The Diverse Collection of Exotic Tropical Fruits in The Indonesian Tropical Fruit Research Institute (ITFRI)

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ABSTRACT

Indonesian Tropical Fruit Research Institute (ITFRI) known as an institute collecting exotic tropical fruits in Indonesia. The present study was carried to evaluate the characters of five exotic fruits in the Indonesian Tropical Fruit Research Institute (ITFRI), Solok, West Sumatra, Indonesia. The experiment used field observation. The characters considered were leaf character (leaf shape, leaf margin, leaf tip, leaf base, the color of upper leaf, color of under leaf, leaf surface, leaf length, leaf width), and fruit character (fruit shape, fruit peel texture, fruit length, fruit width, fruit weight, the color of mature peel, the color of mature flesh, taste, fruit weight, seed weight, seed number). Data were analyzed descriptively using tables. The five exotic fruits’ morphological characteristics have demonstrated that every species of fruit has specific characteristics. These fruits have the potential to be raw materials for the pharmacy industry.

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1. INTRODUCTION

Asia has more than 70 different fruits; however, there are only about 20 species for large-scale commercial cultivation (Arora & Rao, 1994). The South-East Asian region is an ideal area to grow fruit crops. The fruits have different appearance, taste, and texture (Yaacob & Subhadra, 1995). Fruits are enriched with essential nutrients and low in calorie content. They can increase people’s health (Devine, et al., 1998).

Indonesia has many genetic resources. Thirty thousand plants grow in the forest, including exotic fruits; however, only about 4,000 species have been used by people (Uji, 2007). Some of them have the potency to be used in domestication program. The exotic fruits need to maintain because of the economic value as traditional medicine or flavor adding in food (Zurriyati, et al., 2018). Because some exotic fruits have almost gone extinct, people need to conserve these fruits. Conservation strategies involve cultural aspects, socio-economic, and plant diversity (Gulati, 2018). Education and tourism are objectives of plant diversity conservation (Hutabarat & Wilkie, 2018).

Indonesian Tropical Fruit Research Institute (ITFRI) collects exotic tropical fruits in Indonesia. The present study was carried to evaluate the characters of five exotic fruits in the Indonesian Tropical Fruit Research Institute (ITFRI), Solok, West Sumatra, Indonesia.

2. MATERIALS AND METHODS

The research was carried out at Indonesian Tropical Fruit Research Institute (ITFRI), Aripan experimental site, Solok, West Sumatra, Indonesia, from January 2012 to December 2014. The experiment used field observation. The characters considered were leaf character (leaf shape, leaf margin, leaf tip, leaf base shape, the color of upper leaf, color of under leaf, leaf surface, leaf length, leaf width), and fruit character (fruit shape, fruit peel texture, fruit length, fruit width, fruit weight, the color of mature peel, the color of mature flesh, taste, fruit weight, seed weight, seed number). Data collected were analyzed descriptively using tables.

3. RESULTS AND DISCUSSIONS

3.1 Fruit Collection

a. Diospyros blancoi

Diospyros blancoi belongs to the Ebenaceae of Ericales family. The fruit is eaten fresh. Its wood is used for carving (Jensen, 2008). Verheij & Cornel (1992) noted that this tree has some vernacular names, i.e., hong nhung (Indo-China); marit (Thailand); mabolo, kamagong, tabang (Philippines); buah lemak, buah mentega.
(Malaysia); buah mentega, bisbol, mabolo (Indonesia); Mabolo, velvet apple (En); Pommier velours (Fr). The leaf shape is oblong with a length of 22-28.5 cm and a width of 7.6 – 10.0 cm. The leaf color is green (Table 1). Putri & Chiknaawati (2016) informed that the leaf is dark green in a mature step. The fruit weight is 236.7 – 399.93 grams (Table 2). The fruit varies greatly at different times. Hung, et al. (2015) recorded that the fruit’s size depends on the time it is harvested.

