessions of mango plants from two villages that visually reveal different morphological characters with tree age ranges over 15 years. Each village was selected 15 random mango trees. The use of tree labels based on the initials of the name of the village where the sample is located then sorted from 1-15 of each village such as West Toboli (TBB) and Pombalowo (PBL).

Mango plants that were sampled that were mango plants which already produce and visually have health level from medium to healthy. To obtain the data it was conducted the interview with the owner of mango plants whose trees were used as a sample. Sample plants (accession) were

then taken the leaves, then put in a plastic sample and gave the label then inserted into the cool box that contains pieces of ice cubes and closed tightly.

Furthermore, anatomical analysis was conducted in the Biotechnology Laboratory of the Faculty of Mathematics and Natural Sciences of Tadulako University. Prior to observation, first, prepare the preparations to be observed, the samples taken were cleaned by using 70% alcohol, make a thin incline as thin as possible on the lower leaf surface, the incision was placed on the glass object, gave 1-2 drops aquades then cover with cover glass, then observe by using a microscope.

The anatomical characters observed include stomata index, stomata density ($mm^2$), stomata size (length and width $\mu m^2$), number of stomata ($\mu m^2$) and epidermis cell size (length and width $\mu m^2$).

Stomata calculation formula(Lestari, 2006) :

$$\text{Stomata Density} = \frac{\text{The Number of Stomata}}{\text{Wide View Area (mm2)}}$$

$$\text{Stomata Index} = \frac{\text{The number of Stomata}}{\text{The number of stomata} + \text{The number of epidermis}}$$

**Dendogram Analysis.** This step is intended to assess the similarity between mango collections with dendogram analysis methods. Morphological data and leaf anatomy, fruit morphology, derived from a number of mango cultivars were transformed into binary data in matrix form. From the matrix and binary data was then calculated the matrix of similarity between the numbers of mango collection observed.

To conclude the kinship between the observed types, all the data collected were analyzed by calculating the Euclidic distance that was linked by closest relation to the computer by using the SYSTAT 8.0 software.

## RESULTS AND DISCUSSION

### Results

Based on the morphological and anatomical observations of 15 mango samples for each village on a certain euclidic distance, in West Toboli Village (TBB) the result of cluster analysis at a distance of 0.670, two accessions which had morphological and anatomical kinship (having similar properties) were TBB15 and TBB1. At a distance of 0.670, there were three related accessions namely TBB1, TBB3 and TBB15. At a distance of 0.695, there were related accessions namely TBB5, TBB3, TBB13, TBB6, and TBB8 and at a distance of 0.719, there were three related accessions namely TBB5, TBB10 and TBB9. At a distance of 0.743, accessions of TBB5, TBB4, TBB7 and TBB8 had similarities, and at a distance of 0.766, accessions that were related namely TBB5, TBB2, TBB4, TBB1, TBB15, TBB3, TBB13, TBB10, TBB9, TBB7, TBB8, and TBB6, so that from selected accessions may be represented by two accessions: TBB5 and TBB2.

At a distance of 0.788, there were thirteen accessions which had kinship that were represented by TBB5 and TBB11, at a distance of 0.871 there were fourteen accessions: TBB14, TBB5, TBB2, TBB4, TBB1, TBB15, TBB3, TBB13, TBB10, TBB9, TBB7 , TBB8, TBB6, and TBB11. As well as at a distance of 0.983, all accessions formed a specific group and selected accession based on the morphology and anatomy of mango leaves in West Toboli Village (TBB) that were accessions of TBB12, TBB14, and TBB11 which located at a distance of 0.788.

Cluster analysis based on analysis of dodor mango morphology and anatomy in Pambalowo Village (PBL) at the distance of 0.415, there were two accessions that had the similarity of morphological and anatomical nature of PBL7 and PBL4, at the distance of 0.455, accessions of PBL12 and PBL7 showed the kinship. At a distance of 0.491, there were several related accessions: PBL12, PBL3, PBL11, PBL7, and PBL4.

To know the morphological and anatomical diversity of mango plants in West Toboli and Pombalowo villages, then observational data of morphology and anatomy of mango was merged.

