

Phenotypic Character of Eight Mango Varieties (*Mangifera indica* L.) Collected by Purwodadi Botanic Garden

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ABSTRACT

Mango is a tropical fruit plant. Distribution center of mango species in Indonesia are in Sumatra and Borneo. Among the species, Mangifera indica L. has more varieties than most other species. Eight varieties of M. indica L. which are Blenyik Bulat, Wader, Bapang, Gondo Lumut, Madu, Endog, Gandik Luyung and Krasak Candi has been studied to recognize the phenotypic character of superior germplasm of mango varieties. Qualitative and quantitative characters of varieties have been measured. Varieties of Madu, Endog and Krasak Candi has a sweet fruit flavor and relatively non-fibrous with the highest scoring value 14 and 12. Quantitatively, it is known that the size of mango varieties under study pertained small, range from 0.12 to 0.3 kg. However, Blenyik Bulat variety with very small fruit has a very attractive appearance, yellow when it is ripe with a uniform color. Based on the ratio between the weight of fruit peel and seeds, it is known that the varieties have thick flesh, heavy pieces of meat more than 60%, variety Blenyik Bulat 80%, Wader 67%, Madu 73%, Bapang 96%, Gondo Lumut 96%, 94% Endog, Gandik Luyung 93%, 89% Krasak Candi. From phenotypic characters of mango variety, we can conclude that the variety of Madu, Endog, and Krasak Candi are quite excellent and their fruit can be developed for domestic consumption, as they have sweet taste. While for other varieties such as Blenyik Bulat, Gondo Lumut, and Bapang, can be developed for processing fruit as juice or dessert even can be developed for export consumption for example to Europe and Australia, as they have sour taste.

Keyword: Manggo, Character, Phenotypic.

Introduction

Mango is a tropical plant grown as a fruit crop. Mango production in Indonesia is second only to bananas, reaching 964.3 tonnes. The export volume dropped considerably mainly due to the quality of Indonesian mango is not able to compete in the global market, or consumers have been fed up with taste of existing varieties such Arumanis and Gadung (Anonymous, 2009; Dirou, 2004). Mango fruit character such as shapes, sizes, colors, and flavors are varied. Mango' shape varies widely, ranging from a full round (ex. variety Gedong and Arumanis), elliptical (Manalagi variety) to flat oval (ex. variety kopek and golek) (Hannah, 2001).

Mangifera comprises 40 species that distributed naturally from India and Sri Lanka with the distribution through Indo China, Malaysia and the Solomon Islands. Indonesia is the one country that has a high diversity of mango, mainly in Sumatra and Kalimantan. Mango plants can growing well in tropical lowland rain forests with an altitude of less than 600 m above sea level. Diversity of species was collected to preserve mango germplasm as practiced in Indonesia and other countries such as Malaysia, Philippines, Thailand and India. This is necessary because basically, all local varieties potentially used for crossbreeding. Introduction and extracting the potential of the species and local varieties are still lacking due to the lack of conservation of their natural habitat (Bally, 2006).

Purwodadi Botanic Garden-LIPI has dry lowland habitat and performs its duties and functions in mango germplasm ex-situ conservation. Mango species collected from different regions of both exploration results and plants exchange. However, the collection will not be meaningful if the aspect of knowledge has not been studied. Therefore, in this study it will be described phenotypic characters of eight varieties of mango, so the advantage of the resources of mango germplasm in Indonesia can be recognized for the purposes of conservation and cultivation. Hopefully, from the introduction of superior character it can be obtained the new variety for breeding as a result of product diversification in the country.

Method

The study was conducted from November and December 2011. The method used in this study was the observation to qualitative and quantitative characters of mango. The mango characters including the length and width of fruit, fruit peel and flesh color of fruit, thick flesh of fruit, seed size and fruit flavors were observed and compared. To scoring characters such as aroma, flavor and texture of the fruit, we used 3 respondents. Character fragrance were ranged on scale of 1-3, the character of the fruit flavors on 1-10 scale and character of the fruit texture on scale of 1-4. Then the value of the three characters was summed. Varieties which have the highest score are considered to have superior properties.

