Journal of Tropical Biology and Conservation 17: 297–307, 2020 ISSN 1823-3902
E-ISSN 2550-1909

Research Article

Utilization of "Benda" (*Artocarpus elasticus* Reinw. ex Blume) in Bogor, West Java, Indonesia: An Ethnobotanical Case Study

Siti Susiarti[1*], Mulyati Rahayu[1], Emma Sri Kuncari[1], Inggit Puji Astuti[2]

[1] Research Center for Biology, Indonesian Institute of Sciences (LIPI)
Cibinong Science Center, Jl Raya Jakarta-Bogor Km. 46, Cibinong, Bogor 16911, Indonesia
[2] Research Center for Plant Conservation and Botanic Gardens – LIPI
Jl. Juanda no 3 Bogor, Indonesia

[*]Corresponding author: susi.etno@yahoo.com

Abstract

Family Moraceae consists of 60 genera, one of which is the genus of *Artocarpus*. One species of *Artocarpus* is *A. elasticus*, known as Benda by local people in Bogor. Its fruit is used as an alternative food but it is still less known. This study was carried out to evaluate the use of *A. elasticus* in Bogor as food and its surroundings by direct observations in the field and interviews with selected informants and proximate analysis. The results of the study revealed that the fruit and the seeds are eaten like other species of *Artocarpus*; i.e. *A. heterophyllus* (Jackfruit), *A. champeden*, the wood of Benda is used for cabinets and latex to catch birds. *A. elasticus* is quite rare now, and the seeds have a high carbohydrate content. So there is a need for intensive cultivation to maintain its sustainability.

Keywords: Ethnobotany, food, *Artocarpus*, proximate, Bogor, West Java.

Introduction

Plant biological resources play an important role to meet basic human needs as a source of food, energy, building materials, and medicines (Sastrapradja, 2006). In general, the Indonesian population relies on plants to meet their food needs, including vegetables, fruits, and a form of alternative carbohydrate. According to Widjaja et al. (2014), food reserves are dominated by fruits.

Received 27 April 2020
Reviewed 28 May 2020
Accepted 01 July 2020
Published 15 October 2020

Moraceae is a large family of a plant consisting 60 genera and nearly 1,400 species, including several important genera such as *Artocarpus, Morus*, and *Ficus*. Several species of *Artocarpus* have long been recognized for their exceptional medicinal value and their edible aggregate fruits in South East Asia, Indonesia, the Western part of Java and India.

The genera of *Artocarpus* comprises circa 45 species and ranges from Sri Lanka to South China and through Malesia to Solomon Islands and Australia; 32 of these species occur as wild trees in Malesia, *A. elasticus* is found in the Thai - Malay Peninsula, Indo Burma, Sumatra, Borneo and Palawan (Philippines), Java and the Lesser Sunda Islands (Berg et al., 2006, Williams et al., 2017). In Indonesia, Benda is known as bendho (Java), teureup (Sundanese, Java), mengko (Sumatra); in Malaysia: terap nasi (Peninsular), terap (Sarawak); in Thailand: oh, ka-oh, tuka (Peninsular) (Djarwaningsih et al., 1995).

The important species belong to the genus *Artocarpus* are *Artocarpus heterophyllus* (Jack fruit), *Artocarpus altilis* (Breadfruit), *Artocarpus hirsutus* (Wild jack), *Artocarpus lakoocha* and *Artocarpus camansi* (Breadnut) (Hari et al., 2014). The genus *Artocarpus* is known to possess potential phytochemicals such as new coumarin isolated from *A. altilis* leaves with antioxidant activity (Abbas et al., 2011). Flavonoid from the bark of Cempedak (*A. champeden*) has potential to be developed as a new antimalarial drug (Nindetu, 2009). Hafid et al. (2010), it was reported that extract from *A. champeden* exhibited potent antimalarial activities against *P. falciparum* in vitro and *P. berghei* in vivo. Several isolated compounds from *A. champeden* exhibited antimalarial activity. Chemical compounds isolated from *A. kemando* displayed inhibition effects to a very susceptible degree in cancer cell line tests (Ee et al., 2011). Phytochemical analysis of *A. lakoocha* revealed the presence of tannins and alkaloids (Kumar et al., 2010).

