

MORPHOLOGICAL DIVERSITY IN FOURTEEN CULTIVARS TIRON VILLAGE, KEDIRI, INDONESIA

Fuad NUR AZIS* and dan Kuntoro BOGA ANDRI

Jl. Raya Karangploso KM.4 Malang 65152, Jawa Timur Indonesia

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Tiron village, Kediri is one of central mangoes in Indonesia. Many cultivar of mangoes encountered at this location. This study aims to look at the diversity of mango cultivars in the Tiron Village, Kediri, Indonesia. Mangoes diversity is based on qualitative and quantitative character of each cultivar. The diversity among cultivar indicated by the standard deviation and variance in the eleven quantitative characters of mango. Mango cultivars categorized by phylogeny morphological characters. The method used for phylogeny analysis is an UPGMA method (unweighted pair group method with arithmetic mean). Phylogenetic analysis is based by the qualitative character of the plant. The results showed there were fourteen cultivars of mango in the village of Tiron Kediri have high diversity. Fourteen mango cultivars were categorized four groups. Based on a qualitative character, there are four classes of mango. The first group is the Katul, Podang Urang, and Podang Lumut. The second group is the Gadung, Jaran, Madu, Endog, Pakel, Dodonilo, Ireng, Lanang and Cantek. Santok Kapur into groups to form groups of three and Kopyor fourth. The high diversity in the village mango Tiron Kediri potential for resource in situ germplasm.

Key words: Manggo, Phylogenetic analysis, UPGMA

INTRODUCTION

Mango (*Mangifera* sp) is a fruit crop potential to be developed in Indonesia. Mango plants have a very broad genetic diversity. This is because the position of Indonesia, located on the equator (WHITMORE, 1980). There are approximately 40 different types of mango are scattered throughout the world (GRUEZO, 1991). This is an opportunity for the development of mango cultivars in Indonesia (TEST, 2007).

Corresponding author: Fuad Nur Azis, BPTP Jawa Timur Jl. Raya Karangploso KM.4 Malang 65152, Jawa Timur Indonesia. Phone 0341 494052, 485055 Fax 0341-471255. email: fn_azis@litbang.pertanian.go.id or fn_azis@yahoo.com.

The high potential of the diversity of mango in Indonesia still can not offset by developing new cultivars. Mango plant breeding process has been difficult because of the nature of the complex panikula and the flowers as well as the low percentage of hibridization (NILASARI *et al.*, 2003). One improvement mango cultivars in Indonesia is to gather local cultivars are grown. East Java is the right location in the development of mango cultivars in Indonesia. This is supported by the collection of mango cultivars in Cukurgondang Research Field in Pasuruan. Kediri is one of center of mango in Indonesia. Kediri District has the highest mango production after Pasuruan in East Java (PERTANIAN, 2014). Almost all mango cultivars in Kediri characterization has been done, but the action has resulted in the shifting cultivation by morphological characters of the mangoes are cultivated in Kediri. Shifting the characters need to be kept in the review back because of the nature of cross-pollination of mango high causing mango cultivars with the same name but different quality and appearance.

Phlogenic analysis can determine the extent of mango cultivars differ from the parent. Phylogenic based morphological trait is one simple phlogenic method that has long been known (SINGH, 1969). Phlogenic methods through morphological markers have advantages easy to do and do not need to use special tools and skills. This study aims to look hungan phylogenic fourteen cultivars are widely known in Kediri. Phylogenic information obtained can be a picture of the character of the existing differences in these cultivars. Dendrogram is one of the tools for the analysis of phylogenic. Coefficient of association such as the coefficient of diversity, similarity coefficient, and the dissimilarity coefficient used in determining the closeness between genotypes (SOKAL and SNEATH, 1963). This study aims to determine the diversity of fourteen mango cultivars growing in the village of Tiron Kediri.

