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Ethnobotanical study on plant leaves for food wrapping in traditional markets of Wonosobo District, Central Java, Indonesia

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Abstract. *Metananda AA, Afrianto WF, Hasanah LN, Aini YS, Noorfajria AS. 2023. Ethnobotanical study on plant leaves for food wrapping in traditional markets of Wonosobo District, Central Java, Indonesia. Biodiversitas 24: 3804-3814.* Currently, almost all items in our daily life are made from plastic, such as food packaging, household appliances, drink bottles, and plastic bags. The use of plastic packaging can harm the environment and human health. Plant leaves for food wrapping can be an alternative to reduce these impacts. Indonesia has many cultures, philosophies, and social activities related to using plant leaves for food wrapping. This study aimed to document public knowledge about plant leaves for food wrapping in the traditional markets of Wonosobo District, Central Java Province, Indonesia. This study used the purposive sampling technique to select 41 informants for the interviews. A total of 10 plant leaves species belonging to 7 families were used for food wrapping by traders in the traditional markets of Wonosobo District. The ten species were *Musa* spp., *Tectona grandis*, *Cocos nucifera*, *Artocarpus heterophyllus*, *Artocarpus camansi*, *Ficus septica*, *Hibiscus tiliaceus*, *Pandanus amaryllifolius*, *Cordyline fruticosa*, and *Alocasia macrorrhizos*. These trees dominate plant growth forms in this study. The leaves of these different plants were used as food plates and wraps for multiple dishes. Efforts are needed to reduce plastic use in the traditional markets by making regulations to minimize or substitute with plant leaves.

Keywords: Food wrapping, plant leaves, plastic, traditional markets, Wonosobo

INTRODUCTION

Recently, almost all items in our daily life are made from plastic, such as food packaging, household appliances, drink bottles, and plastic bags. This is not without reason because plastic is a practical and economical material to be processed into a product. The use of plastic from time to time continues to increase significantly. However, plastic can have negative impacts on the environment and human health. This object is difficult to decompose in nature, and long-term use is also dangerous for human health.

Plastic pollution has emerged as a pressing environmental issue of considerable significance in contemporary times. Plastic pollution does not occur on land but also pollutes the rivers because of the large amount of garbage dumped in the rivers. High pollution in the marine can cause several negative impacts, such as increasing the potential for flooding (Honingh et al. 2020), disturbing marine habitats and biodiversity (Gall and Thompson 2015; Compa et al. 2019; Azevedo-Santos et al. 2021), the risk to food safety and human health because of contamination of water and seafood with microplastics (Smith et al. 2018; Danopoulos et al. 2020).

Indonesia encounters significant environmental challenges, particularly in relation to the issue of plastic pollution. (Purba et al. 2019; Vriend et al. 2021). According to data from the Indonesian Ministry of Environment and Forestry, the total waste heap in Indonesia reaches 30,783,783.82 tons/year, of which 34.94% of the waste needs to be managed correctly (KLHK 2021). After China, Indonesia is the second most significant contributor to marine plastic waste globally. Cigarette butts were found the most, followed by food packaging and plastic waste in drink bottles, crackle bags, plastic straws, plastic containers, plastic drink lids, and styrofoam (Abdila 2021). Plastic pollution in Indonesia is expected to increase. For example, in the beverage industry of Indonesia in the first quarter of 2019, the growth of the beverage processing industry reached 24.2% year-on-year (YoY), only behind the apparel industry. Rapid growth will increase the number of plastic waste.

For human health, it can make a particle and chemicals toxic because plastic equipment is made from polypropylene, polyethylene terephthalate, polyester, polyethylene, polystyrene, polycarbonate, epoxy resins, polyvinylidene chloride, polysulfone, polyvinyl chloride, and melamine formaldehyde (Vethaak and Leslie 2016). Furthermore, plastic debris can be a pathogen and parasite vector. For instance, human pathogenic bacteria, i.e., *Bacillus cereus*, *Escherichia coli*, and *Stenotrophomonas maltophilia*, are found in plastic debris off the Belgian coast (van der Meulen 2014).

The use of leaves as dining plates, food wraps, and food packing materials is closely related to religious, medicinal, cultural, and socio-economic aspects (Mensah et al. 2012; Hounsou et al. 2022; Ouétchéhou et al. 2022). Generally, traditional markets provide various fresh agricultural products and traditional foods (Iskandar et al. 2018; Deanova et al. 2021; Iskandar et al. 2022). In contrast to modern markets, where alternative materials are predominantly employed for dining plates, food wraps, and food packaging, using leaves remains prevalent in traditional markets. Apart from being an alternative to reducing the use of plastic, the use of leaves will also be able to increase the value of plants, especially for plant species that have been forgotten (Afrianto et al. 2020; Afrianto et al. 2021; Afrianto et al. 2022; Afrianto et al. 2023). This study aims to document public knowledge about plant species and how to use them for food wrapping in Wonosobo District, Central Java Province, Indonesia.

MATERIALS AND METHODS

Study area

The study was carried out in January 2021 in seven traditional markets of Wonosobo District, Central Java Province, Indonesia. The study areas are (i) Leksono Market, (ii) Wonosobo Market, (iii) Selomerto Market, (iv) Garung Market, (v) Kejajar Market, (vi) Kertek Market, and (vii) Kalibeber Market (Figure 1). Wonosobo is located at 7.3684940°S 109.8983841°E, about 120 km from Semarang. This district is located in the Dieng Plateau. Its area is 984.68 km², and its population is 879,124 at the 2020 census. Most of Wonosobo District is a mountainous area. The eastern part of the area (border with Temanggung District) contains two prominent volcanoes: Mount Sindoro (3,136 meters) and Mount Sumbing (3,371 meters). The northern area is part of the Dieng Plateau, with its peak Mount Prahu (2,565 meters). In the south, there is Wadaslintang Reservoir. The topography of the Wonosobo District area has hilly and mountainous characteristics, located at an altitude between 200 to 2,250 m above sea level. Wonosobo District comprises 15 sub-districts, 29 urban villages (*kelurahan*), and 236 villages (*desa*).

Data collection

Forty-one respondents were selected through purposive sampling based on different socio-demographic conditions (i.e., sex, age, and education) and commodities sold (Table 1). Prior to commencing the interview, explicit consent was obtained from the participants, and the subsequent interview procedures adhered to internationally recognized ethical guidelines. The compilation of plant specimens in this study was conducted in accordance with established taxonomical protocols, and the corresponding plant names have been revised and documented on the botanical website (http://www.plantsoftheworldonline.org). Notably, no deposition of plant specimens into the herbarium was undertaken as part of this investigation.