Carbohydrates play a major role in human diet, comprising about 4 - 85% of energy intake. Its most important nutritional property is its easy digestibility in the small intestine (Shakappa & Talari, 2016).

The genus *Artocarpus* consists of 45 species in which the fruits of 15 species of *Artocarpus* are widely used as table fruit or processed materials in Indonesia such as jackfruit, and its relatives include *A. elasticus* (Uji, 2004). However, research on *A. elasticus* is still rarely done, and neither is its use in the community. The objective of this study was to study ethnobotany and

determine the nutrient content of Benda (*A. elasticus*). Therefore, it needs to be explored further in order to support the diversification programme.

Materials and Methods

The study was conducted in the city of Bogor and Bogor regency, West Java: 106º43'30'' – 106º51'00''E and 30'30'' – 6º41'00''S, with altitude ranging from 190 to maximum 350 m.a.s.l. (Figure 1). Data on *A. elasticus* was collected by interviewing local communities (Sundanese) comprising about 20 people, men and women, especially about Benda plant (*Artocarpus elasticus*) (Table 1). Interviews were conducted in open, free and purposive sampling as well as direct observation in the field by showing a picture of Benda (Walujo, 2004; Vogl et al., 2004; Nolan & Turner, 2011). In addition to the interviews, plant collections for herbarium samples, fruits and seeds were collected for proximate analysis.

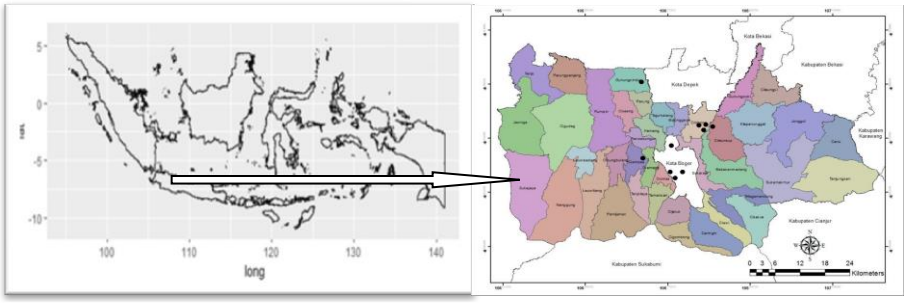

Figure 1. Maps of Indonesia (left), Bogor (right)

Table 1. Characteristic of respondents in Bogor, West Java

	Data	Total number	Percentage (%)
Gender	Male	13	59.09
	Female	9	40.91
Age	50 - 60	8	36.36
	40 - 49	7	31.82
	30 -39	7	31.82
Education	Primary school	10	45.45
	Junior high school	8	36.36
	Senior high school	4	18.19
Job	Employee	4	18.19
	Worker	13	59.09
	Housewife	3	13.63
	Fruit seller, bird seller	2	09.09

Proximate analysis was carried out in the Research Center for Bioresources and Biotechnology, IPB University. Proximate analysis was performed using the standard AOAC methods (1984). Ash content was determined through the gravimetric method. The Kjeldahl method was used to determine protein content. Fat content was determined using the Soxhlet method; while crude fibre content by gravimetric; carbohydrates by different method.

Results

Based on the results of interviews and field observations, it is known that Benda plant is scattered in several locations in the city of Bogor and Bogor regency (Cikaret, Pasir kuda, Semplak, Tanah baru, Salabenda), Botanical Garden and several districts of Ciampea (Cicadas 1 village); Cibinong: Sampora, Nanggewer, Nanggewer Mekar; Citeureup (Leuwinutug village); Sukaraja (Cijujung village), and Gunung Sindur (Pabuaran village) (Table 1) (Figure 1).

Table 2. Distribution of benda in Bogor city and Bogor regency

No	Location in Bogor city	Location in Bogor regency
1.	Cikaret (west of Bogor city)	Cicadas 1 Village (Ciampea district)
2.	Pasir kuda (west of Bogor city)	Sampora (Cibinong)
3.	Semplak (west of Bogor city)	Nanggewer (Cibinong)
4.	Tanah Baru (North of Bogor city)	Nanggewer Mekar (Cibinong)
5.	Salabenda (North of Bogor city)	Leuwinutug Village (Citeureup district)
6.	Botanical gardens (Centre of Bogor city)	Cijujung Village (Sukaraja district)
7.		Pabuaran Village (Gunung Sindur district)

Only a small number of Sundanese people in Bogor know about Benda , this is due to the decreasing population of Benda to the extent that it is rarely found and increasing human population causes a decrease in land for planting Benda. Benda is usually found on the banks of rivers, open areas next to housing estates and in the Bogor Botanical Garden. Benda plants are also known by the people of Cianjur regency.