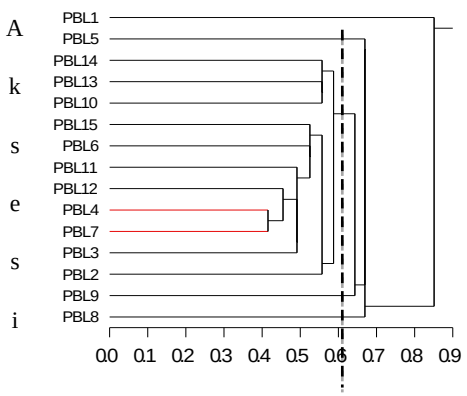



Figure 1. Dendogram analysis of mango clusters in West Toboli village based on morphological identification and leaf anatomy.

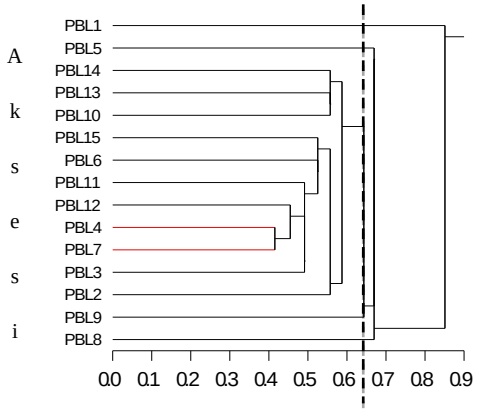



Figure 2. Dendogram analysis of mango clusters in Pombalowo Village based on morphological identification and leaf anatomy.

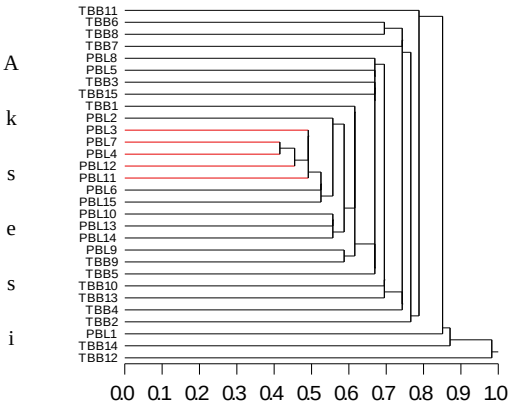
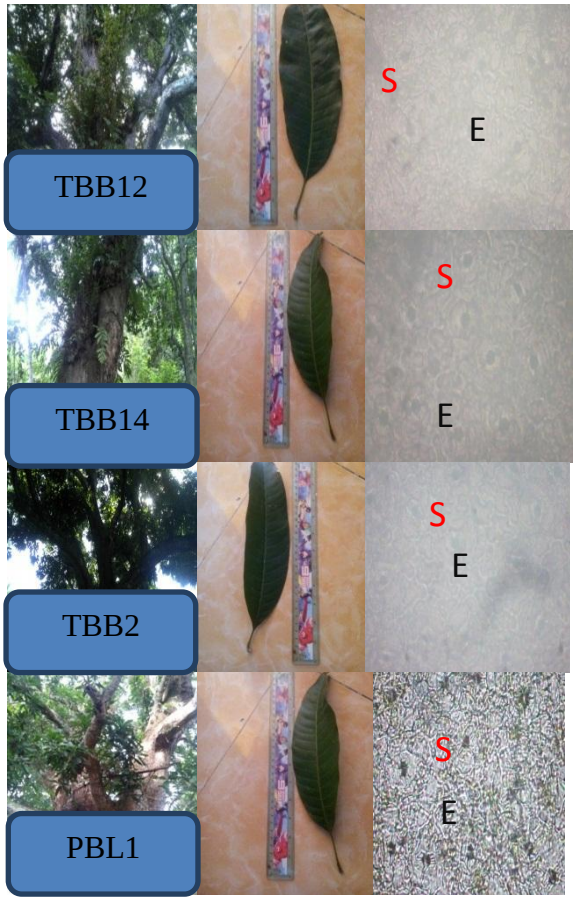



Figure 3. Dendogram analysis of mango clusters in West Toboli Village and Pombalowo Village based on morphological identification and leaf anatomy.

At a distance of 0.415 to 0.557, the accession of a dodor mango which had kinship was still in one village. At a distance of 0.415, there were two accessions which had similarities that were PBL7 and PBL4, at a distance of 0.455 there were three accessions that had similarities that were PBL12, PBL7 and PBL4 and then at a distance of 0.491 there were several accessions that had similarities that were PBL12, PBL3, PBL11, PBL4, and PBL7, at a distance of 0.525, there were seven accessions that were related namely PBL15, PBL6, PBL11, PBL2, PBL10, PBL13, and PBL14, at a distance of 0.557, there was formed some accessions that were related ie PBL15, PBL6, PBL11, PBL12, PBL4, PBL7, PBL3, PBL2, PBL10, PBL13, PBL14, PBL9, and TBB9.