Data analysis

The data analysis in this study was conducted using an ethical approach and an emic perspective, employing a three-step process that involved cross-checking, summarizing, and synthesizing. Furthermore, narrative descriptive analysis was employed as the analytical framework as described by Iskandar (2018). Cross-checking was done to validate data from the respondents according to observations and reports. The cross-checking data were then summarized and synthesized. An index of interest types of plant species (Fidelity level) was calculated by the formula as follows:

$$FL = Ip/Iu \times 100\%$$

Where:
FL : Fidelity level
Ip : Number of informants who gave the same answer to a particular plant species
Iu : The total number of informants who expressed the usefulness of these plant species

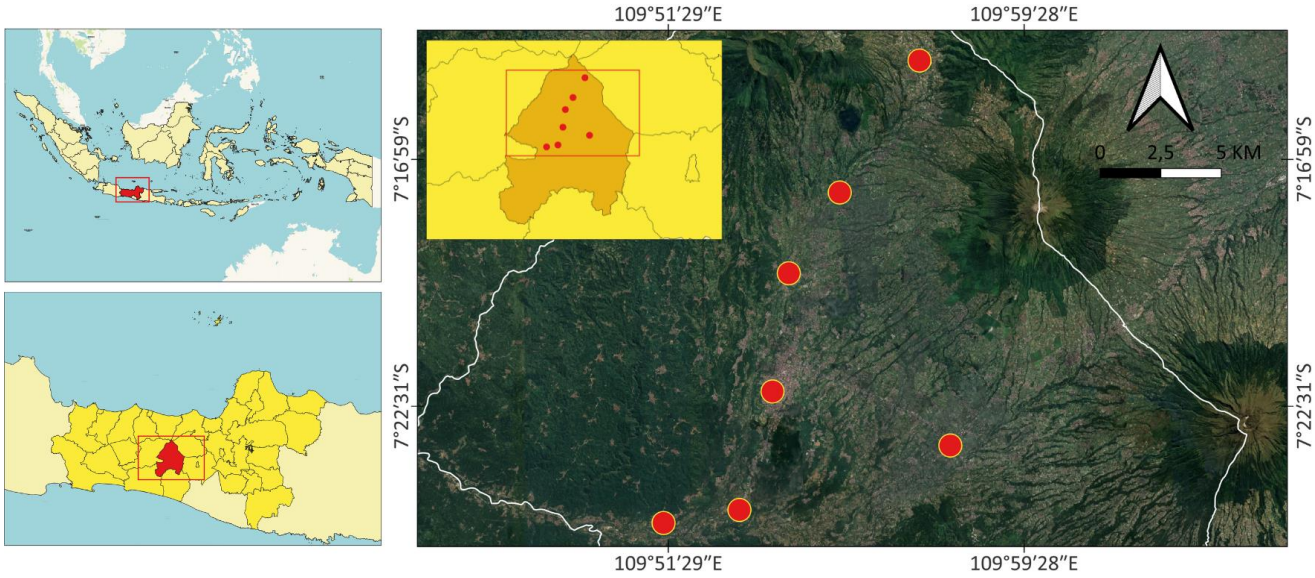

Figure 1. A map study area in Wonosobo District, Central Java Province, Indonesia

RESULTS AND DISCUSSION

Description of the traditional markets

This study observed that markets generally offer a wide range of products, including produce, pantry items, dairy products, snacks, meat and fish, and wellness-related items (Figure 2). The market conditions, exemplified by Leksono Market in Garung, Wonosobo, and Selomerto Market, have been revitalized, resulting in an overall average state of cleanliness, tidiness, absence of odors, and a modernized ambiance. For Wonosobo Market, it is a wholesale market in Wonosobo District. The Wonosobo Market is located in the city center of Wonosobo District, founded in 1861 and completed in 2005. It has a land area of 17,945 m^2 and a building area of 14,434 m^2; Until now, there have been 2,746 merchant booths and 320 stalls. Kejajar Market is located in Serang, Kejajar Subdistrict, Wonosobo District. This market is located on the route to the Dieng Mountains, so many people also visit it for tourist purposes. This market is open from 4 am to 3 pm. Pasar Kertek is the biggest market in Wonosobo. This market operates 24 hours a day. However, this market condition needs to be maintained. Some traditional markets will be crowded according to the Javanese calendar (every *pahing* and *wage* day), such as the Kretek and Leksono markets. *Pahing* and *Wage* Day are one of the Javanese calendar systems used to determine luck, event planning, and specific activities.

Socio-demographic characteristics

This study interviewed a total of 41 informants. Table 1 shows that 95.1% were females, and 4.9% were males. The age range was dominated by 51-60 (34.1%) and 41-50 (29.3%). Most of them have an elementary school education (61.1%), while the percentage of other educational levels is no school (22.1%), middle school (14.6%), and high school (2.4%). Most of them know how to make packaging out of these leaves based on previous generations of information, and many sellers still know about food wrappers from leaves for traditional food. Even so, many traders admit they do not know its philosophical values, especially for younger generations. It aligns with Mutaqin et al. (2020) that there needs to be more traditional ecological knowledge among the younger generation regarding knowledge of plant utilization. Several factors can cause the loss of traditional knowledge, including bilingualism, education, and subsistence mode (Iskandar et al. 2018).

Diversity of plant leaves used for food wrapping and their uses

In the study areas, a total of 10 plant leaves utilized for food wrapping purposes, belonging to 7 distinct plant families, were identified. Table 2 displays local names, scientific names, family names, growth forms, habitats, and management. The family was dominated by Moraceae (3 species) and growth-form trees (6 species). Most plant species' habitats were from the garden and backyard (9 species), and it was cultivated (9 species). Table 3 shows that *Musa* spp., *C. nucifera*, and *P. amaryllifolius* were sold. The prices of *Musa* spp. per bunch was IDR 11,000. Meanwhile, the price for *Ketupat* rhombus is around IDR 500-1,500 per each. *Musa* spp. can generally be found in all traditional markets of the Wonosobo District. This is related to the Javanese culture, which uses leaves as part of the consumption process, especially as wrappers.

Based on the informants, 28 foods used *Musa* spp. as food met, wrapping, and dining. In addition, informants also stated that *Musa* spp. could be used for wrapping fresh flowers and vegetables. Leaves with a long and wide morphology tend to be used for various uses, as in *Musa* spp., which can be used for food met, wrapping, and dining. On the other hand, leaves with a narrow morphology, such as *C. nucifera*, are only used as food wrapping.

Table 1. Socio-demographic of respondents

Categories	Alternatives	Total (n=41)	Percentage (%)
Sex	Male	2	4.9
	Female	39	95.1
Age	20-30	1	2.4
	31-40	6	14.6
	41-50	12	29.3
	51-60	14	34.1
	>60	8	19.5
Education	No school	9	22.1
	Elementary school	25	61.1
	Middle school	6	14.6
	High school	1	2.4
	University	0	0

A **B**

Figure 2. Trading conditions in traditional markets, (A) inside and (B) outside in Leksono Market

Table 2. List of the diversity of plant leaves used for food wrapping in Wonosobo District, Indonesia; (1) Leksono Market (LM), (2) Wonosobo Market (WM), (3) Selomerto Market (SM), (4) Garung Market (GM), (5) Kejajar Market (KEM), (6) Kertek Market (KERM), and (7) Kalibeber Market (KAM)

Local name	Species name	Family	Growth form	Habitat	Management	LM	WM	SM	GM	KEM	KERM	KAM
Andong	*Cordyline fruticosa* Göpp.	Asparagaceae	Shrub	Garden and backyard	Cultivated	-	-	-	-	-	-	+
Awar-awar	*Ficus septica* Burm. f.	Moraceae	Tree	Garden and backyard	Cultivated	+	-		-	-	-	-
Jati	*Tectona grandis* L.f.	Lamiaceae	Tree	Forest	Cultivated	+	-	+	-	-	-	-
Kelapa	*Cocos nucifera* L.	Arecaceae	Tree	Garden and backyard	Cultivated	+	+	+	-	-	-	-
Kluwih	*Artocarpus camansi* Blanco	Moraceae	Tree	Garden and backyard	Cultivated	-	-	+	-	-	-	-
Nangka	*Artocarpus heterophyllus* Lam.	Moraceae	Tree	Garden and backyard	Cultivated	-	+	-	-	-	-	-
Pandan	*Pandanus amaryllifolius* Roxb. ex Lindl.	Pandanaceae	Shrub	Garden and backyard	Cultivated	-	-	-	-	-	-	-
Pisang	*Musa* spp.	Musaceae	Herb	Forest, garden, and backyard	Cultivated	+	+	+	+	+	+	+
Sente	*Alocasia macrorrhizos* (L.) G.Don	Araceae	Shrub	Garden and backyard	Cultivated	+	-	-	-	-	-	-
Waru	*Hibiscus tiliaceus* L.	Malvaceae	Tree	Forest, garden, and backyard	Cultivated	-	+	+	-	-	-	-