A. elasticus is a tree (Benda) up to 40m in height. The leaves are spirally arranged; lamina coriaceous to chartaceous, entire, elliptic, size 20-95cm by 10-50cm, or when a juvenile is pinnately incised with 3 or 4 pairs of lobes; upper surface scabrous. Infructescences are ellipsoid to cylindrical or to subglobose, size up to 6-17cm by 5.5-12cm, covered with 3-4mm long cushion shaped to pyramidate to cylindrical apices of the perianths: skin covered with yellow-brown to bright orange; fruits are sweet, aromatic (but not as strong as

A. champeden), 4–207 seeds, and edible; fruiting in August-September and ripening in December–January (Figure 2 & 3); seeds are many and variation shaped, oval, globose, circa 1cm long. A tree has circa 200 fruits, their weight is 234-565 grams. It sometimes grows up to 1,500 m above sea level. This species is closely related to *A. sericicarpus*.

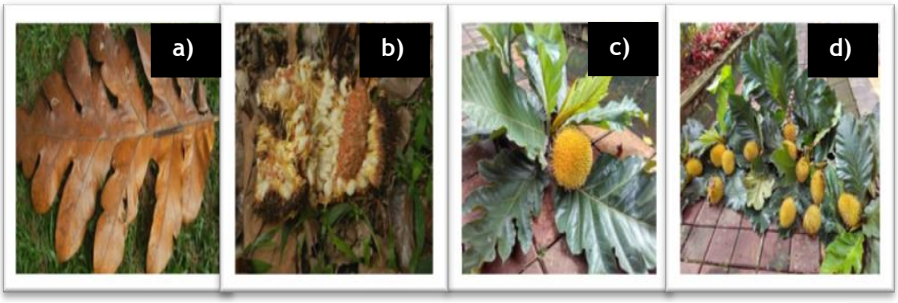

Figure 2. Leaves, Fruits of 'Benda' (a) Dry leaf), (b) Ripe fruit with seeds exposed, c) Single ripe fruit with leaves and (d) Many ripe fruits (*Artocarpus elasticus*)

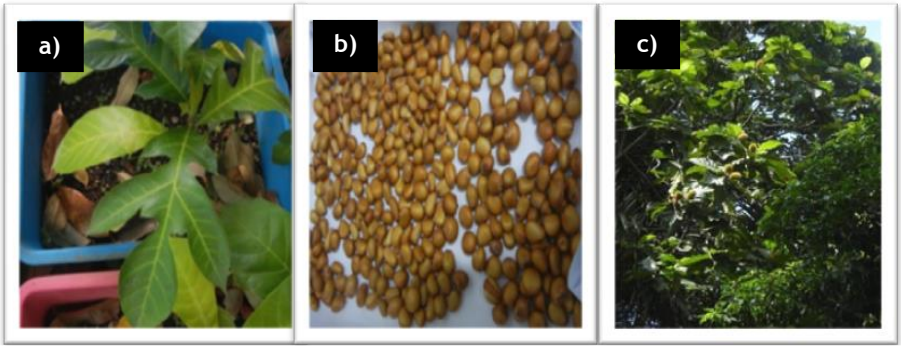

Figure 3. (a) Seedling, (b) seeds and (c) habit of Benda (*Artocarpus elasticus*)

Based on specimens of *A. elasticus* in Herbarium Bogoriense, Botany Division, Research Center for Biology, this species was found in the Thai - Malay Peninsula, Indo Burma, Sumatra, Borneo and Palawan (Philippines), Java and the Lesser Sunda Islands.