MATERIALS AND METHODS

Research done through existing mango exploration in the village of East Java, Tiron village, Kediri, Indonesia(6048'47 S, 1070 36'52 E). Fourteen cultivars of mango exploration results in morphological characteristics by IPGRI (2006) and FITMAWATI (2009). The observed morphological characters were divided into two groups: quantitative and qualitative characters. Quantitative characters were observed among other fruit weight (g), fruit length (cm) thick pieces (cm), thick rind (mm), thick flesh (cm), the percentage of edible fruit (%), grain weight (g), seed length (cm), thick seed (cm), TTS ($^{\circ}$ Brix), total acid (%), Ratio TTS / total acid, and vitamin C (mg/100 g). Quantitative character used include leaf shape, leaf edge shape, the basic form of leaves, leaf tip shape, fruit shape, fruit tip shape, the color of the fruit base, blush color on the fruit, seed chambers in the fruit, meat texture, fiber in the flesh, aroma, total acid content and TTS (total soluble solids). The diversity among cultivars indicated by the standard deviation and variance in the mango fifteen quantitative character. Character variant greater than two times the standard deviation has a broad diversity (STEEL and TORRIE, 1960). Cluster analysis and dendrogram is based similarity coefficient hamming distribution with agglomerative method UPGMA (unweighted pair group method with arithmetic mean) of the qualitative character of the plant. Analysis using the procedure in the package phangorn Cran R (SCHLIEP, 2011; PARADIS *et al.*, 2004).

RESULTS AND DISCUSSION

Quantitative analysis of the diversity of eleven characters in fourteen cultivars showed that almost all the characters mangoes in the village Tiron Kediri has a broad diversity. Some

characters such as fruit flesh diameter (cm), thick flesh (cm), seed width (cm) and thick seed (cm) has a narrow diversity. Broad diversity in fourteen cultivars in the village of Tiron suggest the potential for breeding does mango in this village. Mango plant is an annual plant with a high degree of cross-breeding.

Table 1. The diversity of quantitative characters mango.

	Average	STD	2 × STD	Variants	Diversity
Physical Character Fruit:					
- The weight of fruit (g)	240.98	123.67	247.34	15294.27	W
- Length of fruit (cm)	10.69	3.62	7:23	13:07	W
- Fruit diameter (cm)	6:37	1:27	2:54	1.61	N
- Thickness of fruit (cm)	5:31	1.78	3:56	5:31	N
- Rind thickness (mm)	0.72	0:55	1:11	0:31	N
- Thick flesh (cm)	1.74	0:43	0.86	0:19	N
- The percentage of edible fruit (%)	69.29	6.79	13:57	46.04	W
Chemical Characters Fruit:					
- TTS (° Brix)	13.64	3:15	6:31	9.94	W
- Total acid (%)	3.70	4:01	8:02	16:09	W
- Ratio TTS / total acid	6:02	3.76	7:53	14:17	W
- Vitamin C (mg / 100g)	21:50	6	12	36.02	W

Description: W: wide diversity N: narrow diversity

Cross-pollination that occurs in the area of the village of Tiron potential to generate superior mango cultivars and species new if no planting of seeds (FITMAWATI *et al.*, 2009). Percent edible fruit, fruit weight, and length of the seed characters in mango mango breeding target in the physical character of fruit (HUMAN and RHEEDER, 2004; LOPEZ *et al.*, 2010).

Physical character of fruit

Fruit character that has a high diversity in fourteen mango cultivars studied only in fruit weight and fruit length. Length of mango is important trait for post harvest mango. Length of mango determinate how to packing mango for market distribution. SPREER and MÜLLER (2011) suggested that the length of mangoes has a close relationship with a maximum diameter of the fruit and fruit thickness. The closeness is very important for fruit trees in conducting post-harvest packaging. Figure 1 shows the general length of diverse fruit followed by fruit diameter and length of the fruit even though the two characters terseut have narrow diversity. Cultivars distance into one cultivar that deviate from the relationship between the length of the fruit with the diameter and thickness. Cultivars distance is long fruit cultivars that have the longest among fourteen other cultivars. The diameter and thickness of fruit cultivars relative distance equal to the other cultivars. This can be a special consideration for cultivars distance in terms of post-harvest packaging that has a long fruit character but the diameter and thickness of the fruit is relatively the same as the other pieces.