However, at a distance of 0.788, there was the most specific accession based on the morphological and anatomical mix of mango leaves between West Toboli Village and Pombalowo that were TBB12, TBB14, PBL1, TBB2, and TBB11.




Description : (E) Epidermis, (S) Stomata, Magnification 100x

Figure 4. Form of canopy, morphology and anatomy of mango leaves in West Toboli Village and Pombalowo Village

## Discussion

Based on the results of cluster analysis obtained from each village on analysis of mango plant morphology and anatomy, it showed that the existence of external influences of the growing environment affected morphological and anatomical differences of mango plant. This can be seen from the differences formed on the similarity of traits or characters possessed by each accession, from thirty samples of mango plants, only four accessions of selected mango plants were analyzed which represented West Toboli Village and Pombalowo namely TBB12, TBB14, PBL1 and TBB11.

Results of West Toboli Village dendrogram, there were three diverse groups of TBB12, TBB14, and TBB11. Morphological distinguishing characters were plant age, plant height, stem diameter, leaf length, leaf width and length of petiole.

Based on morphological characteristics, in terms of the length of the accession leaves TBB11 was longer and wider than the other accessions of 22.4 cm and 6.47 cm, whereas the length and width of the narrowest leaves was TBB14 of 19 cm and 5.35 cm (Table 1) and each grow at an altitude of 217 m asl and 214 m above sea level. This difference is due to environmental factors.

The highest number of stomata was in TBB14 that was 189 with stomatal density of 66.78, while the least was TBB12 with stomata number of 159 and stomata density of 56.18 (Table 1).

Table 1. Distinctive Features Of Morphology And Anatomy Of Mango Leaf Plants On Accessions Of TBB12, TBB14, PBL1, TBB2, And TBB11 In West Toboli Village And Pombalowo Village.

| No | Main Characteristic Features | Number of Sample | | | | |
|---|---|---|---|---|---|---|
| | | **TBB12** | **TBB14** | **PBL1** | **TBB2** | **TBB11** |
| 1 | Plant height (m) | 80.9 m | 60.4 m | 90.19 m | 85 m | 23 m |
| 2 | Stem diameter (cm) | 260 cm | 255 cm | 300 cm | 185 cm | 75 cm |
| 3 | Canopy form | SM | PB | PB | SM | SM |
| 4 | Stem color | CKP | CKP | CKK | CKK | CKP |
| 5 | Leaf Length (cm) | 19.2 cm | 19 cm | 20.3 cm | 24.6 cm | 22.4 cm |
| 6 | Leaf Width (cm) | 5.6 cm | 5.35cm | 6.3 cm | 6.17 cm | 6.47cm |
| 7 | Petiole Length (cm) | 3.15 cm | 2.5 cm | 3.2 cm | 3.85 cm | 3.35 cm |
| 8 | Stomata size (µm) | | | | | |
| | a. Length | 18.33 | 20.67 | 19.33 | 18.67 | 18 |
| | b. Width | 19.67 | 23.67 | 23.33 | 21.33 | 22 |
| 9 | Jumlah Stomata | 159 | 189 | 144 | 180 | 182 |
| 10 | Epidermal Size (µm) | | | | | |
| | a. Length | 16 | 21.33 | 14.67 | 13.67 | 23.67 |
| | b. Width | 11 | 11 | 7.67 | 9 | 14 |
| 11 | Stomata Index | 0.36 | 0.41 | 0.34 | 0.38 | 0.42 |
| 12 | Stomata density ($mm^2$) | 56.18 | 66.78 | 50.88 | 63.60 | 64.31 |

Description : SM (semi-circular), PB (round pyramidal), CKP (whitish chocolate), CKK (yellowish brown).

Analysis of dodor mango dendrogram in Pombalowo Village, there were four diverse groups. The first group was represented by PBL1, group two was represented by PBL5, third group was represented by PBL9 and fourth group was represented by PBL8.