Benda (*A. elasticus*) and its utilization today is less known; however, it was popular around 25 years ago. The flesh of ripe fruits are eaten raw, while the seeds are cooked before being consumed, unripe fruits can also be eaten cooked. The seed resemble peanuts seed; it is consumed fried or roasted after

washing. The stem's latex which is known as Pulut is used to snare birds/ birdlime which can ensnare little birds. Apart from latex of Benda, people also use latex from breadfruit, jackfruit and rubber to trap birds. The latex from Benda can be used without any latex mixture from other plants. Benda latex is more sticky compared to other latex. Latex from other species of *Artocarpus* such as *A. champeden*, is also used for birdlime (Heyne, 1987). The wood of Benda is usually used as a coffin board (Table 3).

Table 3. Utilization of Benda (*A. elasticus*)

No	Part of Plant	Utilization
1.	Fruit	Flesh of ripe fruits eaten raw and unripe fruits eaten cooked
2.	Seed	consumed fried or roasted after washing
3.	Latex	used to snare birds/ birdlime
4.	Wood	used as coffin board

The results of proximate analysis of seeds and flesh of Benda collected from Bogor show that Benda seeds contain 1.43% ash, 6.85% protein, 2.39% fat, 10.62% crude fiber, 49.03% carbohydrate (Table 4). Steamed Benda flesh contain 1.21% ash, 0.97% protein, 0.61% fat, 2.73% crude fiber, 11.72% carbohydrate (Table 5). Proximate composition is important in determining the quality of raw material and often the basis for establishing the nutritional value and overall acceptance of consumers (Kavitha & Parimalavalli, 2014).

Table 4. Proximate Composition of Benda, Tarap, Jackfruit and Pigeon pea

Samples	Benda seeds (*A. elasticus*)	Tarap seeds (*A. odoratissimus*)*[1]	Jackfruit seeds (*A. heterophyllus*)*[2]	Pigeon pea (*C. cajan*)*[3]
Ash %	1.43	1.17		3.80
Protein %	6.85	8.80		14 - 30
Fat %	2.39	15.60	5.40	1 - 9
Crude fiber %	10.62	12.30		5 - 9.4
Carbohydrate %	49.03	49.65	51.10	36 - 65.8

Note: *[1]Masri et al. (2017); *[2] Mahmud et al. (2009); *[3]Van der Maesen & Somaatmadja (1989).

Table 5. Proximate Composition of Benda flesh, Tarap flesh

Samples	Benda flesh (*A. elasticus*)	Tarap flesh (*A. odoratissimus*) *[1]
Ash %	1.21	0.6 – 0.8
Protein %	0.97	1.2 – 1.5
Fat %	0.61	
Crude fiber %	2.73	0.8 - 1.3
Carbohydrate %	11.72	12.0 - 25.2

Note: *[1]Tang *et al.* (2013)

Discussion

According to Uji (2004), there are many species of native fruits from Kalimantan, edible or genetic biodiversity source. These are mostly in the form of trees and Moraceae are among the top trees after Euphorbiaceae and Anacardiaceae. *A. elasticus*, one species of Moraceae.

For Bogor city, many regions come from the name of plants in Sunda language or Indonesian language commonly. Not many people realize that the name of their home comes from a plant name. Based on Hidayat (2009) about region names that still exist and those that do not any longer, in Bogor Regency there are names that come from the family of Moraceae, especially *Artocarpus*, like Bojong Nangka, Ciampea (*Artocarpus heterophyllus*), Bojong kulur (*Artocarpus altilis*), Cigudeg (*Artocarpus heterophyllus*)and Citeureup (*Artocarpus elasticus*). In this research, Citeureup and Ciampea are included.

According to Megawati et al. (2015), based on the diversity of native Kalimantan fruit trees in the Botanical Garden of Mulawarman University, Samarinda it is known from 235 Ha there are 18 species of trees, and the dominant one is the Moraceae family, and the most species is terap (*Artocarpus elasticus*) comprising 95 trees.

Places to grow Benda apart from the botanical garden are in areas where the tree is in poorly maintained condition, such as at cliffs or riverside prone to flooding, and trees that are not maintained grow wild. Sujarwo *et al*. (2016) stated that like in Bali, land use changes were observed and identified as causes of decline for *Artocarpus elasticus*, *Amorphophallus campanulatus*, *Arenga pinnata*, and *Borassus flabellifer*. The consumption of wild and semi-wild edible plants has been "a way of life" for many rural populations throughout the world. The wild edible plants are used as supplements to food but information on possible toxic effects are not known (Acharya & Acharya, 2010).

