



## Analysis of the Relation of Mango Plants in Jember Using The Taximetry Method

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**Abstrak: Analisis Hubungan Kekerbatan Tanaman Mangga Di Jember Dengan Metode Taksimetri.** Analisis hubungan kekerabatan tanaman mangga dilakukan dengan metode taksimetri dengan menggunakan instrumen penelitian berupa tabel karakteristik yang nantinya akan dikode secara biner. Data yang digunakan berupa data kualitatif yang kemudian diubah menjadi data kuantitatif. Penelitian ini dilakukan di 5 Kecamatan di kabupaten Jember yaitu kecamatan Ambulu, Tempurejo, Panti, Tanggul dan Sumbersari pada bulan November 2020. Penelitian ini bertujuan untuk mendapatkan nilai jarak kekerabatan antar tanaman mangga yang diamati. Berdasarkan dari hasil analisis yang telah diperoleh, diketahui bahwa pasangan yang memiliki hubungan kekerabatan paling dekat adalah mangga apel dan mangga endog dengan nilai indeks similaritas 0,898. Sedangkan untuk pasangan yang memiliki hubungan kekerabatan paling jauh adalah mangga gadung dan mangga apel dengan nilai indeks similaritas 0,610.

**Kata kunci:** mangga, taksimetri, indeks similaritas

**Abstract: Analysis of the Relation of Mango Plants in Jember Using the Taximetry Method.** The analysis of the relation of mango plants was carried out by the taxymetric method using a research instrument in the form of a characteristic table which would later be coded binary. The data used is in the form of qualitative data which is then converted into quantitative data. This research was conducted in 5 sub-districts in Jember district, namely Ambulu, Tempurejo, Panti, Tanggul and Sumbersari sub-districts in November 2020.. This study aims to obtain the value of the distance between the observed mango plants. Based on the results of the analysis that has been obtained, it is known that the pair that has the closest kinship relationship is the apple mango and the endog mango with a similarity index value of 0.898. Meanwhile, the pair that has the most distant kinship relationship is the gadung mango and the apple mango with a similarity index value of 0.610.

**Keywords:** mango, taximetry, similarity index

## INTRODUCTION

Mango plants are an important commodity for tropical communities, especially Indonesia after bananas (Kencanaputra, 2014). Along with the development of the times and the increasing demand for mangoes, farmers need to increase productivity and crop quality. To obtain higher quality mangoes, knowledge and understanding of the diversity of mango species is required. Fitmawati (2013), stated that the mango plant has great potential for further cultivation because it has a high level of genetic diversity so that the mango germplasm needs to be preserved. Variations in the shape, color and size of mangoes show high genetic diversity (Putu, 2017).

Research in observing the diversity and morphological characters of mangoes aims to make an inventory of how many local mangoes were found so that the relationship between these mangoes can be analyzed. The closeness of this kinship relationship can determine the success of plant breeding. This research will be conducted in Jember district, East Java.

Jember Regency itself has an area of 3,293.34 km<sup>2</sup>. Based on Jember Regency BPS data (2020), the mango production produced by Jember Regency in 2018 was 26,821.9 tons. However, there was a slight decrease in production in 2019 with a total production of 20,818.6 tons. From the number of harvests, Jember district can be said to have a large number of mango trees. Mango plants that grow and spread in Jember Regency are generally not cultivated on a large plantation. But only planted in the yard of the house and has a variety of types.

Along with the development of the community, the types of local mango plants that are not usually marketed have begun to decrease. This can later cause genetic erosion which can inhibit plant breeding activities. In this regard, according to Situmorang (2015), the first step to support a plant breeding program is to characterize and analyze plant diversity and relationships.

According to Sumiasri (2008), the threat of genetic erosion can be caused by several things, including the decline in the mango population due to the rapid development of the area into cities and dense settlements, imported cultivars are sold at lower prices, and most people only plant mangoes that have high economic value. such as Manalagi and Gadung mangoes. This also happens in Jember district, most of the people only plant high-yielding mango trees, while other varieties such as Endog, Kuweni or Podang mangoes are rare. Krismawati (2013) stated, to anticipate the erosion of the germplasm gene of mango species, it is necessary to carry out genetic material conservation activities through exploration, characterization and documentation activities.

Through genetic material conservation activities, it is hoped that more complete and supportive mango description data will be obtained in Jember. Therefore, it is necessary to conduct a study on the diversity and kinship of mangoes in an area for further mango cultivation. By knowing how the relationship between mango species is, it is hoped that it can help mango farmers or other researchers to find superior mango varieties.

The analysis of the mango kinship was carried out by the taximetry method. Taximetry is a taxonomic method in which classifications are made based on a multivariate analysis of the differences and similarities between taxonomic groups (Zhigila, 2015). In taximetry, the similarity or difference data obtained is in the form of qualitative data from the *Operational Taxonomy Unit (OTU)*. The data is then converted into quantitative data by encoding each character in binary.