Tabel 3. The usage of each plant species

Species name	Economic status	Foods	Utilization	IUCN status	FL (%)
Musa spp.	Sold	*Tempeh, pelas bongko, nagasari, lemper, lupis, pecel, pelas bongko, sengkulun, klepon, ketan, pepes, garang asem, pasung, wajik, gudeg, kue matasapi, rujak, cenil, carang gesing, bubur,* corn rice, *arem-arem, lemit, jongkong,* rice, *kue ku, meniran, bothok*	Food met, wrapping, and dining	NA	98
Tectona grandis L.f.	Unsold	Rice, *tempeh*	Food wrapping and dining	EN	29
Cocos nucifera L.	Sold	*Ketupat*	Food wrapping	NA	29
Hibiscus tiliaceus L.	Unsold	*Ikan pindang*, *tempeh*, rice, meat	Food wrapping and dining	LC	10
Artocarpus heterophyllus Lam.	Unsold	Rice, *kue pasung procot*, *apem*	Food wrapping	NA	7
Artocarpus camansi Blanco	Unsold	Rice	Food dining	NA	2
Ficus septica Burm. f.	Unsold	*Tempeh*	Food wrapping	LC	2
Pandanus amaryllifolius Roxb. ex Lindl.	Sold	*Ketupat*	Food dining	NA	2
Cordyline fruticosa Göpp.	Unsold	*Tempeh*	Food wrapping	LC	2
Alocasia macrorrhizos (L.) G.Don	Unsold	*Tape*	Food wrapping	NA	2

Notes: Not Evaluated (NE), Data Deficient (DD), Least Concern (LC), Near Threatened (NT), Vulnerable (VU), Endangered (ED), Critically Endangered (CR), Extinct in the Wild (EW), Extinct (EX), and Not Available (NA)

Table 4. Method to create food wrapping style using leaves

Wrapping style	How to create	Leaves
Clorot	The bone in the middle of the coconut leaves is discarded. Twist while rotating so that it forms a cone. The bottom must be tight so it does not leak. The top of the leaves is pinned so it does not come off.	*C. nucifera*
Ketupat	The way to make Ketupat is (1) *C. nucifera* leaves are rolled up to three times in the left hand with the bottom of the leaf facing up. (2) Leaves are taken to be rolled in the left hand three times with a bit of pressure by the thumb. However, this time the position of the leaves is facing upwards. (3) Both rolls of leaves are made but must be kept crossing each other. (4) One end of the leaves is taken and rotated behind the arrangement of the leaves. (5) The tip of the leaves that have been rotated is inserted into the middle position. The way to insert leaves is like weaving. (6) Weaving is continued to the bottom. The same process is also done on the other end. (7) The base of the leaves already on the side can be woven straight up.	*C. nucifera*
Lemper	Leaves are rolled and pinned on one end with a stick, then add the washed rice and compact it; in the last step, pin the other end to close it.	*Musa* spp.
Lepet	The coconut leaves are folded inward twice, then bent inwards. The inside of the leaf is filled with sticky rice. The middle part is folded, then tied to the right and left sides up to three times with bamboo. The remaining rope is pinned inside.	*C. nucifera*
Lontong	Leaves are rolled and pinned on one end with a stick, then add the washed rice and compact; in the last step, pin the other end to close it.	*Musa* spp.
Pasung	It is made by cutting leaves in the shape of a circle or semi-circle and then rolling them to form an elongated conical wrapping.	*Musa* spp.
Pincuk	It is made from square-shaped banana leaves that are folded to resemble a triangle, and the ends are pinned with sticks.	*Musa* spp., *T. grandis*
Pinjung	A square banana leaf then forms a cone, and then the remaining leaves are tucked in as a cover.	*Musa* spp.
Samir	Leaves are formed in a circle according to the size needed.	*Musa* spp.
Sudi	A piece of banana leaves is shaped into a circle and then pinned to the side with a stick. Then the pointy end is pressed inwards so that a triangle like a bowl appears.	*Musa* spp.
Sumpil	Leaves fold the triangle at one end, then fill it with food; the other end can be pinned with a stick or tucked in.	*Musa* spp.
Takir	It is made by folding the two ends, and then a stick must be attached so that it is sturdy and does not spill when filled with food.	*Musa* spp.
Tempeh	*Tempeh* is placed in the middle of the leaf, then folded until all parts are covered. So that the fermentation will be good, the leaves are then tied.	*Musa* spp., *T. grandis*, *H. tiliaceus*, *F. septica*, *C. fruticosa*
Tempeleng	Food is placed in the middle of a piece of banana leaves, and then the left and right sides are rolled up tightly. The top and bottom ends are then folded back.	*Musa* spp.
Tum	It is made with square banana leaves with both ends folded up and pinned with a stick.	*Musa* spp.

According to the IUCN (International Union for Conservation of Nature) status assessment, six plant species were classified as "unavailable" regarding their current availability (Table 3). *Tectona grandis* is categorized as endangered. Meanwhile, *H. tiliaceus*, *F. septica* and *C. fruticosa* are categorized as least concern. This observation suggests that the utilization of these leaves for food wrapping purposes is acceptable.

Table 3 shows that the highest fidelity level was *Musa* spp. (98%). As per the interview findings, several reasons were identified for choosing banana leaves as a preferred option. One of the primary factors is the wide and easily shapeable morphology of banana leaves. Banana leaves can also create a distinctive aroma in food when used as food wrappers. Another reason is that banana leaves are easy to get; some traders get them from their gardens or have to buy them. Furthermore, some traders preferred using banana leaves due to their perceived environmental friendliness compared to plastic materials.

Table 4 shows that the leaves of *Musa* spp. have the most diverse number of packaging forms. It is, then, followed by *C. nucifera* leaves. It also affects the intensity of using *Musa* spp. leaves in daily activities as food wrappers. In terms of food science, banana leaves gave the highest acceptability of the organoleptic test compared to plastic and teak leaves (Astuti 2009). According to Sulistiyono et al. (2016), *tempeh* with plastic wrap spoils more easily than those wrapped in banana and teak leaves. *Tempeh* is made from fermented soybeans with the help of the fungus *Rhizopus oligosporus*. This fermentation process produces a dense texture with a distinctive taste.

In contrast, the analysis of *tempeh* packaged in plastic revealed a more stable color change compared to the utilization of packaging materials made from various types of leaves, such as banana, teak, and hibiscus. This difference in appearance and color index suggests that plastic packaging provides better color stability for *tempeh* (Utama et al. 2018). According to Erdiansyah et al. (2021), the type of packaging material does not affect changes in the composition of the bacterial community in the *tempeh* fermentation process.

Musa spp.

Musa spp. is known as *pisang* in Indonesia and *gedhang* in Wonosobo (Java). *Musa* spp. is a fruit plant from the herbaceous category and originates from Indo-Malaya. This species belongs to the group of annual monocotyledonous terna in the form of a tree composed of pseudo stems. This pseudo stem is a pile of leaf sheaths that are arranged in a tightly regular manner. The characteristics of *Musa* spp. leaves are elongated and wide with large leaf bones called midribs. Its leaves have a high-water content and are hollow inside. The tip of the leaves is blunt with a flat edge. The leaves on the top surface are shiny and green. While at the bottom of *Musa* spp. leaves are covered with a layer of white wax. According to TFNet (2016), young leaves typically exhibit a dark green coloration, while the surface of mature leaves appears light green. Furthermore, newly emerged young leaves tend to be curled, reflecting their recent growth from the growing point. The pharmacological activities of *Musa* spp. leaves are antidiarrheal, anti-ulcerative, antimicrobial, hypoglycemic, hypocholesterolemic, antihypertensive, effective in atherosclerosis, antioxidant, diuretic, wound healing, antiallergic, antimalarial, effective on muscle, and mutagenicity (Imam and Akter 2011; Rao et al. 2014; Mathew and Negi 2017). Almost any leaf of *Musa* spp. can be used for wrapping, but according to the respondents, *Klutuk* or square banana (*Musa balbisiana*) is often used (Figure 3).