In three years, two out of seven Benda trees were lost because they were old and some were too close to rivers/cliffs causing them to die easily. Some were lost to make way for construction of buildings. One way to preserve this tree is through cultivation. Cultivation efforts are still needed, as from 226 species in 35 plant families of fruits native to Kalimantan, only 58 species were cultivated (Uji, 2004). There are 15 species of *Artocarpus* genera, and of these 11 species have been planted in local community gardens and 12 species grew wild in the forest in Kalimantan (Siregar, 2006).

Proximate analysis of Benda seeds is almost the same compared to that *A. odoratissimus* seeds i.e. 1.17% ash, 8.8% protein, 15.60% fat, 12.30% crude fiber, 49.65% carbohydrate (Masri et al., 2017). Carbohydrate and fat content of Benda seeds is lower compared to that of Jackfruit seeds i.e. 51.10% carbohydrate and 5.40% fat (Mahmud et al., 2009), and Sy Muhammad et al. (2019) reported, that the proximate analysis of Jackfruit seed powder i.e. 69.39 carbohydrate%, 13.67% protein, 10.78% moisture, 2.41% ash, 0.75% fat and 3.00% crude fiber.

Proximate analysis of *Cajanus cajan* i.e. 3.8% ash, 14-30% protein, 1–9% fat, 5-9.4% crude fiber, 36-65.8% carbohydrate (Van der Maesen & Somaatmadja, 1989) (Table 4). Proximate analysis of benda flesh is almost the same with *A. odoratissimus* flesh i.e. 0.6-0.8% ash, 1.2-1.5% protein, 0.8-1.3% crude fiber, 12.0-25.2% carbohydrate (Tang et al., 2013) (Table 5).

One such popular variation commonly found in Brunei Darussalam is its hybrid with *A. heterophyllus* (Jackfruit). The hybrid is locally called Tibadak-nangka or nanchem since the local name for Jackfruit is Nangka and *A. champeden* is known as Chempedak. Both *A. champeden* and its hybrid are popular edible fruits in Brunei Darussalam as well as in South East Asia due to their soft and firmly textured flesh. Ripened *A. champeden* (2.8 – 3.5%) and Nanchem (3.2 – 3.4%) have higher total carbohydrates and energy content than the unripe (1.8 – 2.5%) seed (Lim et al., 2011).

Aside from being used as food, latex of Benda is also used as an adhesive, to ensnare small birds. Pulut is an effective way to trap small birds wthout injuring or damaging bird feathers (Munandi, 2013; Miller, 2019). The study of Ridwan et al. (2015) showed that there is a relationship between bird population and the diversity of trees in Kentingan Campus Surakarta, i.e. Moraceae, Fabaceae and Myrtaceae inhabited by Cabai Jawa (*Dicaeum trochileum*), Pleci/Kacamata (*Zosterops palpebrosus*), Prenjak Jawa (*Prinia familiaris*).

In other locations there are 22 latex producing plants including those from the Moraceae family, namely *A. elasticus, Ficus* sp., *Parartocarpus* cf. *triandra* which is used by the Suku Anak Dalam in Jambi. The latex called Tungkal is used to catch birds (Andhika et al., 2015). *A. elasticus* is harvested from natural forests and indigenous agroforestry in Kalimantan (Uji, 2004).

Conclusion

Up to now the Sundanese community in Bogor consume the fruits and seeds of Benda (*A. Elasticus)* as an alternative food source, and use it as building material (wood). Benda contains a high carbohydrate content. This study can be an interesting insight for the community, breeders and policy makers.

Acknowledgment

The authors would like to express their gratitude to the informants in Bogor for their generosity in sharing their precious knowledge on the usage of Benda. Warm appreciation to Dr. Praptiwi, reader for the valuable and important comments and suggestions to the manuscript.

References

Abbas J, Djamilah, Artanti N. 2011. Bioactive Coumarin from the Leaves of *Artocarpus altilis*. *Proc. of The Second Int. Symposium on Temulawak IPB*, Bogor.p:258-63.

Acharya KP, Acharya R. 2010. Eating From The Wild: Indigenous Knowledge on Wild Edible Plants in Parroha VDC of Rupandehi District, Central Nepal. *International Journal of Social Forestry* **3(1):** 28-48.

