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Ethnobotany of food plants utilized by Malay Ethnic in Belitung District, Indonesia

TATIK CHIKMAWATI[1,♥], SULISTIJORINI[1], NINA RATNA DJUITA[1], DIMAS PRASAJA[1], THOBIB HASAN AL YAMINI[1], MIFTAHUDIN[1], YULIAN FAKHRURROZI[2]

[1]Department of Biology, Faculty of Mathematics and Natural Sciences, Institut Pertanian Bogor. Jl. Agatis, Kampus IPB Dramaga, Bogor 16680, West Java, Indonesia. Tel./Fax.: +62-251-8622833, ♥email: tatikch@apps.ipb.ac.id
[2]Belitung Island Geopark Management Agency. Jl. Dusun Taruna Mulya, East Belitung 33512, Belitung, Indonesia

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Abstract. *Chikmawati T, Sulistijorini, Djuita NR, Prasaja D, Yamini THA, Miftahudin, Fakhrurrozi Y. 2023. Ethnobotany of food plants utilized by Malay Ethnic in Belitung District, Indonesia. Biodiversitas 24: 2977-2987.* Many food commodities in Belitung District, Indonesia are imported from the other islands. However, the local government's experience with the COVID-19 pandemic has encouraged the community to increase the diversification of local food products. Comprehensive data on the species used and the utilization is needed to support the effort. The research aimed to study the potential of plant biodiversity as a food source through ethnobotanical studies of the Malay ethnic group in the Belitung District. The study began by determining key and ordinary respondents using purposive and snowball sampling methods. Furthermore, data were collected through open, semi-structured, and structured interviews. The index of cultural significance (ICS) was determined based on quantitative data. The Malay community in the Belitung District utilizes 181 plant species as food, and most species are wild plants (59%). The number of plants used as food varies among sub-districts and is significantly correlated with forest area in each sub-district. The edible plants are divided into seven utilization categories: fruits, cooking spices, vegetables, sources of carbohydrates, beverage ingredients, grains, and staple food. The most used plant organ is the fruit. The plant with the highest ICS value in four sub-districts, i.e., Membalong, Tanjung Pandan, Sijuk, Badau, was coconut (*Cocos nucifera*); whereas the highest ICS value in the Selat Nasik sub-district was orange konci (*Citrus microcarpa*). Rice (*Oryza sativa*) and white pepper (*Piper nigrum*) also have high ICS values. Rice is an irreplaceable staple food source, while pepper is a commodity with high economic value for the community. The large number of wild plants the community uses indicates that there are many alternative plant species to meet food needs.

Keywords: Diversity, ethnobotany, food plants, Index of Cultural Significance, Malay Ethnic

INTRODUCTION

Belitung has a unique environment with many nutrient-poor heath forests and ex-tin mining areas. Therefore, only plants that are tolerant to this environment can grow, such as sapu padang (*Baeckea frutescens*), pasak bumi (*Eurycoma longifolia*), kantong semar (*Nepenthes gracilis*), and gelam (*Melaleuca leucadendron*) (Sulistyaningsih et al. 2019). Such natural conditions cause low amount of food crop farming activities and their productivity to be low. The Food Security and Agriculture Service of the Belitung District recorded that the total rice (*Oryza sativa*) production from farmers from January to June 2021 reached 1,152 tons of dry milled grain, consisting of paddy rice (1,114 tons) and field rice (38.20 tons). However, this production is still below the production target in 2021 (BPSKB 2021). As a result, many food commodities must be imported from outside the island to meet the basic food needs of the people. However, as people have grown accustomed to limited mobility due to the extended length of the COVID-19 pandemic, the Belitung regional government is trying to increase local food supply and agricultural production by promoting diversity in food consumption such as Belitung taro (*Xanthosoma sagittifolium* (L.) Schott), Belitung's special areca nut, and other local food species as food reserves. The program accelerating diversity in food consumption is essential because it can stabilize the food supply and increase food self-sufficiency.

Indonesia is composed of 1,340 ethnic groups (BPS 2010). Each ethnic group is unique in utilizing the plants around them as they possess knowledge about wild food plants, which differ from one group to the other. It shows the role of ethnicity in the preference and use of wild food plants (Ghorbani et al. 2012). Several studies report that different ethnic and linguistic groups inhabiting the same area do not always consume the same wild food plant in the same way (Kolosova et al. 2020, Quave and Pieroni 2015, Pieroni et al. 2018, Pieroni and Sõukand 2019). The process of fulfilling food needs through selection and efforts to recognize useful plants becomes knowledges that are continuously maintained and passed on from generation to generation. In conveying local wisdom, the community uses folklore as learning material (Sarman 2016). The local knowledge of the Belitung Malay communities can be seen in various aspects of life, including the use of plants in multiple fields. To maintain a healthy body, the Malay Belitung communities utilize the surrounding flora, including 86 plant species originating from the heath forest, to treat fever and other diseases, and for postpartum care