Tectona grandis

Tectona grandis originated in India and was deliberately cultivated in Indonesia. The tree exhibits substantial growth in tropical climates, attaining heights of up to 50 meters and a diameter of 2 meters. *Tectona grandis* trees are often found in dry areas with low soil. The leaf shape of *T. grandis* is round with a tapered tip. The leaf bone structure is pinnate. On the upper surface of *T. grandis*, the leaves are smooth. On the back, *T. grandis* leaves feel rough and jagged. The leaf size is 5-50 cm long and 30-25 cm wide (POWO 2023a). Pharmacologically, *T. grandis* leaves can be used for anti-inflammatory, antioxidant, analgesic, antipyretic, hypoglycemic, cytotoxic, wound healing, antimicrobial, and antiplasmodial activities (Nayeem and Karvekar 2011; Shoeb et al. 2014; Shahid et al. 2018; Vyas et al. 2019; Suryanti et al. 2020). *Tectona grandis* leaves are obtained from the garden or yard. Typically, traders do not purchase *T. grandis* leaves due to their requirement for leaves in smaller quantities. These leaves can be used as the packaging of *tempeh* (Figure 4).

Cocos nucifera

Cocos nucifera, commonly known as the coconut tree, originates from South America. Its leaves have parallel leaf veins and midribs. Strands of *C. nucifera* leaves are arranged on the right and left of the midrib. The leaves pinnate of *C. nucifera* has a feather shape of 4-7 m (long) and 1-1.5 m (wide) at the broadest part. Leaf stalks of coconuts are 1-2 cm in length and thorn-less (CABI 2014). The young leaves (*janur*) have a flexible texture and are easy to shape. The young leaves of the coconut are yellow and dark green when they are old. *Cocos nucifera* leaves extract can be used as an antimicrobial candidate (Uddin et al. 2020; Ngaffo et al. 2021).

The leaves of *C. nucifera* are traditionally woven into a shape called *Ketupat*. This food is made from rice and wrapped in woven young coconut leaves. *Ketupat* holds significant cultural and symbolic value as a traditional food item to celebrate Eid al-Fitr and Eid al-Adha. In Javanese culture, it is known as *Lebaran Kupat*, which takes place a week after Eid. At that time, people cooked or purchased *lepet* and *ketupat* (Figure 5A). *Kupat* stands for *laku papat* or four spiritual actions (Rianti et al. 2018): (i) *Lebaran*, which comes from the word width (over). *Lebaran* marks the end of the month-long fasting month of Ramadan. (ii) *Luberan*, which is derived from the word overflowing. In this case, overflowing is interpreted as an invitation to share the abundance of *Rizki* (wealth) by giving tithes and

alms to those entitled to receive it. (iii) *Leburan*, which comes from the word melt or eliminate. It means admitting mistakes, apologizing, and giving forgiveness. Thus, the sins and mistakes become melted. (iv) *Laburan*, which is derived from the word chalk, means to whiten the house's walls and purify the water. *Laburan* means that humans always maintain their inner and outer purity.

In addition, the square shape of the diamond is the embodiment of *kiblat papat lima pancer*. The four qibla are the four main cardinal directions, namely East, South, West, and North, based on one center. This means that wherever humans go, they should never forget *pancer* (center of life), God Almighty.

Lepet is also served on holidays. *Lepet* is a dish of glutinous rice, grated coconut and salt. *Lepet* comes from the word *silep* which means 'tomb or save,' and *rapet*, which means tight (Figure 5B). The famous proverb about *lepet* is *monggo dipun silep ingkang rapet*, which means 'let us bury it tightly.' In addition, *lepet* also has a symbol of purity and cleanliness. For this reason, many people use it as a hanger in front of the house (roof, door, and others) to drive away negative things. *Lepet* is similar to *lemper* and *lontong*, although the texture is tougher and stickier. The shape of *lepet* is unique because it resembles a corpse. *Lepet* is also given three coiled ropes like a corpse wrapper. Philosophically, being roped in three like a corpse means that mistakes should not become vengeful to death. In addition, *lepet* is a symbol that humans are not free from mistakes. It is hoped that with *lepet*, mutual understanding will grow and forgive each other's mistakes. Each material component used in making *lepet* has its meaning, as follows (Sitoresmi 2022): (i) Glutinous rice with a sticky texture illustrates a strong bond of friendship. (ii) Grated coconut, with its fine texture, serves as a metaphorical representation of the delicacy and refinement of emotions and behaviors expected from Muslims during the observance of Eid al-Fitr. (iii) Salt depicts the balance of relationships between harmonious communities. (iv) *Janur*, which comes from the word *jatining nur* which means true light, describes the sanctity of the human condition after receiving true light during Ramadan. The difficulty in taking the leaf from the top of the tree illustrates the efforts made by Muslims to achieve purity. (v) Bamboo rope is a symbol of strong friendship because of the nature of bamboo plants that grow in groups. (vi) *Clorot* is a traditional snack from Purworejo, Central Java, with a unique appearance (Figure 5C). The snack, wrapped in *C. nucifera* leaves, resembles miniature trumpets upon initial observation. This brown snack is made from rice flour, coconut milk, and liquid brown sugar. Not surprisingly, the texture of *clorot* feels very chewy and soft when eaten. Usually, *clorot* is served as a morning snack with hot tea or a complementary dish during celebrations or other traditional events.

Artocarpus heterophyllus

The origin of *Artocarpus heterophyllus* is India. The species has spread to various countries (tropical climates). Generally, *A. heterophyllus* trees are medium size with a height of around 20 m to 30 m. The leaves from *A. heterophyllus* are classified as single leaves and grow alternating patterns on plant branches. On the surface of the leaves, there is a color with a slightly slippery texture. On the surface of the leaves at the bottom, a dark green hue is present, accompanied by a subtly rough texture. The leaves of *A. heterophyllus* have an *apex folii* or a tapered leaf tip. The base of *A. heterophyllus* leaves has triangular support and a brownish tint. Even the leaves already have leaf edges that are flat and pinnately boned leaves (CABI 2023). The pharmacological uses of *A. heterophyllus* are antimicrobial, anticarcinogenic, and wound healing (Loizzo et al. 2010; Baliga et al. 2011; Periyanayagam and Karthikeyan 2013).

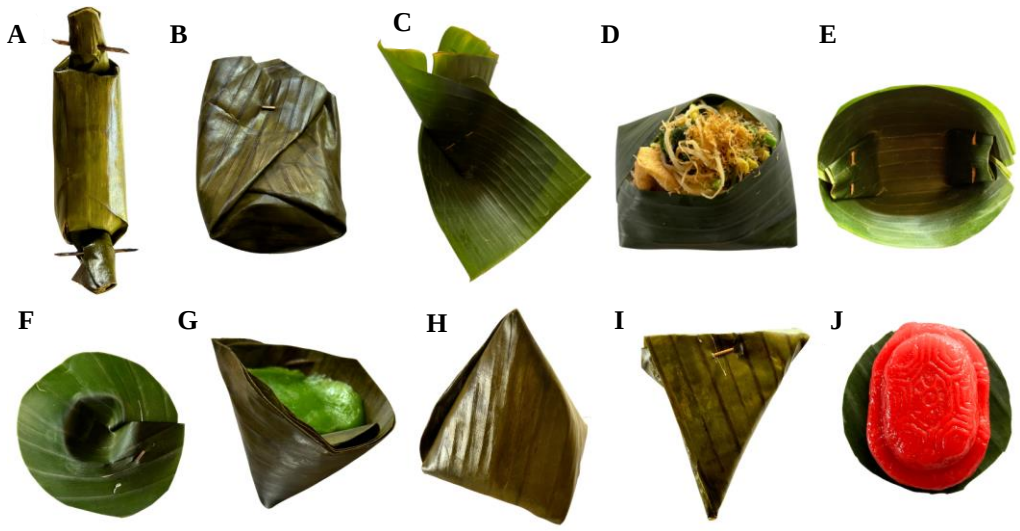

Figure 3. Food wrapping style of *Musa* spp. leaves. A. Lemper, B. Tum, C. Pincuk, D. Tempeleng, E. Takir, F. Sudi, G. Pasung, H. Pinjung, I. Sumpil, and J. Samir