Andhika RR, Hariyadi B, Saudagar F. 2015. Etnobotani Penghasil Getah Oleh Suku Anak Dalam di Taman Nasional Bukit Duabelas Kabupaten Sarolangun, Jambi. *Jurnal Ilmu Pertanian Indonesia* **20(1):** 33–38.

AOAC. 1984. *Official methods of analysis*. Association of official Analytical Chemists. Washington DC. USA.

Berg CC, Corner EJH, Jarrett FM. 2006. Moraceae Genera Other Than Ficus. *Flora Malesiana* **1(17):** 1–152.

Djarwaningsih T, Alonso DS, Sudo S, Sosef MSM. 1995. *Artocarpus* JR Forster & JG Forster In: 59 – 71. *Lemmens* et al. (Eds.). *Plant Resources of South- East Asia* 5 (2). *Timber Trees: Minor Commercial Timbers*. Indonesia.

Ee GC, Teo SH, Rahmani M, Lim CK, Lim YM, Go R. 2011. Artomandin, a new xanthone from *Artocarpus kemando* (Moraceae). *Natural Product Research* **25(10):** 995-1003.

Hafid AF, Miatmoko A, Hidayati AR, Tumewu L, Radjaram A, Widyawaruyanti A. 2010. The Development of Tablet Formulation of *Artocarpus champeden* Stem Bark Extract as Antimalarial Drug. *Proc. of International Conference on Medicinal Plants*, Unair, Surabaya, Indonesia, 21-22 July 2010.

Hari A, Revikumar KG, Divya D. 2014. *Artocarpus*: A Review of its Phytochemistry and Pharmacology. *Journal of Pharma Search* **9(1):** 7-12.

Heyne K. 1987. *Tumbuhan Berguna Indonesia*. Badan Litbang Departemen Kehutanan. Yayasan Sarana Wana Jaya. Jakarta (terjemahan).

Hidayat S. 2009. Toponimi Bogor dalam Dunia Tumbuhan Sebagai Salah Satu Kajian Dasar Etnobotani. P: 564 – 70. Purwanto & Walujo (Eds.). *Proc. of Seminar Nasional Etnobotani IV*. Keanekaragaman Hayati, Budaya dan Ilmu Pengetahuan. Puslit.Biologi – LIPI.

Kumar MBS, Kumar MCR, Bharath AC, Kumar HRV, Kekuda TRP, Nandini KC, Rakshitha MN, Raghavendra HL. 2010. Screening Of Selected Biological Activities Of *Artocarpus lakoocha* Roxb (Moraceae) Fruit Pericarp. *Journal of Basic and Clinical Pharmacy* **1(4):** 239–245.

Kavitha S, Parimalavalli R. 2014. Effect of Processing Methods on Proximate Composition of Cereal and Legume Flours. *Journal of Human Nutrition and Food Science* **2(4):** 1051- 1055.

Lim LBL, Chieng HI, Wimmer FL. 2011. Nutrient Composition of Artocarpus *champeden* and its hybrid (Nanchem) in Negara Brunei Darussalam. *ASEAN Journal on Science and Technology for Development* **28(2):** 122–138.

Mahmud MK, Hermana, Zulfianto NA, Apriyantono RR, Ngadiarti I, Hartati B, Bernadus, Tinexcelly. 2009. *Tabel Komposisi Pangan Indonesia*. Persatuan Ahli Gizi Indonesia. Kompas Gramedia. Jakarta. 64 p.

Masri N, Mansoor AH, Mamat H. 2017. Proximate composition, mineral content and functional properties of Tarap (*Artocarpus odoratissimus*) seed flour. *Food Research* **1(3)**: 89–96. https://doi.org/10.26656/fr.2017.3.025.

Megawati TF, Kamarubayana L, Endayani S, 2015. Inventarisasi Dan Pemetaan Pohon Buah (Edible Fruits) Asli Kalimantan Di Kebun Raya Univ. Mulawarman, Samarinda (KRUS). *Agrifor* **14(2):** 269-286.

Miller B. 2019. *Cara Menangkap Burung Liar Di Hutan (Ciblek, Prenjak, Kolibri)*. https://nsela.net/cara-menangkap-burung-liar/ July 29 2019 (Access Oktober 29, 2019).