Result and discussion

Mango varieties collected by Purwodadi Botanic Garden comprises 42 varieties of seven species and several species that have not been identified (*Mangifera* spp.). The seven species of mango are *Mangifera caesia* Jack ex Wall., *M. foetida* Lour., *M. indica* L., *M. longipes* Griff., *M. minor* Blume, *M. odorata* Griff., *M. similis* Blume.

Table 1. Mango Species and Varieties collected in Purwodadi Botanic Garden.

Species	Variety	Origin
<i>Mangifera caesia</i> Jack ex Wall.		West. malesia
<i>M. foetida</i> Lour.	cv. Pakel	Indo-china to W.Malesia
	cv. Pakel Bawang	Indo-china to W.Malesia
	cv. Pakel Lumut	Indo-china to W.Malesia
<i>M. indica</i> L.,	cv. Angsa	C. Java
	cv. Bajul	E.Java
	cv. Bapang	E.Java
	cv. Bapang Lumut	E.Java
	cv. Bapang Nanas	C. Java
	cv. Blenyik Bulat	C. Java
	cv. Blenyik Lonjong	C. Java
	cv. Cantel	E.Java
	cv. Daging Manis	C. Java
	cv. Dodosari	C. Java
	cv. Endog	E. Java
	cv. Gandik Luyung	E. Java
	cv. Gandik Melati	E. Java
	cv. Gayam	E. Java
	cv. Gendruk	E. Java
	cv. Gondo Lumut	E. Java
	cv. Gondo Nanas	C. Java
	cv. Guling	C. Java
	cv. Guling	C. Java
	cv. Kapasan	E. Java
	cv. Kecil	E. Java
cv. Kepodang	E. Java	
cv. Kopyor	E. Java	
cv. Kopyor Kumut	E. Java	
cv. Krasak Candi	C. Java	
cv. Krasak Kranggan	C. Java	
cv. Lempeni	E. Java	
cv. Madu	E. Java	
cv. Malam	E. Java	
cv. Putihah	E. Java	
cv. Randu	E. Java	
cv. Rante	E. Java	
cv. Wader	E. Java	
<i>M. Longipes</i> Griff.		Sumbawa
<i>M. Minor</i> Blume		C. sulawesi

<i>M. Odorata</i> Griff.		Malesia
cv. kuweni		C. java

Mangifera indica L.

Species *Mangifera indica* L. has many varieties, there are about 25 varieties that were collected at Purwodadi Botanic Garden. The species *Mangifera indica* L. is a species which has the most varieties than other species. Diversity of varieties in Java is quite high. Fruits vary in size, shape, color of skin and flesh of fruit, texture, aroma, and taste of the fruit. Fruit shape varies from round, oval to oblong with a comparison of different length and width. The weight of fruit also varies from less than 50 g to more than 2 kg. In the development of fruit maturity, fruit color also becomes an important identifier among mango varieties. There are several varieties that have green, orange, red to red-purple. Flesh color varies from yellow, orange to red with smooth to fibrous texture.

Mangifera indica L. cv. Blenyik Bulat

This variety can be found in Central Java, the fruits are relatively small, round-shaped with a range of 6-8 cm long and 4.7 to 6.3 cm wide. Light green to bright yellow when young and old orange at the mature. The color is evenly spread throughout the fruit and the taste of fruit is sweet sour. This mango flavored strong enough when ripe, bright orange flesh, but the flesh is very fibrous.

Mangifera indica L. cv. Wader

This variety is origin from East Java. The fruit is medium-sized, oval-shaped with a range of 10.7 cm long and 5.8 cm wide. Green is a bit old at a young age with ornaments skin rash dark green. It has bright orange flesh of fruit and sour fruit flavors. The fruit is sour and has smooth fibers.

Mangifera indica L. cv. Madu

This variety can be found in East Java. The fruit is round and has medium size with a range of 8.8 to 9.5 cm long and 6.9 to 7.8 cm wide. It has bright green fruit color when young and yellowish green when old. The flesh of fruit is bright orange. It has sweet fruit flavors with a crisp texture. The aroma of its fruit is fresh and very interesting.

Mangifera indica L. cv. Bapang

This variety can be found in East Java. The fruit is oval-shaped, of medium size with a range of 10.6 to 12.2 cm long and 7.3 to 8 cm wide. Its peel color is bright green when young and yellowish green when old. It has bright orange flesh with a strong aroma, taste of the fruit tends to be somewhat sour.