(Oktavia et al. 2022). The Malay community on Belitung Island also has a local wisdom in preserving the environment by maintaining plants in the Kelekak, an area planted with fruit trees prepared for their offspring, and the Pemalian (forbidden) forests, forests that the community cannot utilize it for any reason (Henry et al. 2022). In the economic field, the community takes advantages of their natural environment wealth and uses it to produce more economically valuable products, such as a local wisdom in the utilization of the resam fern (*Dicranopteris linearis*) as a material for making resam caps and the use of natural dyes in cual weaving (Syariful 2018). To meet their food needs, people use various sources of carbohydrates, including cassava (*Manihot esculenta*), sweet potatoes (*Ipomoea batatas*), ararot (*Maranta arundinacea*), gembili (*Dioscorea esculenta*), nubong (*Tacca leontopetaloides*), taro (*Xanthosoma nigrum*) and several other taros (*Colocasia esculenta*). Besides rice, people consume 'Aruk rice' from cassava (BPSKB 2021).

Malay communities in Belitung have utilized food plants from nearby plants, both wild and cultivated, which leads to diversification on food consumption. Still, there needs to be comprehensive data on the species used, their availability in nature, the conservation status of these species, the level of their development in the community, and specific local knowledge in managing plants and their environment. Such data are initial fundamental data for local food diversification programs and can be made available simultaneously through ethnobotanical studies. The research aimed to scientifically examine the potential of plant biodiversity as a food source for Malays Ethic in Belitung District through ethnobotanical studies of local food plants and to compare the uses among them from different sub-districts.

MATERIALS AND METHODS

Study area

This study was conducted in Belitung District, Bangka-Belitung Islands Province, Indonesia which is located between 107°08' E to 107°58' E and 02°30' S to 03°15' S with a total area of 229,369 ha. Belitung District has a wet tropical climate with annual rainfall in 2020 between 82.5 mm to 400.1 mm from 12 to 26 rainy days per month, relative humidity ranging from 79-90%, and temperatures ranges from 26ºC-28.5 ºC. The peak of the dry season occurs from July to September (BPSRB 2021). Research data were collected from five sub-districts, i.e., Membalong, Tanjung Pandan, Sijuk, Badau, and Selat Nasik in July 2022 and October 2022. Data were collected from 1 to 3 villages in each sub-district (Figure 1, Table 1).

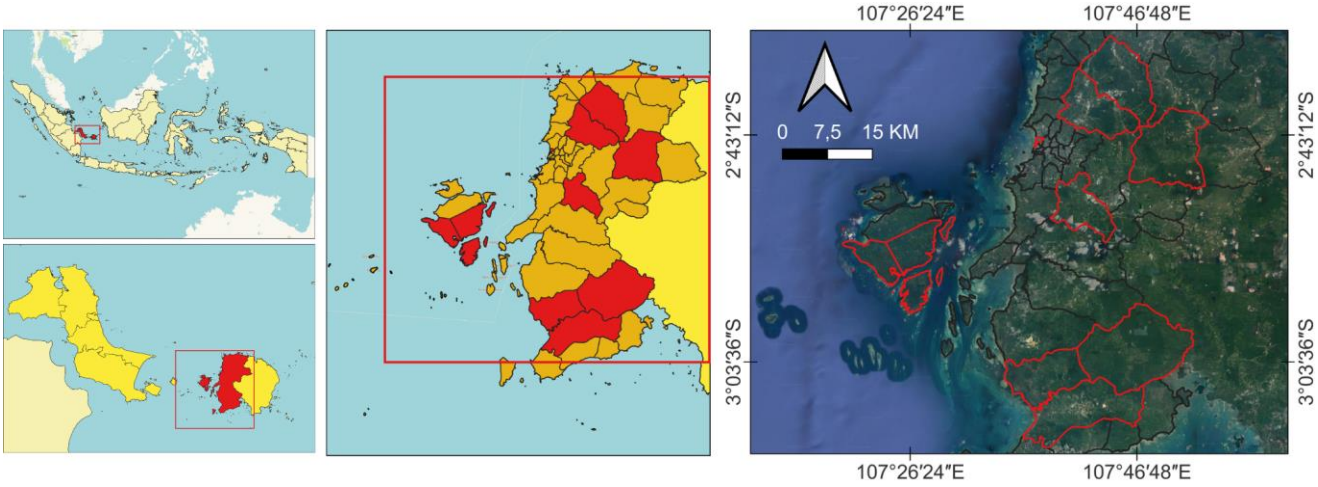

Figure 1. Map of research location in Belitung District, Bangka-Belitung Islands Province, Indonesia