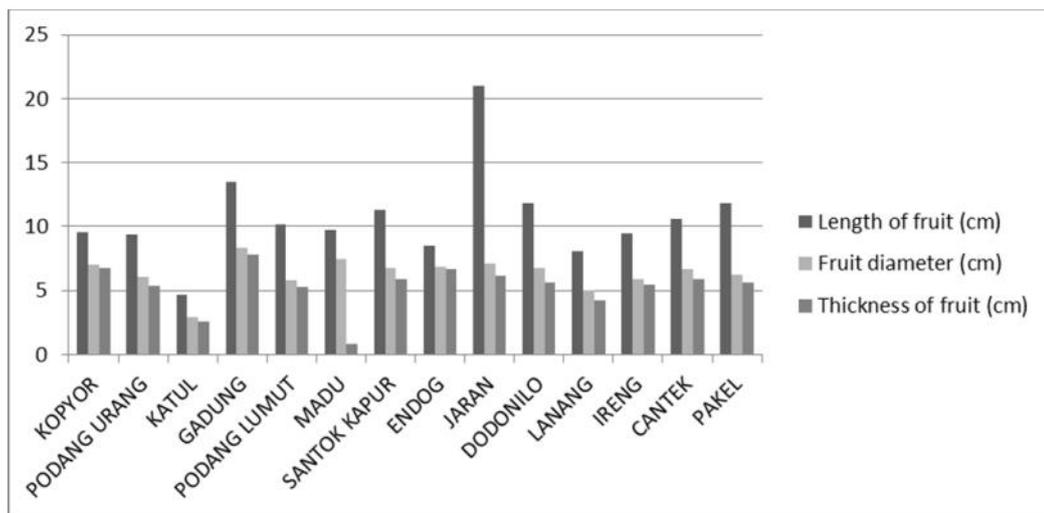


Figure 1. The length, diameter, and thickness of the fourteen pieces of mango cultivars in the village of Tiron, Kediri

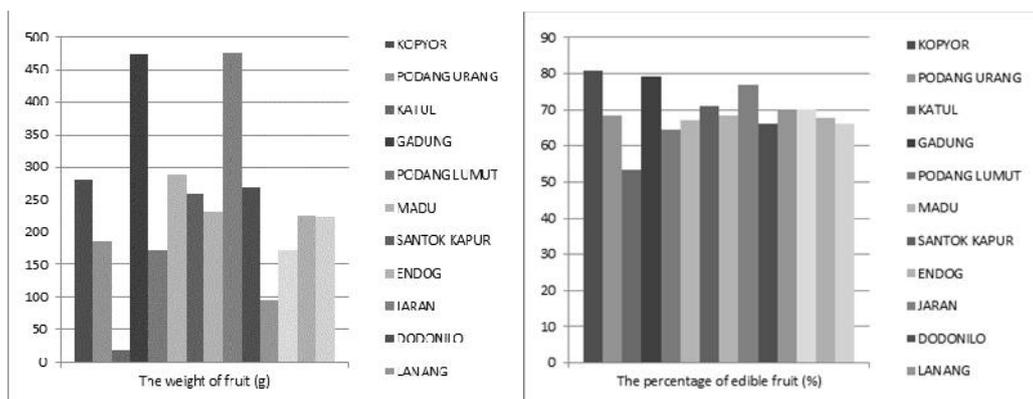


Figure 2. Weight of fruit (a) and the percentage of edible fruit (b) in fourteen cultivars of mango in the village of Tiron, Kediri

Mango fruit characters such as weight and percentage of fruit that can be eaten are the two main characters on which to base public preferences on a cultivar. Figure 2 shows that the fruit weight and percentage of edible fruit equally diverse. Mango cultivars gadung have best performance. This is evident with fruit weight and percentage of fruit that can be eaten are high. this is what causes the mango yam into one mango seed in the district of Kediri especially Tiron Village. This mango is very rapid development so that it becomes one of the cultivars that dominate in the village Tiron, Kediri (ANDREW *et al.*, 2013)

Chemical Characters Fruit

Chemical character of fruit greatly affect the quality and taste of the fruit. This is related to the use of fruit. Fruits with high TTS values can be potentially as fruit fresh food. Fruit with a low level of TTS can be potentially as preserves. The content of the TTS does not determine the quality and taste of mango. Other chemical constituents such as total acid also determines the taste of fruits.