The leaf has the potential to be a raw material for the pharmacy industry. The leaf extract has antioxidant compounds. It can function as an antidiabetic because it can reduce blood glucose (Demetillo, et al., 2018). The leaf extract has antimicrobial properties (Howlader et al., 2015). The leaf characteristics are smallness (1.8-2.5 x 2.1-2.5 cm), ovate, and a glossy surface. The leaf color is dark green in the mature step (Table 1). The leaf extract can decrease blood glucose (Demetillo, et al., 2018). The leaf extract has antioxidant properties (Irawan, 2017). The extract of fruit peel has antioxidant properties and steroid. It can be antioxidant agents (Irawan, 2017). The tree provides leaf domes that are suitable for ants’ habitat because the leaf color is green (Table 1). The leaf is suitable for ants’ habitat because the leaf shape is obovate (7.7 cm x 5.9 cm). The leaf color is green (Table 1).

b. *Eugenia uniflora*

*Eugenia uniflora* is a tree in the family Myrtaceae. This plant is called Brazil cherry. It is a nutritious fruit growing in the tropics and sub-tropics areas (Griffis, et al., 2009). The leaf characteristics are smallness (1.8-2.5 x 2.1-2.5 cm), ovate, and a glossy surface. The fruit weight of *E. uniflora* is 5.1-9.6 grams and red with 1-3 seeds (Table 1). The pulp juice is sweet-acid. It can function as a raw material for commercial products, such as jellies, jams, desserts, and juices (Griffis, et al., 2008). The pulp has the potential to be food colorants (Borges, et al., 2016).

*E. uniflora* has biological activities as a medicinal plant. The fruit extract has the potential to function as an antioxidant and antidepressant because it against metabolic alteration (Oliveira, et al., 2017). The leaf extract has phenolic content (Bakr, et al., 2017; Ramos, et al., 2011), flavonoids (Rattmann, et al., 2012), anti-inflammatory, antibacterial properties (Falcao, et al., 2018), antioxidant (Migues, et al., 2018). The ripe fruit has analgesic properties (Ogugo, 2018).

c. *Pometia pinnata*

*Pometia pinnata* belongs to the family Sapindaceae. The leaf shape is obovate (7.7 – 9 cm x 5.9 – 4.9 cm). The leaf color is yellow-green group 148 C. Fruit shape is ellipsoid, medium (2.9 – 3.3 cm x 2.2 – 2.8 cm), and the taste is slightly sweet (Table 1 and 2). This plant can be a roadside tree (Sarwadi, et al., 2018), and it can be an herb. The leaf extract contains polyphenol and dolichol (Basyuni & Wati, 2018).

The tree provides leaf domes that are suitable for ants’ habitat because the tree provides leaf domestic and food (Moog, et al., 2008). The pulp flavor of *Pometia pinnata* is sweet, TSS value is 9.8 – 31.2° Brix (Furay, et al., 2019).

The fruit of *Pometia pinnata* commonly used as a traditional medicine. The flesh contains tannins, phenolic and steroid. It can be antioxidant agents (Irawan, et al., 2017). The extract of fruit peel has antioxidant properties (Faustina & Santos, 2014). The leaf extract can decrease blood pressure (Purwidyaningrum et al., 2017). The stem bark contains triterpenoid (Trimedona, et al., 2015). The fruit has a seed that can function as a medicine for diabetes since it has anti-diabetic properties (Sukiman, et al., 2018).

d. *Cynometra cauliflora*

*Cynometra cauliflora* is a plant in the family Fabaceae. *C. cauliflora* (namnam) is a small or shrub tree. The fruit shape is kidney shape, and the taste is sour (Table 2). It is suitable for salad (Verheij & Coronel, 1992). The composition of *Cynometra cauliflora* per 100 g edible portion is moisture 87.27%, ash 1.41%, protein 0.66%, fat 0.18%, fiber 1.72%, carbohydrate 8.77%. The mineral content in *Cynometra cauliflora* per 100 g samples is calcium 6.14 mg, zinc 0.48 mg, iron 1.01 mg, natrium 0.55 mg (Rabeta & Faraniza, 2013).