Table 1. Description of research location in Belitung District, Bangka-Belitung Islands Province, Indonesia

Sub-districts	Observed villages	Altitude (mdpl)	Distance from town (km)	Area (km^2)	Forest area (km^2)
Membalong	Kembiri, Membalong, Perpat	175	55	909.55	324.85
Tanjung Pandan	Tanjung Pendam	200	0	378.45	43.84
Sijuk	Air Selumar, Air Seruk	500	21	413.99	204.44
Badau	Kacang Butor, Cerucuk	350	35	458.20	139.10
Selat Nasik	Petaling dan Suak Gual	150	50	133.50	113.10

Note: Source: BPSKB (2021)

Procedures

Ethnobotanical data collection

The research began with the selection of key respondents and common respondents using purposive sampling and snowball sampling methods. The selected respondents assisting the research process were community leaders, village heads, and residents with good knowledge in environmental units and the diversity of plants and their utilization. A key respondent per sub-district, were determined by a village officer and appointed by a traditional leader. A number of 7-18 ordinary respondents in each village were involved in the research with the following details: Kembiri (18 people), Membalong (9 people), Perpat (14 people), Tanjung Pendam (7 people), Air Selumar (7 people), Air Seruk (10 people), Kacang Butor (8 people), Cerucuk (9 people), Petaling (8 people) dan Suak Gual (7 people). The total number of respondents was 97 people consisting of 64 males and 33 females. There were more male respondents than females, except in the Sijuk Sub-district, where the number of female respondents was more significant. The respondents' ages ranged from 28-60 years with most ages were around 40-50.

The research utilized an emic and ethical approaches. The emic procedure was performed through participatory observation and open-ended, semi-structural, and structural interviews (Martin 1998). The ethical process was carried out by validating the scientific perceptions, views, and knowledge regarding environmental units and plant diversity. The ethnobotanical data comprised of qualitative and quantitative data obtained through participant observation interviews, free-listing, and questionnaires. Furthermore, the results of interviews with key informants were verified by field surveys of ordinary respondents.

Herbarium preparation and identification

Plant samples that could not be identified using standard methods were collected from the field to make herbarium specimens for plants that could not be identified using standard methods (Simpson 2006). Furthermore, scientific identification and plant documentation was carried out for each plant. Identification of plants used two reference books, i.e., The Flora of Java (Backer and Bakhuizen van den Brink 1968) and A Guide to the Potential Plants of Belitung (Sulistyaningsih et al. 2019). The plant's identity was verified with herbarium specimens from the virtual Herbarium (http://apps.kew.org/herbcat/navigator.do and https:// plants.jstor.org/partner/NHN). The plant scientific name refers to the 'Accepted Name' of The Plantlist (http://www.theplantlist.org/) and Plant of the World online (http://powo.science.kew.org/.org/).

Data analysis

The data in this study include two types of data, i.e., primary and secondary data. Primary data was obtained directly from the field research by conducting interviews. The primary data that are consisted of the diversity of food plant species, the plant parts used, the category of use, the location of harvest, the degree of preference, and the utilization of the plants were obtained through literature and documentation studies. The types of the collected secondary data included biophysical aspects, climatic data, and rainfall data obtained from the local Central Bureau of Statistics.

The similarity of the community's knowledge of useful food plants among sub-districts was analyzed using the mean character differences. Pearson's correlation coefficients between the knowledge of the Malay community on useful food plants and environmental factors (altitude, distance from sub-district to city, area of sub-district, forest area in each sub-district) were analyzed using the R program with package "metan".

The data related to the use of plant was collected including the local names of food plants, the uses of the plants, the parts of the plants used, and how the plants were used. Quantitative data was collected and analyzed by calculating the index value of cultural significance or Index of Cultural Significance (ICS) and then used to determine the value of plant species used by the community. The ICS was calculated with the following formula (Turner 1988):

$$ICS = \sum_{i=1}^{n} (q \times i \times e)ni$$

Where: ICS is the number of calculations for the utilization of a plant species from 1 to n where n represents the n^{th} utilization, i is the value from 1 to n; (q) is the quality value representing the value of the usability quality of a plant species that is calculated by giving a score or value to the quality value of a plant species: 5 = staple food; 4 = secondary/supplementary food + primary materials, 3 = other food ingredients + secondary materials + medicinal plants; 2 = ritual, mythology, recreation, etc; 1 =mere recognition, species have value but are not used specifically; (i) is the intensity value that describes the intensity usage of useful plant species, the i is calculated by giving a value, i.e.: 5 = very high intensity; 4 = moderately high intensity of use; 3 = moderate intensity of use; 2 = low intensity of use; and value 1 = the intensity of its use is very rare; and (e) is the exclusivity value that represents the preference value of useful plant species. The e is calculated as follows 2 = most preferred, when the species is the first choice and second to none; 1 when there are several species that are likely to be selected; and 0.5 when the species is a secondary source or a secondary material.