Mangifera indica L. cv. Gondo Lumut

This variety is originally from East Java. The fruit is medium-sized and relatively can reach in considerable size. Fruit size ranged from 9.3 to 11.9 cm long and 5.8 to 7.4 cm wide. Green rind is a bit old when it was young, while green and yellow when it is mature. It has bright orange flesh and the fruit flavors tend to be a bit sour.

Mangifera indica L. cv. Endog

This variety can be found in East Java. The fruit is medium-sized, round-shaped, with an average length of 8.4 cm and 8.4 cm wide. It has dark green fruit skin while still young and green when old. Color bright orange flesh with fine fiber and fruit flavors tend to be a bit sour.

Mangifera indica L. cv. Gandik Luyung

This variety can be found in East Java. The fruit is medium-sized, oval shaped to very oval, with a length ranging from 13.1 to 15.5 cm and a width of 5.0 to 6.1 cm. The rind is light green and very bright when young and yellowish green when old. It has pale orange flesh. The taste of fruit tends to be sour taste.

Mangifera indica L. cv. Krasak Candi

This variety can be found in Central Java. The fruit has medium size, but the size of the fruit vary. Fruit is oval-shaped. The length ranges from 8.3 to 12.5 cm and wide 5-7 cm. The rind is dark green at both young and old as the color of yellowish at the base of the fruit when they are old. It has dark reddish orange flesh and pretty sweet fruit flavors.

Table 1. Quantitative characters of eight mango varieties

Variety	Fruit weight (kg)			Fruit length (mm)	Fruit width (mm)
	peel	flesh	Total		
Blenyik Bulat	0.017	0.097	0.12	72.25	54.57
Wader	0.03	0.12	0.18	107.2	58.83
Madu	0.04	0.22	0.3	91.96	72.76
Bapang	0.06	0.25	0.26	114.3	77.82
Gondo Lumut	0.05	0.255	0.26	106.05	65.87
Endog	0.05	0.16	0.17	84.1	84.8
Gandik Luyung	0.04	0.14	0.15	140.1	54.4
Krasak Candi	0.04	0.17	0.19	104.47	60.72

Table 2. Quantitative characters of eight mango varieties

Variety	Weight (kg)	Length (mm)	Fruit width (mm)	Thickness (mm)
Blenyik Bulat	0.04	58.3	32.74	17.5
Wader	0.04	85	31	20.9
Madu	0.05	65	40.5	21.25
Bapang	0.05	90	37.5	19.3
Gondo Lumut	0.05	101.9	38	18.7
Endog	0.03	70	42	20.2
Gandik Luyung	0.04	115.3	36.7	16.8
Krasak Candi	0.05	88.7	37.8	19.07

Tabel 3. Qualitative character scoring eight mango varieties

Variety	Aroma	Fruit Taste	Texture
Blenyik Bulat	3	7	1
Wader	2	4	3
Madu	2	10	2
Bapang	2	5	2
Gondo Lumut	3	2	2
Endog	3	8	1
Gandik Luyung	2	4	2
Krasak Candi	3	9	2

Keterangan :

Aroma : 1. Non-aromatic
2. fresh aromatic
3. strong aromatic

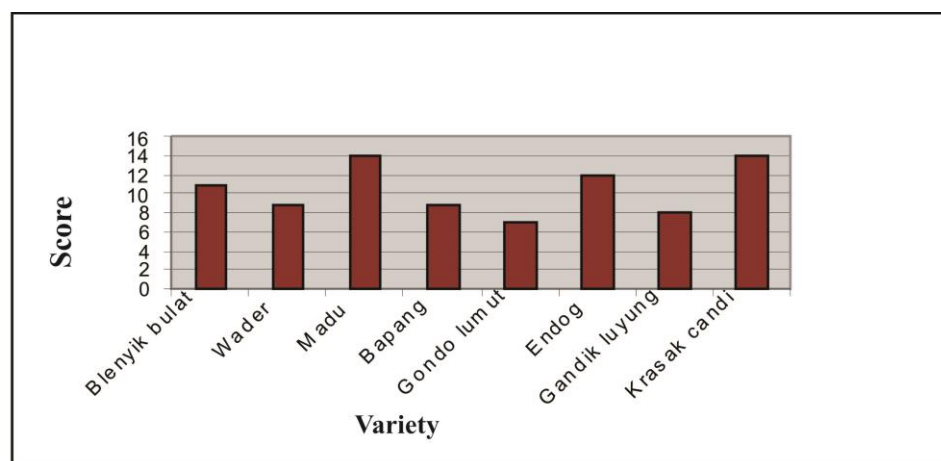
Fruit taste : 1-2 : sour
3-5 : rather sour
6-8 : sour sweet
9-10 : sweet