Munandi A. 2013. Menangkap Burung Lengkap menggunakan getah. https://omkicau.com/2013/08/19/menangkap-burung-lepas-menggunakan-getah/. (Access Oktober 29, 2019).

Nindetu M. 2009. Prospek Senyawa Flavonoid kulit batang Cempedak Sebagai inhibitor Detoksifikasi hemeparasit Malaria. *Tumbuhan Obat Indonesia* **2 (2):** 72–82.

Nolan JM, Turner NJ. 2011. *Ethnobotany*: The Study of People – Plant Relationship. In: *Anderson EN, Pearsall D, Hunn E, Turner NJ* (Eds). *Ethnobiology*. Wiley - Blackwell, New Jersey: 133–48.

Ridwan M, Choirunnafi A, Sugiyarto, Suseno WA, Putri, RDA. 2015. Hubungan Keanekaragaman Burung dan Komposisi Pohon di Kampus Kentingan Universitas Sebelas Maret Surakarta, Jawa Tengah. *Proc. of Seminar Nasional Masy. Biodiv. Indon.* **1(3):** 660–666.

Sastrapradja S. 2006. Mengelola Sumber Daya Tumbuhan Di Indonesia. Mampukah Kita? In: 209 - 232. *Soemodihardjo, S. & Setijati, D. Sastrapradja* (Eds.). *Enam Dasawarsa Ilmu dan Ilmuwan di Indonesia*. Naturindo. Bogor. 576 p.

Shakappa D, Talari A. 2016. Analysis of Available Carbohydrate Faractions From Indian Foods By Using A Modified AOAC Total Dietary Fiber Method. *Indian Indian Journal of Scientific Research* **7(1):** 1-9.

Siregar M. 2006. Review: Species Diversity of Local Fruit Trees in Kalimantan: Problems of Conservation and Its Development. *Biodiversitas* **7(1):** 94 – 99. DOI: 10.13057biodiv/d070123.

Sujarwo W, Arinasa IBK, Caneva G, Guarrera PM. 2016. Traditional knowledge of wild and semi-wild edible plants used in Bali (Indonesia) to maintain biological and cultural diversity. *Plant Biosystems* **150(5):** 971–976, http://dx.doi.org/10.1080/ 11263504.2014.994577.

Sy Mohamad SF, Said MF, Munaim MSA, Mohamad S, Wan Sulaiman WMA. 2019. Proximate composition mineral contents, functional properties of Mastura variety Jackfruit (*Artocarpus heterophyllus*) seeds and lethal effects of its crude extract on zebrafish (Danio rerio) embryos. *Food Research* **3(5):** 546–555. https://doi.org/10.26656/fr.2017.3(5).095.

Tang YP, Linda BLL, Franz LW. 2013. Proximate Analysis of *Artocarpus odoratissimus* (Tarap) in Brunei Darussalam. *International Food Research Journal* **20(1):** 409–415.

Uji T. 2004. Keanekaragaman Jenis, Plasama Nutfah, Dan Potensi Buah - buahan Asli Kalimantan. *BioSmart* **6(2):** 117 – 125.

Van der Maesen LJG, Somaatmadja S. (Eds.). 1989. Plant Resources of South East Asia. No 1. Pulses. Pudoc, Wageningen.

Vogl CR, Vogl-Lukasser B, Puri RK. 2004. Tools and Methods for Data Collection in Ethnobotanical Studies of Homegardens. *Field Methods* **16(3):** 285–306.

Walujo EB. 2004. Pengumpulan Data Etnobotani. In *Rugayah, Elizabeth A. Widjaja dan Praptiwi* (Eds). *Pedoman Pengumpulan Data Keanekaragaman Flora*. Pusat Penelitian Biologi-LIPI.

Widjaja EA, Rahayuningsih Y, Rahajoe JS, Ubaidillah R, Maryanto I, Walujo EB, Semiadi G. 2014. *Kekinian Keanekaragaman Hayati Indonesia*. LIPI Press.

Williams EW, Gardner EM, Harris R, Chaveerach A, Pereira JT, Zerega NJ. 2017. Out of Borneo: biogeography, phylogeny and divergence date estimates of *Artocarpus* (Moraceae). *Annals of Botany* **119:** 611–627. Doi: 10.1093/aob/mcw249.