RESULTS AND DISCUSSION

Food plant diversity

Humans depended on wild edible plants for most of our history. Some parts of the plant have been eaten or considered delicious and palatable for nutrition and are generally considered safe for consumption. Humans usually take advantage of the plants available around them. However, since different ecosystems provide different plant species, the use of plants by humans varies greatly. For example, the various human groups living in environments that are similar or only slightly different, especially in tropical forests and savannas like in the Alto Orinoco as well as in rural areas, utilized a basket of very

different plant species (Turner et al. 2011). The differences in the use of wild plants for food among the various ethnic groups living in a region occur at an individual level (Kolosova et al. 2020). For examples, the Soliga and Bedagampana communities in Malai Mahadeshwara (MM) Hills, located in South India used 126 wild food species belonging to 58 families. The number of species utilized varied among the villages studied (Harisha et al. 2021). The Saibatin community in Lampung, Indonesia, knows 192 species belonged to 73 plant families primarily used as foodstuff. But the number of plant species for foodstuff vary between two villages which have different topography and altitude (Wakhidah et al. 2020). Therefore, ecological, and economic factors influence the continued use of a plant species over time (Kolosova et al. 2020).

Malay people in the Belitung District use plants as food ingredients consisting of 181 plant species, 123 genera, and 59 families. They also use three mango cultivars (*Mangifera indica*) and five cassava cultivars (*Manihot esculenta*). The number of plant species used for food varies among sub-districts. Communities in the Membalong Sub-district utilize more plant species (173 species), while people in Tanjung Pandan use fewer plant species (47 species) than the other sub-districts (Table 2). As many as 26 species of plants used for food can be found in all sub-districts. Twenty-two percent of the food plant species are found only in Membalong Sub-district, while 78% are commonly found in the other locations. The similarity of the Malay community's knowledge on useful food plants in Belitung District varies among sub-districts, ranging from 30,4-92,8%. The highest similarity is between the Sijuk and Selat Nasik Sub-districts, while the lowest is between the Membalong and Tanjung Pandan Sub-districts (Table 3). The species of plants that the Malay community in Belitung District can consume food plants that are obtained from five types of landscapes (ecosystems), i.e., forests, gardens, yards, rice fields, and swamps. Most people in the District found plants in forests, gardens, and yards, except in the Tanjung Pandan Sub-district who found most of the food plant species in their yards, and only a few found it in gardens because this sub-district is located in an urban area, and a yard is a landscape located closest to their living. The most common species of food plants are found in forest (Table 2). Malay communities in Belitung District generally have wide gardens and yards apart from the forest, therefore many species of food plants are also found in both landscapes (BPSKB 2021). The distance between the garden and the house is close. Corn, chili, durian, and other food plant are planted in the garden. In all sub-districts, the fewest food plants were found in rice fields and swamps. Even though the number of food crops in paddy fields is only one species, their presence is significant because paddy is consumed daily.

The diversity of food plants used by the Malay Community in the Belitung District varies in the five sub-districts. Three factors are causing the difference: forest area, sub-district area, and distance from sub-district to urban areas (Figure 2). Forest area has a significant, positive, and linear correlation with community knowledge about food plants (r=90). It means that the wider the forest, the higher the knowledge of Malay People on food plants. The area of the sub-district and the distance from the sub-district to urban areas also positively correlate with the community's knowledge of food plants. However, it is not significant (r=80 and r=0.81, respectively). Sub-district with large area usually has a broader forest area (r=0.81). Out of the five sub-districts, the Membalong has a much wider area and forest area than the other four sub-districts. Consequently, Malay Communities in this region are most familiar with and utilize food plant species.