Figure 4. Food wrapping style of teak leaves

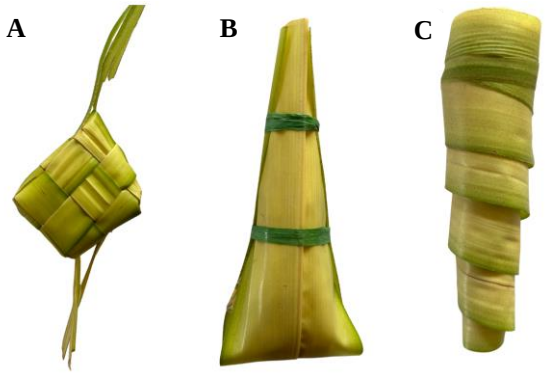

Figure 5. Food wrapping style of coconut leaves. A. *Ketupat*, B. *Lepet*, C. *Clorot*

Figure 6. Food wrapping style of *Pasung*

Pasung is the name of a type of traditional food closely related to the *Ruwahan* tradition in several areas in Central Java (including Blora and Salatiga Regencies) (Figure 6). The basic ingredients are the same as *apem* cake: rice flour packaged in a cone-shaped leaf and cooked by steaming. *Ruwahan* or *megengan* is one of the traditions of welcoming Ramadan, in which families make and send food to each other. The delivery contents usually consist of sticky rice, *apem*, and *pasung*. Leaves can be obtained from the backyard and garden, more often than a wrapper. So, these leaves are usually not sold.

Artocarpus camansi

Artocarpus camansi, or breadnut, is a flowering plant that can grow large and has thorny fruit and seeds. The tree's height is around 10-15 meters or even more. This plant begins to bear fruit after 8-10 years. The fruit bears a resemblance to breadfruit, although breadfruit is characterized by smooth skin and lacks seeds. It is included in the Moraceae family. Almost all parts of this plant can secrete sap, starting from flowers, fruit, leaves, twigs, branches, stems, and roots. Large leaves are 40-60 cm long (Orwa et al. 2009). According to the respondents, these leaves are used to wrap rice because of the wide shape of the leaves. *Artocarpus camansi* is obtained from the backyard and garden. It can be used for antibacterial, antimalarial, antioxidant, cytotoxic, and immunomodulatory activity (Salonga et al. 2014; Tantengco and Jacinto 2015; Ante et al. 2016; Hafid et al. 2016; Asrin et al. 2018).

Ficus septica

Ficus septica is often found around us. This plant usually grows wild on the side of the road and near the forest. This plant origin is from the Ryukyu Islands of Japan and then spreads throughout Malesia (except the Malay Peninsula), the Solomon Islands to Vanuatu, and Queensland in northern Australia. The leaves of this plant are in the form of a single support, large, very pointed, single leaf, and steamed. They are either arranged alternately or in an opposite-facing manner, with the stem measuring approximately 2.53 cm. Strands oval or elliptical are rounded base, flat edge, 15 x 30 cm, shiny dark green above, with many pale spots, light green below, left and right-side midrib with prominent side veins; both sides of leaves veins are striking because of their pale color (Lucidcentral 2023). The use of *F. septica* leaves to wrap *tempeh*. Leaves extract of *F. septica* can be used for antimicrobial activity and cytotoxicity (Vital et al. 2010). *Ficus septica* extracts also can be used against the Dengue virus (Huang et al. 2017). These leaves can be readily obtained from backyard and garden settings. However, they are not frequently used as wrappers, resulting in limited commercial availability, and thus are typically not sold in markets.

Hibiscus tiliaceus

Hibiscus tiliaceus, or coast cottonwood, is easy to find in the surrounding environment in the yard and on the roadside. As a plant that grows on the side of the road, this plant is often used as a shade plant. The leaves are round and of a single type. The leaves are about 6-23 cm long, with flat-leaf edges and finger bones. In hibiscus plants, supporting leaves have an oval shape measuring 2.5 cm (POWO 2023b). *Hibiscus tiliaceus* leaves are usually used to wrap Qurban meat tied with bamboo in Eid al-Adha. Eid al-Adha is one of the major holidays in Islam. On Eid al-Adha, Muslims who can afford it usually slaughter livestock, such as sheep, cows or goats, as part of the ritual sacrifice. The meat of the sacrificial animals is then distributed to families, neighbors and those in need. These leaves are also used to wrap *pindang* and *tempeh*. *Pindang* is a traditional Indonesian dish with leading ingredients such as meat, fish or vegetables, which are boiled in special spices. *Hibiscus tiliaceus* leaves can be used as an antioxidant, antimicrobial, anti-inflammatory, and antinociceptive (Kumar et al. 2009; Samsudin et al. 2019). The leaves can be easily obtained from backyard gardens.

However, their use as wrappers is not very common, so they are typically not sold in markets.

Pandanus amaryllifolius

Pandanus amaryllifolius, or scented pandan, can grow in tropical climates. This plant is also often planted in a backyard and garden. Sometimes, *P. amaryllifolius* leaves also grow wild on the banks of rivers, on the edges of swamps, and in slightly damp places. This plant is a type of monocotyledon from the Pandanaceae family. This plant can thrive in coastal areas with an altitude of about 500 masl. These leaves are elongated like palm leaves and appear to be arranged in a tight rosette. Scented *P. amaryllifolius* leaves are a single leaf, sitting like hugging the stem. Its shape is narrow and elongated. The leaves are like ribbons, tapering at the ends with small sharp barbed edges. The leaf veins are parallel. The leaves are around 40-80 cm long, with a width of about 3-5 cm and a yellowish-green color. If it is squeezed, the leaves are very fragrant (Wongpornchai 2006). *Pandanus amaryllifolius* leaves have a shape that is almost similar to coconut leaves, so according to respondents, pandan leaves can be used as *Ketupat*. The benefits as the pharmacological of *P. amaryllifolius* are antihyperglycemic effects, antioxidant, anticancer, antiviral, antibacterial, antitubercular, and dental anxiety (Bungihan et al. 2013; Ghasemzadeh and Jaafar 2013; Chiabchalard and Nooron 2015; Laluces et al. 2015; Pradopo et al. 2017). In addition, it can also be used as a food preservative (Resmi and Mardiyaningsih 2016).

Cordyline fruticosa

Cordyline fruticosa belongs to the genus Cordyline. Its leaves are densely clustered in a spiral pattern at the apex of upright, robust, and smooth branches. The leaves are stout, hairless, and grooved, with a greenish color and a length ranging from 5 to 10 cm. The blades of the *Cordyline fruticosa* are narrowly oblong, measuring between 18 to 45 cm in length and 5 to 10 cm in width. They are broadest near the middle and gradually narrowed to long-pointed ends, thin and flexible, not toothed on edges with many long delicate parallel veins (CABI 2012). The leaves are shiny green on both surfaces, leaving a ring scar. According to respondents, these leaves are used to wrap *tempeh*. The plants are typically obtained from backyard gardens, which results in limited commercial availability. As a result, traders only sometimes sell or purchase these plants. *Cordyline fruticosa* leaves can be used for antimicrobial, antidiarrheal antioxidant, analgesic, antipyretic anti-inflammatory, and cytotoxic (Elfita et al. 2019; Naher et al. 2019a; Naher et al. 2019b; Bogoriani et al. 2021).