The binary data from the OTU characters will later be analyzed to get the value of the kinship distance between the research objects. In this study, the qualitative data used were the morphological characteristics of mango plants with the selected OTU being the types of mangoes found in Jember district. The binary data from the OTU characters will later be analyzed to get the value of the kinship distance between the research objects. In this study, the qualitative data used were the morphological characteristics of mango plants with the selected OTU being the types of mangoes found in Jember district.

The use of morphological characteristics as a benchmark is considered sufficient and easier to observe. In addition, because the morphological character is one of the benchmarks for identification. According to Ribeiro (2013), morphological characters when associated with genetic diversity can help farmers or researchers in selecting prospective plants to be crossed for further development of the population. While Bhamini (2018), states that the evaluation of morphological and agronomic characters can provide relevant information regarding crop yields and quality characteristics as well as other information such as descriptions of available variations.

## METHOD

The type of research conducted is descriptive quantitative research. Mango plant data taken from Jember district. The population of this study were all types of mango plants found in Jember district from 5 sub-districts namely Panti, Ambulu, Silo, Tanggul and Summersari. The research sample was every mango plant found in that location. The samples taken were only mango plants which were found complete with morphological parts such as trees, leaves, flowers, and fruit. The characteristics of these parts are then observed based on the table that has been made. There are 47 morphological characters used as parameters.

The mango plants obtained were then observed based on the table. Then the qualitative data obtained is converted into quantitative data in a binary manner. The quantitative data will be processed and analyzed to obtain similarity index data and group analysis in the form of a dendogram. The similarity index was calculated using the *Simple Matching Coefficient* with the help of SPSS version 22. This analysis was carried out based on 47 predetermined morphological characters. *The Simple Matching Coefficient* was introduced to numerical taxonomy by Sokal & Michener with the formula for the number of equal characters divided by the total number of all characters. The formula is as follows:

$$S_{ij} = \frac{a + d}{p}$$

Description:

$S_{ij}$  = resemblance

$a$  = the same number of characters 1

$d$  = the same number of 0 characters

$p$  = total number of all characters (Source: Dunn, 2004).

## RESULT

**Mango Plants in Jember.** The distribution of mango cultivars found in Jember district appears to be even in each sub-district. The details can be seen in the Table 1.

Table 1. Distribution of mango in Jember

No.	Districts	Mango type
1	Embankment	Gadung, Manalagi, Golek, Endog, Apple
2	House	Gadung, Manalagi, Golek, Endog, Apple
3	Sumbersari	Gadung, Manalagi, Golek, Endog, Apple
4	Ambulu	Gadung, Manalagi, Golek, Endog, Apple
5	Tempurejo	Gadung, Manalagi, Golek, Endog, Apple

The mango plants found can be seen in Figure 1.

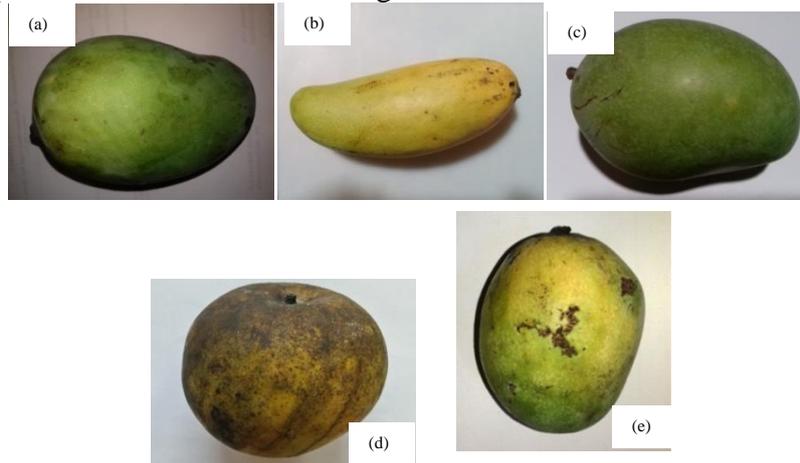


Figure 1. Mango (a) Gadung (b) Golek (c) Manalagi (d) Apple (e) endog.

The kinship or proximity of mango plants found is indicated by similarity index and dendogram. The similarity index is used to find out how big the kinship value of each OTU is based on the level of similarity of the observed characteristics or traits. According to Pakpahan (2013), morphological characters are one of the easiest and fastest ways to see plant diversity. The results of the similarity index analysis can be seen in the table below.

Table 2. The mango similarity index in Jember

	Simple matching Measure				
	1:Gadung	2:Golek	3:Apel	4:Manalagi	5:Endog
1:Gadung	1,000				
2:Golek	, 729	1,000			
3:Apel	, 610	, 678	1,000		
4:Manalagi	, 831	, 729	, 712	1,000	
5:Endog	, 678	, 712	, 898	, 780	1,000

The value of the similarity index indicates the distance between the OTUs being compared. The greater the value, it indicates that the kinship between the OTUs is getting closer. Vice versa, the smaller the value, the more distant the kinship between the OTUs. Based on the resulting dendogram, it can be seen that the mangoes found were divided into two main groups. The first group consisted of apple mango and manalagi mango. While the second group consisted of gadung mango, manalagi mango and golek mango.