Morphological distinguishing characteristics were plant height, canopy diameter, stem color, leaf length, leaf width and petiole length, based on the morphological characters, it can be concluded that PBL8 accession had the longest leaves of 31.65 cm, while the accession which had the smallest leaf length was accession of PBL1 with a leaf length of 20.3 cm.

Environmental factors affect the physiological growth of plants, but it will also affect the various functions of plants such as mineral and water element absorbers (Harjadi, 1996). The highest stomatal density was PBL8 of 58.30 $mm^2$ while the smallest was PBL1 with stomatal density of 50.88 $mm^2$.

The results of the merger of West Toboli Village and Pombalowo Village at a distance of 0.788 was formed five diverse groups, which group one was represented by TBB12, the second group was represented by TBB14, group III was represented by PBL1, the fourth group was represented by TBB2 and group five was represented by TBB11.

According to Hendrawan (2004), environment is one important factor in the growth of plants, therefore the color difference of stems on the four accessions are influenced by environmental factors.

Through anatomical character, it can be ascertained that the largest number of stomata was TBB14 which was 189 and accession which had the least amount of stomata was PBL1 that was 144. According to Fahn (1991), the amount of stomata will decrease with the decrease of light intensity.

Based on the measurement result of Global Positioning System (GPS), the location of TBB14 accession is at 214 m altitude and accession of PBL1 is at 60 m asl and this accession is lower than TBB14. Fahn (1991) suggested that the amount of stomata will decrease by the decreasing intensity of light. It is assumed that the light intensity of PBL1 accession was less than the light intensity at TBB14 accession so that it influenced the amount of stomata.

Morphological characteristics of mango plants based on the samples used for cluster analysis in West Toboli and Pombalowo villages looked different but there were also some of the same characters, such as at altitude, in terms of plant height variation, leaf size (length and width) and color of stem. Most of the mango plants in both villages had a Semi-circular canopy (SM), round Pyramidal (PB), with a diameter of less than 6 to more than 12 meters.

Results of research from West Toboli Village and Pombalowo that some accession number which had variation of leaf color, difference of color and shape of leaf are allegedly caused by existence of external influence in the form of environment where the mango plant grow.

Leaf size is the ratio between the length and width of mango leaves and leaf size is also very varied. For the leaf size of West Toboli Village and Pombalowo there was variation of size such as leaf length for accession of TBB12 had 19.2 cm leaf length, TBB14 of 19 cm, PBL1 of 20.3 cm, TBB2 of 24.6 cm and TBB11 of 22.4 cm. while the width of the leaf on TBB12 was 5.6 cm, TBB14 of 5.35 cm, PBL1 of 6.3 cm, TBB2 of 3.85 cm and TBB11 of 6.74 cm.

Plants with many kinds and varieties that have leaves with different strands too, both about the shape, size, and color, it is not easy to find two types of plants that the leaves are exactly the same shape and color (Tjitrosoepomo, 2009).

Anatomical observation results showed stomatal density at four selected accessions, highest stomatal density was found in accession of TBB14 with stomatal density

of 66,78 $mm^2$ while stomatal density with the smallest size was PBL1 with stomatal density of 50,88 $mm^2$. Thus, the results of TBB12, TBB11, TBB2 and PBL1 accessions studies had low stomatal density so that both accessions can be resistant to dry environmental conditions.

## CONCLUSION AND SUGGESTION

### Conclusion

Based on the identification of mango morphology and anatomy in West Toboli Village and Pombalowo Village, it can be concluded as follows:

1. There were morphological and anatomical mango accessions in West Toboli Village namely TBB12, TBB14, and TBB11, selected accessions in Pombalowo Village were PBL1, PBL5, PBL9, and PBL8. Selected specific mango accessions from the combined two villages were TBB12, TBB14, PBL1, TBB2 and TBB11. The characters that distinguish the chosen accession were the height of the plant and the diameter of the stem. The not selected accessions of PBL5, PBL9, and PBL8 to the West Toboli Village and Pombalowo villages merge is because in the two villages the accessions still had kinship.
2. There was a diversity of mango anatomy in West Toboli and Pombalowo villages, the largest number of stomata and stomatal density of the two villages combined was on TBB14 with stomata number of 189 and stomatal density of 66.78, while the lowest number of stomata obtained was on PBL1 with number of stomata of 144 and stomatal density of 50.88.

### Suggestion

It is desirable to conduct further research on selected accessions by using DNA analysis in order to obtain more accurate results in relation to the diversity of main mango trees.

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