Texture : 1. Very fibrous
2. Fibrous
3. Smooth fibrous
4. Non-fibrous

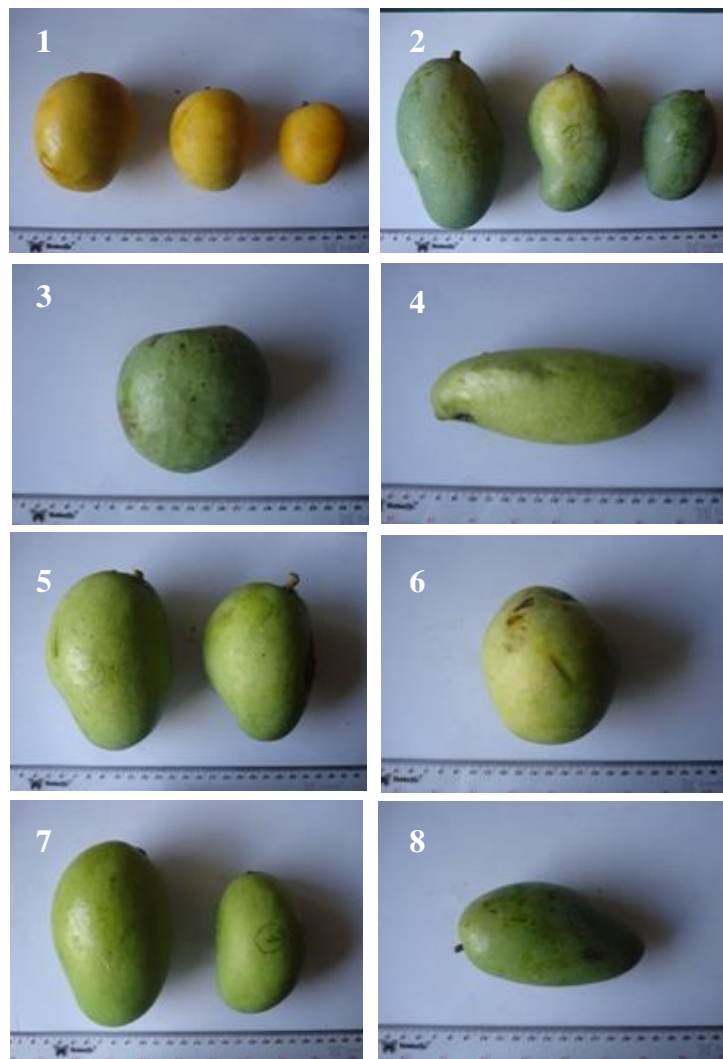
Identification and introduction of varieties of mangoes in Indonesia are essential because *Mangifera indica* L. germplasm still lack of resistance genes against most pathogens and insects. Standardization of criteria required to evaluate the selection of seeds and germplasm collections. Character recognition should be done in the area as much as possible, especially because preference of varieties may vary in different regions of the world.

From the description of phenotype character of eight mango varieties can be revealed that the varieties of Madu, Endog and Krasak Candi were superior variety because it has sweet fruit flavors and relatively non-fibrous flesh of fruit. Quantitatively, the size of mango varieties under study is small, ranging from 0.12 to 0.3 kg. However, Blenyik Bulat varieties have very small size and an attractive appearance of fruit. It is yellow when ripe with color evenly. The comparison between the weight of the fruit, rind and seeds showed that eight varieties have quite thick flesh of fruit and flesh weight more than 60%. Moreover, the weight of fruit flesh of varieties Blenyik Bulat was 80%, Wader 67%, Madu 73%, Bapang 96%, Gondo Lumut 96%, Endog 94%, Gandik Luyung 93%, and Krasak Candi 89%. The comparison among flesh of fruit showed that varieties Bapang, Gondo Lumut, Krasak Candi and Endog considered as superior variety. Considerably, the weight of fruit commonly showed the superiority of mango, although it is relatively affected by water content (Majumder, 2012).