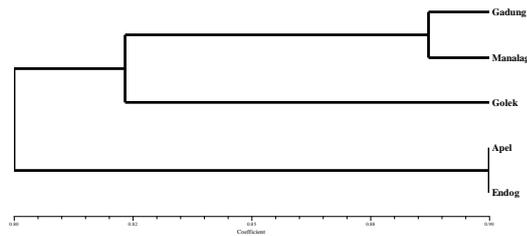


Figure 2. Mango kinship dendrogram in Jember

## DISCUSSION

Mango plants, especially *Mangifera indica* L. is a type of seasonal fruit that is commonly marketed and very easy to find in Jember. According to Nilasaari (2013), mango plants in Indonesia originally came from India which then spread throughout Southeast Asia including Indonesia. Based on the data that has been obtained, there are 5 kinds of mango (*Mangifera indica* L.) found in Jember, namely Gadung mango, Golek mango, Manalagi mango, Apple mango and Endog mango. These five types of mangoes were found in all research locations in 5 sub-districts.

From the observations that have been made, there are morphological characters of mango from each cultivar which have many similarities. This was because the five mango cultivars observed were from the same species, namely *Mangifera indica* L.. The characters seen in all cultivars were the color of the upper and lower leaf surfaces. The color of the upper surface of the leaves on all cultivars is dark green, while on the lower surface of the leaves the color is lighter, namely light green. According to Tjitrosoepomo (2011), the color of the upper and lower leaves is generally different, usually the upper side looks greener and shiny than the lower side of the leaf. The color difference is due to the green pigment found on the upper side of the leaf.

The closest mango kinship relationship was apple mango and endog mango with a value of 0.898. Almost all plant parts of the apple mango and endog characters have similarities. Starting from the semi-circular crown shape, reddish pink discharge, roundish or rounded fruit shape and the same young leaf color, which is reddish brown.

Meanwhile, the mango pair which has the second largest similarity index is the gadung mango and the manalagi mango with a similarity index of 0.831. The most striking resemblance of the two mangoes is seen in the lanceolate leaf shape with an acute leaf tip shape, and the color of the fruit, which when ripe is mostly green. In the inflorescence, the gadung mango and manalagi mango have similarities with the green color.

The third pair of mangoes has a similarity index of 0.780 which is owned by the manalagi mango and the endog mango. There are some similarities in the morphological characters of the two mangoes, the most obvious of which is in the tree crown and tree growth. Where the canopy of manalagi mango and endog mango both have a semi-circular shape with spreading tree growth. But for the shape of the fruit both have differences. Manalagi mango has an elliptic fruit shape while endog mango has a roundish fruit shape.

The next pair with a similarity index of 0.729 belonged to two pairs of mangoes. The first pair is mango gadung and mango golek, then the second pair is mango golek and mango manalagi. Mango golek has several similarities and differences that are almost balanced with mango gadung and mango manalagi. The most striking difference can be seen in the fruit which has a very different shape so it is easy to distinguish. The golek

mango is oblong or elongated, while the gadung mango is obovoid and the manalagi mango has an elliptical shape.

The next pair of mangoes had a similarity index of 0.712 for the two pairs of OTUs. The pair are mango golek and mango endog, as well as apple mango and manalagi mango. When viewed from the shape of the fruit, each pair has a different fruit shape. In the first pair, the golek mango has an oblong shape while the endog mango has a roundish shape. While in the second pair, Manalagi mango has an elliptic fruit shape while apple mango has a roundish fruit shape. For the next pair of mangoes, a similarity index of 0.678 also occurred in the two pairs of OTUs. The pair are mango gadung and mango endog, as well as apple mango and golek mango. Based on observations, the two pairs of mangoes also have a striking difference in the shape of the fruit. In the first pair, the gadung mango has an obovoid fruit shape while the endog mango has a roundish fruit shape. While in the second pair, the mango golek has an oblong fruit shape.

While the furthest kinship relationship is mango gadung and mango apple with a value of 0.610. Judging from the tree alone, the two mangoes already look different. Mango gadung has a pyramid-shaped tree crown, which is slightly pointed at the top. While the apple mango has a semi-circular tree crown. The shape of the fruit, the leaves and flower parts of the two mangoes are also different.

## CONCLUSION

Based on the results of the analysis of five types of mango (*Mangifera indica* L.) found in Jember district, it is known that the pair of mangoes with the highest similarity index value is owned by apple mango and endog mango. Meanwhile, the pair of mangoes with the smallest similarity index value was owned by the apple mango and the gadung mango. The greater the value of the similarity index, the closer the kinship distance. When viewed from the resulting dendrogram, it can be seen that the five types of mangoes found were divided into two main groups. The first group consisted of apple mango and endog mango, while the second group consisted of gadung mango, manalagi mango and golek mango.

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