Table 2. Total species number, cultivation status, landscape types, plant utilization in each sub-district in Belitung District, Indonesia

Sub-districts		Membalong	Tanjung Pandan	Sijuk	Badau	Selat Nasik	Total
				Species number			
Total species number		173	47	86	114	93	181
Cultivation status	Cultivated	68	36	53	55	57	74
	Wild	105	11	33	59	36	107
Landscape Types	Forest	103	0	23	44	25	106
	Garden	49	9	37	31	45	57
	Yard	98	38	25	36	29	95
	Swamp	1	0	1	1	1	1
	Rice field	1	0	1	1	1	1
Plant utization	Process	95	30	57	65	51	94
	Unprocess	84	17	29	49	42	87

Table 3. The similarity index of the Malay community's knowledge on food plants in Belitung District, Indonesia

	Membalong	Tanjung Pandan	Sijuk	Badau
Tanjung Pandan	**0.30**			
Sijuk	0.46	0.51		
Badau	0.67	0.57	0.61	
Selat Nasik	0.48	0.58	**0.93**	0.60

Meanwhile, people in the Tanjung Pandan Sub-district, an urban area, are least to food plant species, as they cultivate limited food plant in their yards and gardens (Table 2). Geographical conditions, such as location and altitude, do not affect the knowledge of Malay people in the Belitung District because the height of the research location only ranges 150-500 m above sea level. Our results are supported with previous studies in various countries in the world, such as the Mediterranean, Greece, Albania, Morocco, Spain, and Tibet, which reported that the traditional use of wild food is declining rapidly due to socio-economic and ecological changes, especially those close to cities (Luczaj et al. 2019, Nedelcheva 2013, Boesi 2014, Mallick et al. 2020). Urban areas have been more and more affected by advances in urbanization and the development of modern agricultural technology so that less and less traditional knowledge is passed on to the younger generation (Sansanelli et al. 2017, Phatlamphu et al. 2021, Jia et al. 2022). Consequently, the cultural and historical factors that diversify the use of plants in a location (specific islands) are more robust than measurable variables such as an area's demographic and geographical features (Łuczaj et al. 2019).

Food plants used by the Malay community in Belitung District consist of the following cultivation status, i.e., 107 species (59%) of wild plants, 74 species (41%) of cultivated plants, while two species (1%) have both cultivated and wild status, namely cashew (*Anacardium occidentalis*) and tampui (*Baccaurea macrocarpa*) (Table 2). The Malay community in the Membalong and Badau Sub-districts uses wild plants more, while those in the Sijuk, Badau, and Selat Nasik Sub-districts use more cultivated plants. The main factor causing the difference in plant status preference is the respective community's proximity to the forest landscape. The sub-districts of Membalong and Badau are located very close to the forest landscape; hence they are more familiar with wild plants that can be consumed, resulting in a higher intensity of consumption of wild plant species and certain species of plants found in forest areas (Table 2).

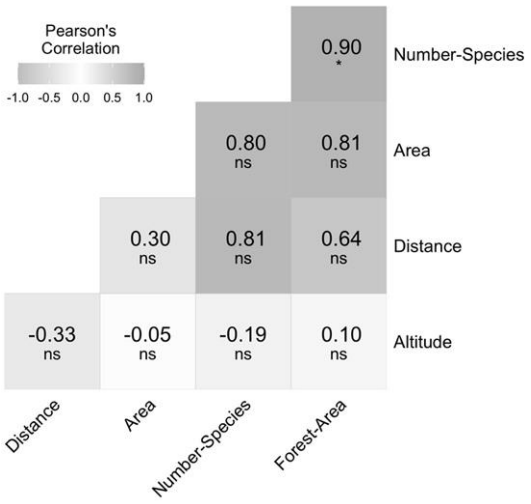

Figure 2. Correlation among the Malay Community's knowledge on food plants in Belitung District, forest area, area, distance from town, and altitude of sub-district. *=significant, ns= not significant

In addition, public transportation is still rare, fuel prices are high, and the location is quite far from urban areas, therefore people use more of the plants that are available around them. The Malay community in the research locations has generally worked most in agriculture, mainly pepper, grain, and tuber crops as commercial, economic commodities. However, since the development of large commercial plantations in the area, especially oil palm & rubber, the community's dependence on cultivated species has become increasingly visible in the other three sub-districts, Tanjung Pandan, Sijuk, and Selat Nasik. The emergence of plantations has caused a slight decrease in forest land in the area. Further urbanization has increased the distance between residences and the source of wild plant species. Furthermore, the number of older people who are relatively more knowledgeable about wild plant species and their use are also decreasing. This situation resulted in the younger members of the Malay community having much less knowledge and carrying out much fewer activities to exploit wild species, switching instead to a more practical lifestyle. The decline in traditional knowledge is also caused by the reduced time to interact with the forest due to changes in work activities, for example, as a tour guide or porter, and having a higher formal education which marginalizes local ethnobotanical knowledge (Saynes-Vasques et al. 2016). The loss of traditional knowledge will cause local people to no longer know how to manage forest resources sustainably, therefore it is an indirect indicator of forest degradation (Pei 2013).