Alocasia macrorrhizos

Alocasia macrorrhizos is an ornamental plant belonging to the herbaceous shrub type. The height can reach up to 5m. The leaves have a tremendous heart-shaped shape. The color of the upper leaves is a silvery green sheen. The lower parts are purplish veins and prominent veins (Flach and Rumawas 1996). The leaves are used to wrap *tape*. *Tape* is made by processing cassava or sticky rice with a yeast fermentation process. This fermentation process produces food that has a sweet taste and is slightly alcoholic. This leaf is not for sale, and traders get it from yards or gardens. The leaves of *A. mycorrhizos* can be used for antihyperglycemic, antimicrobial, antioxidant, and cytotoxic (Mandal et al. 2010; Rahman et al. 2012).

In conclusion, some plant leaves used in traditional markets in Wonosobo District show the importance of local wisdom in the study area. The findings revealed the utilization of ten species of plant leaves from seven different families for food wrapping purposes. This practice is deemed essential to reduce reliance on plastic wraps and promote more sustainable alternatives. Several steps can be taken to make leaves packaging for food sustainability in the future, namely (i) Ensuring abundance and renewability: Ensure that leaves are abundant in nature and renewable resources. (ii) Designing efficient and functional packaging: Focus on designing efficient and functional packaging, practical, sturdy, and efficient packaging. For example, these packages can protect food well, are resistant to moisture or oil, and are easy to open and close. (iii) Embracing technological advancements: Explore innovative cutting or lamination techniques to enhance the durability and packability of leaves as packaging materials. (iv) Implementing supportive government policies: Government has a role in making policies and regulations that encourage sustainable leaves as packaging. (v) Providing incentives and support: Governments and industries should also be encouraged to adopt policies that support environmentally friendly packaging and provide incentives for companies that do so. (vi) Increasing public awareness: Efforts should increase public awareness about the importance of using sustainable leaves as packaging, socialize the benefits, and invite the public to choose environmentally friendly leaf packaging products. (vii) Promoting collaboration with related companies and industry players. This is necessary to develop sustainable solutions in leaf packaging. Together, find ways to increase production efficiency, reduce waste and achieve sustainable goals. With these steps, we can promote and adopt more sustainable leaves as packaging in the future, helping to reduce plastic usage and its negative impact on the environment.

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REFERENCES

Abdila R. 2021. Indonesia penyumbang sampah plastik terbesar kedua di dunia. https://www.tribunnews.com/nasional/2021/09/26/indonesia-penyumbang-sampah-plastik-terbesar-kedua-di-dunia#google_vignette. [Indonesian]

Afrianto WF, Hasanah LN, Prananditaputra R, Hidayatullah T, Wati SI, Aini YS, Budiyoko B. 2023. Local knowledge and practice of entomophagy in Datengan Village, Kediri, East Java, Indonesia.

Sriwijaya J Environ 7 (3): 148-155. DOI: 10.22135/sje.2022.7.3.148-155.

Afrianto WF, Putra RP, Aini YS. 2022. Overview of the ethnobotany on the use of plants as potential botanical pesticides in Indonesia. J Biol Trop 22 (1): 220-243. DOI: 10.29303/jbt.v22i1.3266.

Afrianto WF, Tamnge F, Hasanah LN. 2020. Review: A relation between ethnobotany and bioprospecting of edible flower butterfly pea (*Clitoria ternatea*) in Indonesia. Asian J Ethnobiol 3 (2): 51-61. DOI: 10.13057/asianjethnobiol/y030202.

Afrianto WF, Tamnge F, Hidayatullah T, Hasanah LN. 2021. Local knowledge of plant-based nutrition sources from forgotten foods in Datengan Village, East Java, Indonesia. Asian J Ethnobiol 4 (1): 53-64. DOI: 10.13057/asianjethnobiol/y040106.

Ante I, Aboaba S, Siddiqui H, Choudhary MI. 2016. Essential oils of the leaf, stem-bark, and nut of *Artocarpus camans*i: Gas Chromatography-Mass Spectrometry analysis and activities against multidrug-resistant bacteria. J Herbs Spices Med Plants 22 (3): 203-210. DOI: 10.1080/10496475.2016.1159638.

Asrin H, Hasibuan PAZ, Marianne M. 2018. Total phenolic content of ethanol extract of *Artrocarpus camansi* leaves and its effect to superoxide dismutase (SOD) level in mice. Indones J Cancer Chemoprevention 8 (3): 101. DOI: 10.14499/indonesianjcanchemoprev8iss3pp101-109.

Astuti. 2009. Sifat Organoleptik Tempe Kedelai yang Dibungkus Plastik, Daun Pisang dan Daun Jati. [Bachelor Thesis]. Universitas Muhammadiyah Surakarta, Surakarta. [Indonesian]

Azevedo-Santos VM, Brito MFG, Manoel PS, Perroca JF, Rodrigues-Filho JL, Paschoal LRP, Gonçalves GRL, Wolf MR, Blettler MCM, Andrade MC, Nobile AB, Lima FP, Ruocco AMC, Silva CV, Perbiche-Neves G, Portinho JL, Giarrizzo T, Arcifa MS, Pelicice FM. 2021. Plastic pollution: A focus on freshwater biodiversity. Ambio 50 (7): 1313-1324. DOI: 10.1007/s13280-020-01496-5.

Baliga MS, Shivashankara AR, Haniadka R, Dsouza J, Bhat HP. 2011. Phytochemistry, nutritional and pharmacological properties of *Artocarpus heterophyllus* Lam (jackfruit): A review. Food Res Intl 44 (7): 1800-1811. DOI: 10.1016/j.foodres.2011.02.035.

Bogoriani NW, Putra AAB, Wahjuni S, Heltyani WE, Dewi NPPMS, Sadin VYK. 2021. The effect of andong (*Cordyline terminalis*) leaves, one of the traditional plants in Bali as anti-oxidant and antibacterial. IOP Conf Ser: Earth Environ Sci 724 (1). DOI: 10.1088/1755-1315/724/1/012018.

Bungihan ME, Nonato MG, Draeger S, Franzblau S, Edison T, Dela CE, Cuevas VC, Hipol RM, Monsalud RG. 2013. Antimicrobial and anti-oxidant activities of fungal leaf endophytes associated with *Pandanus amaryllifolius* Roxb. Philip Sci Lett 6 (2): 128-137.

CABI. 2012. *Cordyline fruticosa* (ti plant). DOI: 10.1079/cabicompendium.11866.

CABI. 2014. *Cocos nucifera* (coconut). DOI: 10.1079/cabicompendium.11788.

CABI. 2023. *Artocarpus heterophyllus* (jackfruit). DOI: 10.1079/cabicompendium.1832.

Chiabchalard A, Nooron N. 2015. Antihyperglycemic effects of *Pandanus amaryllifolius* Roxb leaf extract. Pharmacogn Mag 11 (41): 117-122. DOI: 10.4103/0973-1296.149724.

Compa M, Alomar C, Wilcox C, van Sebille E, Lebreton L, Hardesty BD, Deudero S. 2019. Risk assessment of plastic pollution on marine diversity in the Mediterranean Sea. Sci Total Environ 678: 188-196. DOI: 10.1016/j.scitotenv.2019.04.355.

Danopoulos E, Twiddy M, Rotchell JM. 2020. Microplastic contamination of drinking water: A systematic review. PLoS ONE 15: 1-23. DOI: 10.1371/journal.pone.0236838.