Mango cultivars TTS Katul contains the highest among the other cultivars but this cultivar acid content is much higher than other types of mango (Figure 3). It makes mango Katul has a wry sense of higher than others. This cultivar has the potential to be processed into refined drinks and preserved because it has a high content of sour so it has a fresh flavor. The content of vitamin C in fruit mango mango variety of potential for development with high vitamin content. kulit and sour flavors inherent in mango can cause genetic erosion on mango cultivars with high vitamin C content. Genetic erosion removes this diversity can eliminate the potential for breeding process in the next stage in the process of breeding mango with high vitamin C.

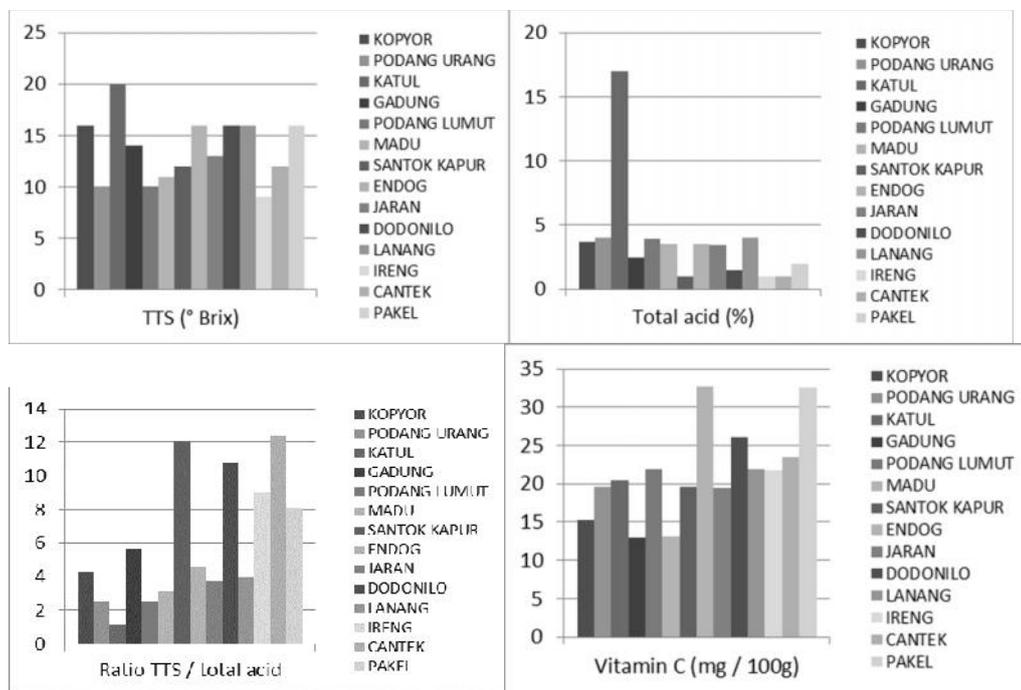


Figure 3. TTS (° Brix), total acid (%), Ratio TTS / total acid and Vitamin C at 14 kultibar mango in Indonesia

Phylogenic 14 cultivars of mango based on morphological characters

Dissimilarity coefficient (*dissimilarity Coefficients*) can be used to infer the degree of difference between species or population in the selected characters. This relationship can analyze the higher coefficient of dissimilarity, the more distant phylogenic (high dissimilarity coefficient 50-75%) (SURATMAN *et al.*, 2000). The observations were performed in fourteen cultivars showed four major groups of cultivars that exist in the study area. Santok Kapur and Kopyor the two cultivars that have the most distant phylogenic among others to become two cultivars that make up each group. Katul, podang urang, podang moss forming a group with the dissimilarity level below 40%. Gadung, Jaran, Madu, Endog, Pakel, Dodonilo, Ireng, Lanang and Cantek form a group with the dissimilarity level below 50%.