Generally, the plant families that are most widely used by the Malay community varies among sub-districts. The plant family that is most widely used is Myrtaceae (the guava family) (Table 4). People in the Membalong sub-district utilize 17 species of five genera, 1.e., *Eugenia, Rhodamnia, Rhodomyrthus, Syzygium,* and *Tristaniopsis*. People ussually used leaves, flower, and fruit from the Myrtaceae family member. Leaves and flowers are used for a spice and/or baverage, while fruit is usually freshly consumed. Most Myrtaceae species (15 species) were found in the forest, and only two species were found in the yards, i.e., Malay apple (*Syzygium malaccensis*) and Indonesian bay leaf (*Syzygium polyanthum*). Two species, Malay apple (*S. malaccensis*) and clove (*S. aromaticum*), are only found as cultivated plants. Cloves are often used as a seasoning for flavor enhancers or aroma enhancers. In many countries, clove is a flavoring additive to meats, stewed fruits, pickles, curries, pies, and salads. According to the US Food and Drug Administration, clove is generally considered safe (GRAS) when consume as a food additive (Singletary 2014). In addition, clove has been shown to have enormous potential as a food preservative (Dudonné et al. 2009).

The second family that is widely used is Arecaceae. The Arecaceae family is most used in the Membalong sub-district (11 species). Malay community used their fruits and stems. The third family that is widely used are Anacardiaceae (mango family) and Zingiberaceae (ginger family), with the highest number of species (12 species) located in the Membalong Sub-district. All species of the

Anacardiaceae family (e.g., cashew and mango) are used for their fruit except for Golden apple (*Spondias dulcis*), which is used for their leaves. The fruit is used as fresh fruit, drinks, and sources of carbohydrates, while the leaves are used for vegetables and seasonings. Most species of the Zingiberaceae family are used for their rhizomes as a cooking spice, and only two are used for their leaves and fruit. Many ethnics in the world, including India, Indonesia, Malaysia, Thailand, Vietnam, and southern China, use many species of Zingiberaceae for cooking spices (Nair 2019; Meitei et al 2022). For example, ginger gives a distinctively spicy taste, preserves food, and makes food a better taste. The positive effects come from its phenolic compounds (Noori et al. 2018; Mao et al. 2019; Tinello and Lante 2020).

The following families that are also frequently used are Fabaceae, Poaceae, Euphorbiaceae, Moraceae, and Cucurbitaceae. The number of species in these families varies in each Sub-district (2-7 species), but the plant organs used are almost the same. These results show that in each sub-district, there are variations in species, family, and number of species in each plant family used by the Malay community. The families widely used in all districts are Anacardiaceae, Arecaceae, Zingiberaceae, Poaceae, and Moraceae, with the number of species varying among sub-districts.

The community's use of food plants, especially wild plants, highly depends on their environmental availability. Different environmental conditions such as altitude, latitude, and climate will provide different species of plants. In temperate climates, the diversity of genera increases with latitude, whereas in tropical climates, the number of genera decreases with increasing latitude (Xu et al. 2017). Variation in altitude in an area causes changes in temperature, humidity, heat, and illumination which then affect the composition of plant species and community structure (He et al. 2013). Therefore, it is not surprising that every ethnic group prefers a particular plant species as a food source.

Category of plant utilization in Belitung District

The Malay Community in Belitung District is a rural community whose life still relies on natural resources to meet their needs for food, medicine, fuel, building materials, materials for mythological needs, and other necessities. They have good knowledge of the diversity of plant species in their surroundings. This knowledge is evident in their ability to recognize, name, and utilize various plant species in their environment, yards, agricultural areas, gardens, and forests. It can be seen from how these people take or harvest plant species in their surroundings. The Malay Community utilizes many species of wild and cultivated plants for consumption and daily needs in their household. The species of plants used are mainly from the Zingiberaceae and Arecaceae families, such as ginger (*Zingiber officinale* Roscoe), turmeric (*Curcuma longa* L.), coconut (*Cocos nucifera* L.), and young shoots of rattan (*Calamus* sp.). This plant species is commonly used in food preparation, mainly used to make Gangan soup, which are special foods whose main ingredients are made from seafood and freshwater fish. Gangan soup is usually served by eating 'bedulang', sitting together while eating a dish.

The Malay community in Belitung District utilizes many species of food plants to fulfill their daily life in a subsistence manner. Most people in five sub-districts in Belitung District (60%) prepare by processing food plants before consuming them (Table 2). Food processing is intended to remove or kill bacteria, increase food taste, extend shelf life, and increase food's economic value. There are several reasons why food needs to be processed before being consumed; for example, food cannot be eaten raw, health reasons, a considerable amount of food due to certain plant species bearing fruit simultaneously, or food being perishable. The reasons follow the general goals in processing agricultural products, i.e., food preservation, food safety, and food security (Knorr et al. 2018).