Deanova AK, Pristiawati CM, Aprilia D, Solikah I, Nurcahyati M, Liza N, Himawan W, Partasasmita R, Setyawan AD. 2021. The diversity of edible plants traded in Ir. Soekarno Market, a traditional market in Sukoharjo District, Indonesia. Biodiversitas 22 (9): 4095-4105. DOI: 10.13057/biodiv/d220958.

Elfita, Mardiyanto, Fitrya, Larasati JE, Julinar, Widjajanti H, Muharni. 2019. Antibacterial activity of *Cordyline fruticosa* leaf extracts and its endophytic fungi extracts. Biodiversitas 20 (12): 3804-3812. DOI: 10.13057/biodiv/d201245.

Erdiansyah M, Meryandini A, Wijaya M, Suwanto A. 2021. Microbiological quality of tempeh with different wraps: banana leaf versus plastic. J Food Sci Technol: 1-8. DOI: 10.1007/s13197-021-05014-7.

Flach M, Rumawas F. 1996. Plant Resources of South-east Asia No. 9. Plants Yielding Non-Seed Carbohydrates. Backhuys Publishers.

Gall SC, Thompson RC. 2015. The impact of debris on marine life. Mar Pollut Bull 92 (1-2): 170-179. DOI: 10.1016/j.marpolbul.2014.12.041.

Ghasemzadeh A, Jaafar HZE. 2013. Profiling of phenolic compounds and their anti-oxidant and anticancer activities in pandan (*Pandanus amaryllifolius* Roxb.) extracts from different locations of Malaysia. BMC Complement Altern Med 13. DOI: 10.1186/1472-6882-13-341.

Hafid AF, Septiani RP, Fabriana LH, Febrianty N, Ranggaditya D, Widyawaruyanti A. 2016. Antimalarial activity of crude extracts of *Artocarpus heterophyllus*, *Artocarpus altilis*, and *Artocarpus camansi*. Asian J Pharm Clin Res 9 (1): 261-263. DOI: 10.4038/ouslj.v9i0.7324.

Honingh D, van Emmerik T, Uijttewaal W, Kardhana H, Hoes O, van de Giesen N. 2020. Urban river water level increase through plastic waste accumulation at a rack structure. Fron Earth Sci 8: 1-8. DOI: 10.3389/feart.2020.00028.

Hounsou M, Dabadé DS, Götz B, Hounhouigan MH, Honfo FG, Albrecht A, Dresch LC, Kreyenschmidt J, Hounhouigan DJ. 2022. Development and use of food packaging from plant leaves in developing countries. J Consumer Prot Food Saf 17: 315-339. DOI: 10.1007/s00003-022-01390-0.

Huang NC, Hung WT, Tsai WL, Lai FY, Lin YS, Huang MS, Chen JJ, Lin WY, Weng JR, Chang TH. 2017. *Ficus septica* plant extracts for treating Dengue virus in vitro. PeerJ 2017 (6): 1-12. DOI: 10.7717/peerj.3448.

Imam MZ, Akter S. 2011. *Musa paradisiaca* L. and *Musa sapientum* L. : A phytochemical and pharmacological review. J Appl Pharm Sci 1 (5): 14-20.

Iskandar BS, Iskandar J, Suroso, Alfian RL, Mulyanto D. 2022. Non-edible plants traded in traditional markets of Beringharjo, Yogyakarta and Pasar Baru, East Kalimantan, Indonesia: The role of biocultural system. Biodiversitas 23 (9): 4657-4669. DOI: 10.13057/biodiv/d230932.

Iskandar J, Iskandar BS, Partasasmita R. 2018. Review: The impact of social and economic change on domesticated plant diversity with special reference to wet rice filed and home-garden farming of West Java, Indonesia. Biodiversitas 19 (2): 502-524. DOI: 10.13057/biodiv/d190227.

KLHK. 2021. Capaian kinerja pengelolaan sampah. https://sipsn.menlhk.go.id/sipsn/ [Indonesian]

Kumar S, Kumar D, Kumar V. 2009. Antinociceptive and anti-Inflammatory activity of *Hibiscus tiliaceus* leaves. Intl J Pharmacogn Phytochem Res 1 (1): 15-17.

Laluces HMC, Nakayama A, Nonato MG, Cruz DTE, Tan MA. 2015. Antimicrobial alkaloids from the leaves of *Pandanus amaryllifolius*. J Appl Pharm Sci 5 (10): 151-153. DOI: 10.7324/JAPS.2015.501026.

Loizzo MR, Tundis R, Chandrika UG, Abeysekera AM, Menichini F, Frega NG. 2010. Anti-oxidant and antibacterial activities on foodborne pathogens of *Artocarpus heterophyllus* Lam. (Moraceae) leaves extracts. J Food Sci 75 (5): 291-295. DOI: 10.1111/j.1750-3841.2010.01614.x.

Lucidcentral. 2023. *Ficus septica* Burm.f. https://apps.lucidcentral.org/rainforest/pdf/entities/ficus_septica.pdf.

Mandal P, Misra TK, Singh ID. 2010. Anti-oxidant activity in the extracts of two edible aroids. Indian J Pharm Sci 72 (1): 105-108. DOI: 10.4103/0250-474X.62242.

Mathew NS, Negi PS. 2017. Traditional uses, phytochemistry and pharmacology of wild banana (*Musa acuminata* Colla): A review. J Ethnopharmacol 196: 124-140. DOI: 10.1016/j.jep.2016.12.009.

Mensah J, Adei E, Adei D, Ashie M. 2012. Perceptions of the use of indigenous leaves as packaging materials in the ready-to-eat cornmeals. Intl J Biol Chem Sci 6 (3). DOI: 10.4314/ijbcs.v6i3.12.

Mutaqin AZ, Kurniadie D, Iskandar J, Nurzaman, M, Partasasmita, R. 2020. Ethnobotany of suweg (*Amorphophallus Paeoniifolius*): folk classification, habitat, and traditional conservation in Cisoka Village, Majalengka District, Cimanuk Watershed Region, Indonesia. Biodiversitas 21 (2): 546-555. DOI: 10.13057/biodiv/d210216.

Naher S, Akter MI, Rahman SMM, Sajon SR, Aziz MA. 2019a. Analgesic, anti-inflammatory and anti-pyretic activities of methanolic extract of *Cordyline fruticosa* (L.) A. Chev. Leaves. J Res Pharm 23 (2): 198-207. DOI: 10.12991/jrp.2019.125.

Naher S, Aziz MA, Akter MI, Rahman SMM., Sajon SR, Mazumder K. 2019a. Anti-diarrheal activity and brine shrimp lethality bioassay of methanolic extract of *Cordyline fruticosa* (L.) A. Chev. leaves. Clin Phytosci 5 (1): 4-9. DOI: 10.1186/s40816-019-0109-z.

Nayeem N, Karvekar M. 2011. Anti microbial and anti-oxidant properties of the isolated compounds from the methanolic extract from the leaves of *Tectona grandis*. J Basic Clin Pharm 2 (4): 163-165.

Ngaffo CMN, Tankeo SB, Guefack MGF, Nayim P, Wamba BEN, Kuete V, Mbaveng AT. 2021. Phytochemical analysis and antibiotic-modulating activity of C*ocos nucifera*, *Glycine max* and *Musa sapientum* methanol extracts against multidrug resistant Gram-negative bacteria. Invest Med Chem Pharmacol 4 (2): 1-12. DOI: 10.31183/imcp.2020.00053.

Orwa C, Mutua A, Kindt R, Jamnadass R, Anthony S. 2009 Agroforestree Database: a tree reference and selection guide version 4.0. http://www.worldagroforestry.org/sites/treedbs/treedatabases.asp.