Kopyor mango and mango pakel have morphologically phylogenic far among others because basically kopyor a different species with other cultivars. Kopyor mango mango *Mangifera* classified in *Laurina*. M tine pakel belonging to the species *Mangifera foetida* nevertheless morphologically mango is still a group with mango lanang Cantek, and dodonilo the lack of resemblance rate of 40% (WONG and ONG, 1993; PURBIATI *et al.*, 1991; KOSTERMANS and BOMPARD, 1993).

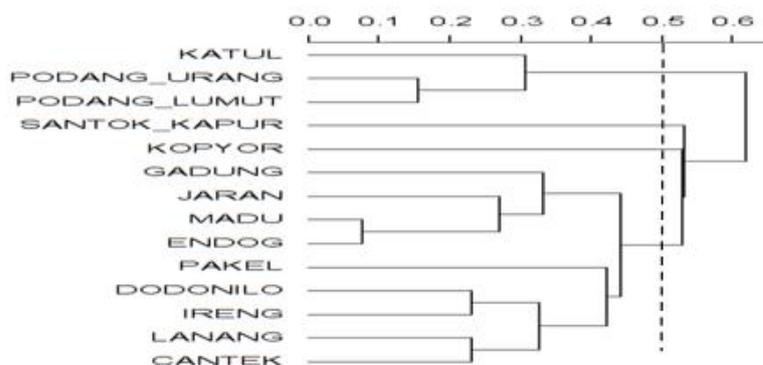


Figure 4. Dendrogram phylogenic emat twelve cultivars of mango in the village of Tiron Kediri

CONCLUSIONS

Fourteen cultivars of mango in the village of Tiron Kediri have high diversity based on qualitative character, there are four classes of mango. The first group is the Katul, Podang Urang, and Podang Lumut. The second group is the Gadung, Jaran, Madu, Endog, Pakel, Dodonilo, Ireng, Lanang and Cantek. Santok Kapur into groups to form groups of three and Kopyor fourth. The high diversity in the village mango Tiron Kediri potential as insitu germplasm *insitu*.

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REFERENCES

- ANDRI, KB, M. WINARNO, PB. DAROINI (2013): Characteristic of Mango Diversity in East Java: Case Study in Tiron, Kediri. Proceeding International Conference The 4th Green Technology Faculty of Science and Technology. 127-131