Table 4 showed the quantitative character scoring of mangoes variety. From the table above, it can be revealed that the most superior varieties of mango is variety of Madu and Krasak Candi with scoring value 14. While Endog and Blenyik Bulat varieties have the excellent enough characters with scores of 12 and 11. If variety which has excellent character is well developed, it will receive the attention from the market. At the very least, knowing the sources of germplasm, its characters and advantages, may be a reference of crossing between two varieties for obtaining new excellent character even for genetic engineering. According to Soemargono & Istianto (2010), selection and crossbreeding should be done together to get new varieties. Crossing takes a long time so it needs foresight about consumer tastes. Currently, the health value of the fruit has begun to be noticed by consumers, not only organoleptic and appearance of the fruit. It can be used as the basis for the selection of the local variety of mango which includes organoleptic, nutritional and fruit phenotype (Majumder, 2012).



Picture 1. Scoring of eight mango varieties



Picture 2. Eight varieties of Mango (*Mangifera indica* L.) 1. Blenyik Bulat, 2. Krasak Candi, 3. Madu, 4. Bapang, 5. Gondo Lumut, 6. Endog, 7. Wader, 8. Gandik Luyung

Consumer's taste of mango between domestic and abroad is different. Domestic consumers prefer to consume the sweet mango than the sour one, for example variety of Arummanis. Contrary, abroad consumers such as Europe and Australia prefer to consume mango which has sour taste than the sweet one (Tirtawinata, 2001). Varieties were seeded in Indonesia are mostly geared to meet domestic demand so the competition with imported products is small. Thus, Indonesia actually has the potential to develop the varieties that un-favored by local consumers but favored by overseas consumers like variety Bapang and Gondo Lumut. Moreover, in the domestic market, the development of mango fruit with relatively sour taste remains ongoing in addition to conservation efforts as well as to meet the demand for such processing fruit juices, preserves and canned fruit. The examples for that case are varieties of Blenyik Bulat, Gondo Lumut and Bapang. The plants are also important as a source of genes to be developed for the purpose of crossing the new hybrid that might get disease resistance and tolerance to environmental conditions.

Conclusion

The study of phenotypic character of local mango variety concluded that the varieties of Madu, Endog, and Krasak Candi are quite superior and can be developed for domestic consumption of fruit. Other varieties such as Blenyik Bulat and Bapang are more suitable to be developed for fruit processed.

Reference

- [1] Anonim. 2009. www.mangga.info. Mangga merah siap bersaing di Pasar global.
- [2] Bally, I. S E. 2006. *Mangifera indica* (mango) Anacardiaceae. www.traditionaltree.org
- [3] Cassani G., B. Timmerman, M. Wakjira, S. Duesseldorf, V. Perrini and D. P. Pudasainy. 2009. Fairtrade Mangoes from India. <http://www.resilience-foundation.nl/docs/mango.pdf>
- [4] Dirou, JF. 2004. Mango Growing. *Agfact* H6.1.10, fourth edition 2004
Hanny. 2001. Mangga kaya antioksidan betakaroten. <http://www.gizi.net/cgi-bin/berita/fullnews.cgi?newsid1009419839,79952>. diakses tanggal 16 November 2009.
- [5] Majumder, D. A.N., Hassan, M.A. Rahim and M. A. Kabir. 2012. Correlation and path coefficient analysis of mango (*mangifera indica* l.). *Bangladesh J. Agril. Res.* 37(3): 493-503, September 2012
- [6] Suwarno, W. B. 2008. Pemuliaan tanaman Mangga. <http://www.fp.unud.ac.id/biotek/wp-content/uploads/2009/02/pemuliaan-mangga.pdf>. diakses tanggal 12 April 2010.
- [7] Tirtawinata, 2001. *Jurus Kuasai Mangga*. PT. Swadaya TRUBUS. Depok. XXXII Januari.
- [8] Soemargono, A & M. Istianto. 2010. Program dan Hasil Penelitian Komoditas Mangga mendukung usaha menghasilkan produk buah yang berkualitas dan aman bagi konsumen. *Prosiding Seminar Nasional Buah Nusantara*. Bogor