Table 4. Plant families utilized by Malay Ethnic in Belitung District, Indonesia

Families	Number of species
Myrtaceae	17
Arecaceae	13
Anacardiaceae, Zingiberaceae	12
Fabaceae	9
Poaceae	8
Euphorbiaceae, Moraceae	7
Cucurbitaceae	6
Clusiaceae, Malvaceae, Meliaceae, Myrsinaceae	4
Lauraceae, Phyllanthaceae, Rutaceae, Sapindaceae, Solanaceae, Theaceae	3
Amaryllidaceae, Asteraceae, Convolvulaceae, Dioscoreaceae, Elaeocarpaceae, Ericaceae, Fagaceae, Gnetaceae, Lecythidaceae, Liliaceae, Melastomaceae, Musaceae, Oxalidaceae, Rubiaceae	2
Alismataceae, Amaranthaceae, Annonaceae, Aquifoliaceae, Araceae, Asparagaceae, Blechnaceae, Bromeliaceae, Calophyllaceae, Cannaceae, Caricaceae, Celastraceae, Combretaceae, Cycadaceae, Hypericaceae, Lamiaceae, Maranthaceae, Menispermaceae, Myristicaceae, Olacaceae, Pandanaceae, Piperaceae, Proteaceae, Smilacaceae, Thymelaeaceae, Ulmaceae, Vitaceae	1

The Malay community uses plants for various purposes. Plant organ used varies, namely tubers, rhizomes, stems, bark, leaves, buds, flowers, fruits, and seeds. The most used plant part is the fruit (Figure 3), followed by the leaves. Some species of food plants can be utilized for more than one organ. Many tribes in the world use more fruit and leaves of plants for food sources than any other plant organs, such as Agni tribes of Central-east and Northeast of Côte d'Ivoire (Malan et al. 2020), people in Sedie Muja District, South Gondar Zone Northwestern Ethiopia (Abera 2022), people of Lawat, District Neelum, Azad Jammu & Kashmir, Pakistan (Ijaz et al. 2022). The food plants used can be grouped into seven utilization categories, namely staple food, sources of carbohydrates, fruits, vegetables, grains, seasonings, and beverages. The highest utilization category is fruits, vegetables, and cooking spices (Figure 4). The lowest utilization category is stapled food because all Malay people in the Belitung District utilize rice as a staple food of rice (*Oryza sativa*). However, rice in the Tanjung Pandan Sub-district is imported from outside of the Island.

The Malay community in Belitung District has the same primary carbohydrate source, namely rice (*Oryza sativa*). However, the Malay community also utilizes various species of tubers as an additional source of carbohydrates. The species used as a source of carbohydrates includes sorghum (*Sorghum bicolor*), cassava (*Manihot esculenta*), intoxicating yam (*Dioscorea hispida*), edible canna (*Canna edulis*), and corn (*Zea mays*). These species are usually consumed by pre-processing, such as sorghum, cassava, and intoxicating yam. Besides being processed by boiling, several species of tubers must be processed in a particular way to remove their toxic content, for example, intoxicating yam tuber. The tubers of this plant species contain hydrogen cyanide compounds which have poisonous properties when they enter our bodies (Pramitha & Wulan 2017). The community has not used this plant species as a substitute for staple food but is only used as additional food because the availability of the staple food, rice, is still sufficient. However, these species can be an alternative for meeting the needs of famine. Wild plants can contribute to meeting food needs, help survive during famine and maintain the sustainability of traditional ecological knowledge because the presence of wild species in their environment will encourage people to find out the benefits of these species and then cultivate them (Turner et al. 2011).

Our results show that the community utilizes most wild and cultivated food plant species as a source of fruits (Table 2). The Belitung Malay community likes to consume wild fruit, especially species of fruit with a sour or sweet taste. The fruit is used to make a hot salad, for example, mango (*Mangifera indica*) and *Asam kelubi* (*Eleiodoxa conferta*). Apart from taste, the safety level of eating them is also an important consideration. The consumption of fruit comes with a few significant risks, as they may be toxic, bitter, spicy, hot, or cause itchiness. This risk can be reduced before eating by peeling the skin first and followed by washing the fruit with running water. Most of the fruit can be consumed fresh or processed into other foods. Fruit species and the number of species used by the Malay community in the Belitung District varied among sub-districts. This result follows the previous study that showed the consumption of wild edible fruit in eastern Bhutan differed significantly between districts, age groups, and indigenous knowledge levels (Yangdon et al. 2022).