The tree is an underutilized fruit, but it has medicinal values. The fruit can function as a cytotoxic to cure the human promyelocytic leukemia (Tajudin, et al., 2012). The leaf extract can function as an antibacterial agent (Abd. Wahab, et al., 2019; Ulpiyah, et al., 2019) and antioxidant (Ado, et al., 2013). Those components are useful in the pharmacy industry or drug formulations.

e. *Manilkara kauki*

*Manilkara kauki* belongs to the family Sapotaceae. The leaf shape is obovate (7.7 – 9 cm x 5.9 – 4.9 cm). The leaf color is yellow-green group 148 C. Fruit shape is ellipsoid, medium (2.9 – 3.3 cm x 2.2 – 2.8 cm), and the taste is slightly sweet (Table 1 and 2). This plant can be a roadside tree (Sarwadi, et al., 2018), and it can be an herb. The leaf extract contains polyphenol and dolichol (Basyuni & Wati, 2018).
Figure 1. The appearance of five exotic fruits (A. Diospyros blancoi, B. Eugenia uniflora, C. Pometia pinnata, D. Cynometra cauliflora, E. Manilkara kauki).

### 3.2 Morphological Characters of Collected Fruits

#### Table 1. Leaf character

| Leaf Character          | Diospyros blancoi | Eugenia uniflora | Pometia pinnata | Cynometra cauliflora | Manilkara kauki |
|-------------------------|-------------------|------------------|-----------------|----------------------|-----------------|
| Leaf shape              | Oblong            | Ovate            | Elliptical      | Ovate-oblong         | Obovate         |
| Leaf margin             | Entire            | Entire           | Entire          | Entire               | Entire          |
| Leaf tip                | Acute             | Obtuse           | Long acuminate  | Emarginate           | Acute           |
| Leaf base               | Rounded           | Rounded          | Acute           | Acute                | Acute           |
| Color of upper leaf     | Green N137A       | Green N137B      | Green N 137 D   | Green group N 137 A  | Green group N 137 A |
| Color of under leaf     | Green 137D        | Green 138 B      | Green 137 C     | Green group N 137 D  | Yellow-green group 148 C |
| Leaf surface            | Shiny             | Glossy           | Shiny           | Glossy               | Glossy          |
| Leaf length (cm)        | 22-28.5           | 2.9-7.1          | 28.3-36.5       | 5.9-8                | 7.7-9           |
| Leaf width (cm)         | 7.6-10.0          | 1.3-3.8          | 8.6-11.1        | 2.2-3.1              | 5.9-4.9         |

#### Table 2. Fruit character

| Fruit Character          | Diospyros blancoi | Eugenia uniflora | Pometia pinnata | Cynometra cauliflora | Manilkara kauki |
|--------------------------|-------------------|------------------|-----------------|----------------------|-----------------|
| Fruit shape              | Globose           | Globose          | Ellipsoid       | Kidney               | Ellipsoid       |
| Fruit peel texture       | hairy             | Soft             | Soft            | Rugose               | Shiny           |
| Fruit length (cm)        | 7.75-8.7          | 1.8-2.5          | 2.88-3.27       | 4.36-5.04            | 2.9-3.3         |
| Fruit width (cm)         | 8.27-9.12         | 2.1-2.5          | 2.51-3.12       | 3.19-3.48            | 2.2-2.8         |
| Fruit Weight (g)         | 236.7-399.93      | 5.1-9.6          | 15.3-20.84      | 16.79-25.43          | 9.7-13.01       |
| Color of mature peel     | Orange-red 34A    | Red group 44 A   | Purple group N77A | Yellow-green group 152 A | Orange-red group 33 B |
| Color of mature flesh    | White 155A        | Red group 44 A   | Yellow- white 158 B | Yellow group 11 C    | Yellow- white group 158 D |
| Taste                    | Slightly sweet    | Sour             | Sweet           | Sour                 | Slightly sweet  |
| Seed weight (g)          | 33.95-50.9        | 4.4-7.8          | 5.2-6.53        | 5.51-6.25            | 1.5-3.1         |
| Number of seeds          | 1-8               | 1-3              | 1               | 1                    | 2-4             |
4. CONCLUSION

Indonesian Tropical Fruit Research Institute (ITFRI) collects exotic fruits to ensure that endangered are conserved. The result of the five exotic fruits’ morphological characteristics demonstrated that every species of fruit has specific characteristics. They have the potential to be raw materials in the drug pharmacy. Hence, it needs more observation to determine the utilization of these fruits in the future, whether as traditional medicine or as edible fruit.