Ouétchéhou R, Dabadé DS, Sanoussi AF, Vieira G, Toukourou CA, Hounhouigan DJ, Azokpota P. 2022. Typology and quality preference of plant leaves used for food packaging in Benin. Intl J Biosci 20 (6): 103-119. DOI: 10.12692/ijb/20.6.103-119.

Periyanayagam K, Karthikeyan V. 2013. Wound healing activity of the leaves of *Artocarpus heterophyllus* Lam. (Moraceae) on ex-vivo porcine skin wound healing model. Innovare J Life Sci 1 (1): 28-33.

POWO. 2023a. *Tectona grandis* L.f. https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:864923-1.

POWO. 2023b. *Hibiscus tiliaceus* L.. https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:30143354-2/general-information.

Pradopo S. Sinaredi BR, Januarisca BV. 2017. Pandan leaves (*Pandanus amaryllifolius*) aromatherapy and relaxation music to reduce dental anxiety of pediatric patients. J Intl Den Med Res 10 (3): 933-937.

Purba NP, Handyman DIW, Pribadi TD, Syakti AD, Pranowo WS, Harvey A, Ihsan YN. 2019. Marine debris in Indonesia: A review of research and status. Mar Pollut Bull 146: 134-144. DOI: 10.1016/j.marpolbul.2019.05.057.

Rahman MM, Hossain MA, Siddique SA, Biplab KP, Uddin MH. 2012. Antihyperglycemic, anti-oxidant, and cytotoxic activities of *Alocasia macrorrhizos* (L.) rhizome extract. Turk J Biol 36 (5): 574-579. DOI: 10.3906/biy-1112-11.

Rao US, Mohd KS, Muhammad A, Ahmad BA, Mohamad M, Ali RM. 2014. Taxonomical, phytochemical and pharmacological reviews of *Musa sapientum* var. *Paradisiaca*. Res J Pharm Technol 7 (11): 1356-1361.

Resmi A, Mardiyaningsih A. 2016. Pandan leaves extract (*Pandanus amaryllifolius* Roxb) as a food preservative. Jurnal Kedokteran Kesehatan Indonesia 7 (4): 166-173. DOI: 10.20885/JKKI.Vol7.Iss4.art8. [Indonesian]

Rianti A, Novenia AE, Christopher A, Lestari D, Parassih EK. 2018. Ketupat as traditional food of Indonesian culture. J Ethnic Foods 5(1): 4-9. DOI: 10.1016/j.jef.2018.01.001.

Salonga RB, Hisaka S, Nose M. 2014. Effect of the hot water extract of *Artocarpus camansi* leaves on 2,4,6-trinitrochlorobenzene (TNCB)-induced contact hypersensitivity in mice. Biol Pharm Bull 37 (3): 493-497. DOI: 10.1248/bpb.b13-00738.

Samsudin MS, Andriani Y, Sarjono PR, Syamsumir DF. 2019. Study on *Hibiscus tiliaceus* leaves as antibacterial and anti-oxidant agents. Alotrop 3 (2): 123-131. DOI: 10.33369/atp.v3i2.9874. [Indonesian]

Shahid UI, Wani SA, Mohammad F. 2018. Imparting functionality viz color, anti-oxidant and antibacterial properties to develop multifunctional wool with *Tectona grandis* leaves extract using reflectance spectroscopy. Intl J Biol Macromol 109: 907-913. DOI: 10.1016/j.ijbiomac.2017.11.068.

Shoeb MAGHA, Madkour HMF, Mohamed LAGRMAM, Saad AM. 2014. Anti-oxidant and cytotoxic activities *Tectona Grandis* Linn. leaves. Intl J Phytopharmacol 5 (2): 143-157.

Sitoresmi AR 2022. Filosofi lepet yang penuh makna tersirat, sajian khas lebaran mirip ketupat. https://m.liputan6.com/islami/read/4956256/filosofi-lepet-yang-penuh-makna-tersirat-sajian-khas-lebaran-mirip-ketupat. [Indonesian]

Smith M, Love DC, Rochman CM, Neff RA. 2018. Microplastics in seafood and the implications for human health. Curr Environ Health Rep 5 (3): 375-386. DOI: 10.1007/s40572-018-0206-z.

Sulistiyono P, Samuel S, Mailani MM. 2016. Pengaruh pembungkus tempe terhadap daya simpan dan sifat fisik tempe. Media Informasi 12 (1): 90-95. DOI: 10.37160/bmi.v12i1.18. [Indonesian]

Suryanti V, Kusumaningsih T, Marliyana SD, Setyono HA, Trisnawati EW. 2020. Identification of active compounds and anti-oxidant activity of teak (*Tectona grandis*) leaves. Biodiversitas 21 (3): 946-952. DOI: 10.13057/biodiv/d210313.

Tantengco OAG, Jacinto SD. 2015. Cytotoxic activity of crude extracts and fractions from *Premna odorata* (Blanco), *Artocarpus camansi* (Blanco) and *Gliricidia sepium* (Jacq.) against selected human cancer cell lines. Asian Pac J Trop Biomed 5 (12): 1037-1041. DOI: 10.1016/j.apjtb.2015.09.011.

TFNet. 2016. Banana name, taxonomy, botany. https://www.itfnet.org/v1/2016/03/banana-name-taxonomy-botany/

Uddin AKMR, Siddique MAB, Rahman F, Ullah AKMA, Khan R. 2020. *Cocos nucifera* leaf extract mediated green synthesis of silver nanoparticles for enhanced antibacterial activity. J Inorg Organomet Polym Mater 30 (9): 3305-3316. DOI: 10.1007/s10904-020-01506-9.

Utama Z, Agrippina FD, Nurmadhani BS. 2018. Comparison of appearances and color indexes for tempe with different packaging using digital image analysis. In: Sukartiko A, Nuringtyas T, Marliana S, Isnansetyo A (eds). Proceeding of the 2nd International Conference on Tropical Agriculture. Universitas Gadjah Mada, Yogyakarta, 26-27 October 2017. DOI: 10.1007/978-3-319-97553-5_7.

van der Meulen MD, DeVriese L, Maes T, van Dalfsen JA, Huvet A, Soudant P, Robbens J, Vethaak A. 2014. Socio-economic impact of microplastics in the 2 seas, Channel and France manche region. MICRO Interreg Project IVa.

Vethaak AD, Leslie HA. 2016. Plastic debris is a human health issue. Environ Sci Technol 50 (13): 6825-6826. DOI: 10.1021/acs.est.6b02569.

Vital PG, Velasco RN, Demigillo, JM, Rivera WL. 2010. Antimicrobial activity, cytotoxicity and phytochemical screening of *Ficus septica* Burm and *Sterculia foetida* L. leaf extracts. J Med Plants Res 4 (1): 058-063. DOI: 10.1016/S1995-7645(11)60202-2.

Vriend P, Hidayat H, van Leeuwen J, Cordova MR, Purba NP, Löhr AJ, Faizal I, Ningsih NS, Agustina K, Husrin S, Suryono DD, Hantoro I., Widianarko B, Lestari P, Vermeulen B, van Emmerik T. 2021. Plastic pollution research in Indonesia: state of science and future research directions to reduce impacts. Front Environ Sci 9: 1-12. DOI: 10.3389/fenvs.2021.692907.

Vyas P, Yadav DK, Khandelwal P. 2019. *Tectona grandis* (teak)-A review on its phytochemical and therapeutic potential. Nat Prod Res 33 (16): 2338-2354. DOI: 10.1080/14786419.2018.1440217.

Wongpornchai S. 2006. 27 - Pandan wangi. In: Peter KV (ed). Woodhead Publishing Series in Food Science, Technology and Nutrition, Handbook of Herbs and Spices. Woodhead Publishing, Oxford. DOI: 10.1533/9781845691717.3.453.