- FITMAWATI, H.A., B.S. PURWOKO (2009): Taksonomi mangga budidaya Indonesia dalam praktik. *Jurnal Agronomi Indonesia (Indonesian Journal of Agronomy)*. 37(2). 130-137
- GRUEZO, W.S. (1991): *Mangifera L.* In : Verheij, E.W.M. and E. Coronel (eds.). *Edible Fruits and Nuts*. Netherlands Pudoc Wageningen. Plant Resources of South-East Asia (PROSEA).
- HARTANA, A., B. S. PURWOKO (2009): Taksonomi mangga budidaya Indonesia dalam praktik. *Jurnal Agronomi Indonesia (Indonesian Journal of Agronomy)*. 37(2).
- HUMAN, C. F. S. RHEEDER (2004): Mango breeding: result and successes. *Acta Horticulture*. 645, 31-335.
- IPGRI. (2006): Descriptors for Mango. International Board for Plant Genetic Resources, Rome, Italy
- PERTANIAN (2014): "Basis Data Statistik Pertanian." *Acces <http://database.pertanian.go.id/bdsp/index.asp>*. [19 November 2014]
- KOSTERMANS, A. J. G. H., J. M. BOMPARD (1993): The mangoes. *Their botany, nomenclature, horticulture and utilization. Academic, London*. Lopez, D.G., M.S. Figueroa, L.D. Anaya dan N.M. Perez. 2010. Morphological characterization of native mangos from Chapas, Mexico. *Subtropical Plant Science*. 62. 18-26.
- NILASARI, A. N., J. B. HEDDY, T. WARDIYATI (2013): Identifikasi Keragaman Morfologi Daun Mangga (*Mangifera Indica L.*) Pada tanaman Hasil persilangan Antara Varietas arumanis 143 Dengan Podang Urang Umur 2 Tahun. *Jurnal Produksi Tanaman*. 1(1):61-69
- PARADIS, E., J. CLAUDE, K. STRIMMER (2004): APE: analyses of phylogenetics and evolution in R language. *Bioinformatics*, 20(2), 289-290.
- PURBIATI, T., L. MARPAUNG, A. L. BUDIONO (1991): Study on the combination of rootstocks and scion in mango (*Mangifera sp.*). *Hortikultura (Indonesia)*.
- SCHLIEP, K. P. (2011): phangorn: Phylogenetic analysis in R. *Bioinformatics*. 27(4). 592-593.
- SINGH, L.B. (1969): Mango. In: Ferwerda, F.P. dan Wit, F. (eds). *Outlines of perennial crop breeding in the tropics*. Veenman and Zonem, Wageningen, Netherlands. p. 309
- SOKAL, R.R., P.H.A. SNEATH (1963): *An Introduction to Taxonomy of Angiosperms*. San Fransisco: W. H Freeman and Co
- SPREER, W., J. MÜLLER (2011). Estimating the mass of mango fruit (*Mangifera indica* cv. Chok Anan) from its geometric dimensions by optical measurement. *Computers and electronics in agriculture*, 75(1), 125-131.
- STEEL, R. G., J. H. TORRIE (1960): Principles and procedures of statistics. *Principles and procedures of statistics*.
- SURATMAN., D. PRIYANTO A. D. SETYAWAN (2000): Analisis Keragaman Genus *Ipomoea* Berdasarkan Karakter Morfologi. *Biodiversitas* 1(2):72-79
- UJI, T. (2007): Keanekaragaman Jenis Buah-Buahan Asli Indonesia dan Potensinya. *Biodiversitas*. 8(2): 157-167
- WONG, K. C., C. H. ONG (1993): Volatile components of the fruits of Bachang (*Mangifera foetida* Lour.) and Kuini (*Mangifera odorata* Griff.). *Flavour and fragrance journal*, 8(3), 147-151

**MORFOLOŠKE RAZLIČNOSTI ETRNAEST SORATA U SELU TIRON,
KEDIRI, INDONEZIJA**

Fuad NUR AZIS^{1*} i dan Kuntoro BOGA ANDRI¹

Jl. Raya Karangploso KM.4 Malang 65152, Jawa Timur Indonezija

Izvod

Selu Tiron, Kediri je jedna od centralnih regiona u kom se gaji mango u Indoneziji. Mnoge sorte mango se gaje na ovoj lokaciji. Ova studija ima za cilj spitivanja raznolikosti sorti manga u Tiron Village, Kediri, Indonezija. Varijabilnost sorata mango se temelji na kvalitativnim i kvantitativnim karakteristikama svake sorte. Na varijabilnost i razlike između u kultivara ukazuju standardne devijacije i varijabilnost u jedanaest kvantitativnih osobina manga. Mango sorte su klasifikovane na osnovu filogeneze morfoloških osobina. UPGMA metod je korišten za analizu filogenija (metoda grupa neponderisanih parametara aritmetičke sredine). Rezultati su pokazali da etrnaest ispitivanih sorata manga u selu Tiron Kediri imaju veliki stepen raznovrsnosti. Sorte su formirale četiri grupe. Na temelju kvalitativnih osobina, postoje četiri klase manga. Uprvoj grupa su sorte *Katul*, *Podang Urang* i *Podang Lumut*, u drugoj sorte Gadung, Jaran, Madu, Endog, Pakel, Dodonilo, Ireng, Lanang i Cantek. Santok Kapur grupu formiraju tri sorte a grupa Kopyor je četvrta. Visoka raznolikost sorata mango u selu Tiron Kediri potencijal za resursima u situ germplazme.

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