REFERENCES

Abd Wahab, N. Z., Badya, N., Ibrahim, N., & Kamarudina, M. K. A. (2019). Phytochemistry and Antimicrobial Activity of Gymnema Cauflilla. Indian Journal of Public Health Research & Development, 10(4).

Ado, M. A., Abas, F., Ismail, I. S., Ghazali, H. M., & Shaari, K. (2015). Polyisoprenoids profile and biological investigation of Eugenia uniflora L. cultivated in Egypt. Journal of Pharmacognosy and Phytotherapy, 9(5), 57-66. https://doi.org/10.5089/PP2017.0443.

Basu, M., & Wati, R. (2018, November). Polyisoprenoids profile and composition from selected plant Sapotaceae family. In IOP Conference Series: Materials Science and Engineering (Vol. 434, p. 012104).

Borges, K. C., Bezerra, M. D. F., Rocha, M. P., Silva, E. S. D., Fujita, M. I., Genovese, A., & Correia, R. P. (2016). Fresh and spray dried pitanga (Eugenia uniflora) and jambolan (Syzygium cumini) pulps are natural sources of bioactive compounds with functional attributes. Journal of Probiotics & Health, 4(2), 1-8.

Demetillo, M. T., Nüeza, O. M., Uy, M. M., & Senarat, W. T. P. S. K. (2018). Phytochemical Screening, Antioxidant and Antidiabetic Evaluation of Leaf Extracts from Diospyros blancoi A. D.C. International Journal of Pharmaceutical Sciences and Research, 10(8): 3951-3956.

Devine, C. M., Connors, M., Bisogni, C. A., & Sobal, J. (1998). Life-course influences on fruit and vegetable trajectories: qualitative analysis of food choices. Journal of Nutrition Education, 30(6), 361-370. https://doi.org/10.1016/S0022-3188(97)00358-9.

Falko, T. R., de Araújo, A. A., Soares, L. A. L. de, de Moraes Ramos, R. T. Bezerra, I. C. F., Ferreira, M. R. A., & de Medeiros, J. S. (2018). Crude extract and fractions from Eugenia uniflora Linn leaves showed anti-inflammatory, antioxidant, and antibacterial activities. BMC complementary and alterntive medicine, 18(1), 84.

Faustina, F. C., & Santoso, F. (2014). Extraction of fruit peels of Pometia pinnata and its antioxidant and antimicrobial activities. J. Pascapanen, 11(2), 80-88.

Furay, A., Ahmad, U., & Widodo, S. (2019, June). Study on Quality Parameters of yellow Matoa Fruit (Pometia pinnata) Using Digital Image Processing. In IOP Conference Series: Materials Science and Engineering (Vol. 557, No. 1, p. 012025). IOP Publishing.

Grillis, Jr. J. L., McDonald, T. G., Smith, V. E., & Manners, M. M. (2008, March). Eugenia uniflora: a nutritious, easy-to-grow fruit for the tropics. In International Symposium on Underutilized Plants for Food Security, Nutrition, Income and Sustainable Development 806 (pp. 277-284).

Gulati, R. (2018). Strategies for sustaining plant germplasm evaluation and conservation—a review. Life Sci Inform, 4, 313-320. doi:10.26479/2018.0405.25.

Houbeler, M. S., Sweere, M. S. R., Ahmed, M. U., Mohidin, A. K., Labu, Z. K., Bellah, S. F., & Islam, M. (2012). Characterization of chemical groups and study of antioxidant, antimicrobial, and cytotoxic activities of ethanolic extract of Diospyros blancoi (Family: Ebenaceae) leaves. J. Pharm Res, 5(6), 3050-3052.

Hung, S. F., I. Z. Chen, and S. F. Roan. (2015). Preliminary results of fruit selection and induced parthenocarpy of mabolo (Diospyros blancoi A. Dc.) Genet Resour Crop Evol. 62: 1127-1134.

Hungr, S. F., Roan, S. F., Chang, T. L., King, H. B., & Chen, I. Z. (2016). Analysis of aroma compounds and nutrient contents of mabolo (Diospyros blancoi A. Dc.), an ethno-botanical fruit of Austronesian Taiwan. Journal of Food and drug analysis, 24(1), 83-89. https://doi.org/10.1016/j.jfda.2015.08.004.

Hutabarat, P. W., & Wilkie, P. (2018). The Sapotaceae of Indonesia and the Potential Role of Botanic Gardens in their Conservation. Sibbaldia: The Journal of Botanic Garden Horticulture, (16), 141-154. https://doi.org/10.23823/sibbaldia.2018252.

Irawan, C., Hanafi, L. S., & Henny, R. (2017). Phytochemistry and total phenolic content of methanol extract of Pometia pinata JF Forst. & G. Forst., fruit flesh from Papua, Indonesia. Tropical Plant Research, 4(3), 401-404.

Jensen, M. (2001). Trees and fruits of Southeast Asia. Orchid Press.

Migues, I., Baenas, N., Gironés-Vilaplana, A., Cesio, M. V., Heizhen, H., & Moreno, D. A. (2018). Phenolic profiling and antioxidant capacity of Eugenia uniflora L.(Pitanga) samples collected in different uruguyan locations. Foods, 7(5), 67. https://doi.org/10.3390/foods7050067.

Moog, I., Atzinger, K., Hashim, R., & Maschwitzi, U. (2008). Do tenants always pay their rent? The Asian ant-plant Pometia pinnata (Sapindaceae) and its leaf domatia provide free access to generalist ants. Asian Myrmecol, 2, 17-32.

Oliveira, P. S., Chaves, V. C., Bona, N. P., Soares, M. S. P., de Souza Cardoso, J., Vasconcellos, F. A. A., & Gamara, G. D. (2017). Eugenia uniflora fruit (red tara) standardized extract: a potential pharmacological tool to diet-induced metabolic syndrome damage management. Biomedicine & pharmaotherapy, 92, 935-941. https://doi.org/10.1016/j.biopha.2017.05.131.

Onggolozer, M. O. (2018). Evaluation of the Nutritional Compositions and Analgesic Effects of the Flavonoid Fraction of Eugenia uniflora Ripe Fruit Pulp. American Journal of Ethnomedicine, 9(1), 7.

Pohar, R. (2003). Enhancing the use of value-added products from underutilized fruit of the endangered mabolo (Diospyros blancoi) tree. International Journal of Environmental and Rural Development, 4(1), 100-105.

Purwiyadiyuningrum, I., Sukandar, E. Y., & Firidiamy, I. R. D. A. (2017). Antihyperpertensive activity of extract and fractions of matoa (Pometia Pinnata J. R & G forts) leaves. Asian J Pharm Clin Res, 10(3), 523-528.

Putri, E. K., & Chikmawati, T. (2016). Leaf flushing as taxonomic evidence of some Diospyros species. Florihunda, 5(2): 31-47. http://dx.doi.org/10.32556/florihunda.v5i2.2015.127.

Rabeta, M. S., & Faraniza, R. N. (2013). Total phenolic content and ferric reducing antioxidant power of the leaves and fruits of Garcinia atrovirdis and Cynometra cauliflora. International Food Research Journal, 20(4).

Ramos, R. T., Bezerra, I. C., Ferreira, M. R., & Soares, L. A. L. (2017). Spectrophotometric quantification of flavonoids in herbal material, crude extract, and fractions from leaves of Eugenia uniflora Linn. Pharmacognosy research, 9(3), 253. doi: 10.4103/pr.pr.143.16.

Rattmann, Y. D., de Souza, L. M., Malqueviez-Pava, S. M., Dartora, N., Sasaki, G. L., Gorin, P. A., & Iacomini, M. (2012). Analysis of flavonoids from Eugenia uniflora leaves and its protective effect against murine sepis. Evidence-Based Complementary and Alternative Medicine, 2012. https://doi.org/10.1155/2012/623940.

Sarwang, A., Irawan, S. N. R., Utami, R. N., & Raya, A. B. (2019, November). Evaluation of some Diospyros species in preventing dietary-induced metabolic syndrome damage. Journal of Probiotics & Health, 4(1), 1-8.

Sukiman, M., Jenny, A. M., Irawan, C., & Sulistiwaty, L. (2018). Evaluation of antidiabetic activity of matoa seed extract (Pometia pinnata) using enzyme α-glucosidase. The Pharma Innovation, 7(5, Part A), 69.