The Malay people use many plants as a seasoning or flavor enhancer source. The plants are added to dishes to enrich processed dishes' taste more optimally. For example, the bay leaves (*S. polyanthum*) enhance the flavor of sour dishes in sour soups, stir-fries, or processed meats such as beef stews. The fragrant aroma can make the food more delicious. The Malay Community generally cooks soup of freshwater fish and seafood, Gangan soup, when someone visits their house or celebrates big events such as weddings and other rituals. This plant species is often found and grows in the yard around the house, on the side of the road, or in the garden. The Malay Community also uses bay leaves for health, such as lowering cholesterol levels and blood pressure because the extract of bay leaves can lower cholesterol levels in the blood (Prianwari et al. 2019). Ismail and Ahmad (2019) reported that its leaves content of three vitamins, i.e. B2 (riboflavin), B3 (niacin), and C (ascorbic acid). The vitamins will help the human body to maintain normal physiological functions. Bay leaves also have antioxidant, antidiabetic, antimicrobial, antitumor, anticancer, antidiarrheal, acetylcholinesterase inhibitory, and lipase inhibitory activities because the leaves contain carbohydrates, tannins, alkaloids, steroids, triterpenoids, and flavonoids (Rahim et al. 2018).

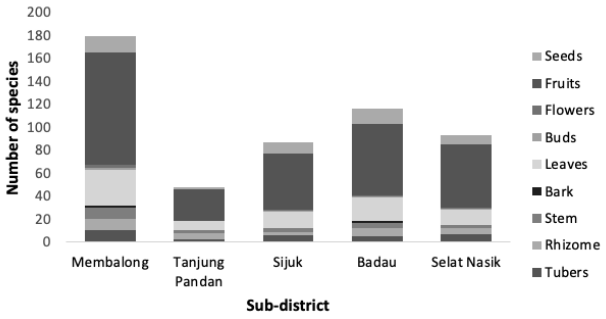

Figure 3. Part of the plant used as a food source

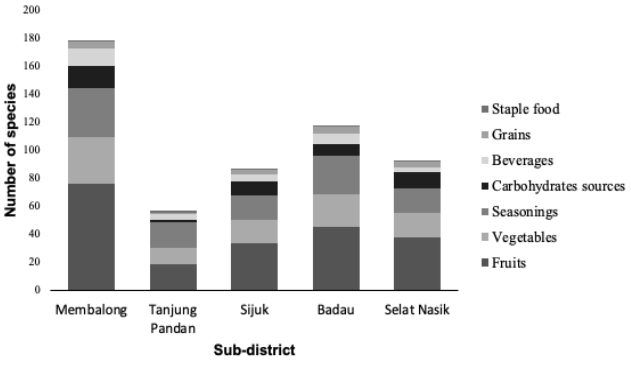

Figure 4. Categories of plant utilization

The Malay community uses many species of wild plants for vegetables. One species, climbing fern (*Stenochlaena palustris*), is a plant species that grows wild in swamps but is often used as a vegetable by the local community. The leaves of climbing fern (*Stenochlaena palustris*) contain vitamin C, iron (Fe), and calcium, which is potentially utilized as an antioxidant function and blood sugar control (Pandiangan et al. 2022). Therefore, it is unsurprising that the Malay community also uses this species as a traditional medicine to treat boils, skin diseases, and blood booster. The Belitung Malay community also uses young rattan stems (*Daemonorops* sp.) to enhance the taste and aroma of Gangan soup. Besides being suitable for vegetables, *Daemonorop* species also have health functions. For example, one species of *Drymonorops*, *D. acehensis*, is known to have a dracorhodin compound. The ethanol extract and phytosome resin of the plant has antioxidant and photoprotective activities (Sari et al. 2022).

Analysis of importance value of food plants

Quantification of the utilization of plant species was carried out by calculating the value of the Index of Cultural Significance (ICS) that represents the importance of plant utilization in the socio-cultural life of the Malay community. The calculation is based on the value of the quality of use (as staple or other food, fruits, drinks, seasonings, and vegetables), the intensity of use, and the value of exclusivity or preference for a species. The ICS value indicates the level of importance of a plant species from the most important (many, frequent, and the primary choice) to the least important or minimal use. The high ICS value means means that the species is of high cultural importance. The more benefits the plant species has, the more often the intensity of its use, and the more exclusive the species, the higher the ICS value of the species for the society.

Table 5 presents ten plant species with high ICS value categories in 5 sub-districts. The valuable plant species with the highest ICS value in 4 sub-districts is coconut (*Cocos nucifera*), with varying values (60-104) among sub-districts. This species has a high ICS value because it has a very high use value and intensity of use and is the most preferred species by the community (high exclusivity value). The primary benefit of this species is as a cooking spice, and almost all parts of this species can be utilized. The leaves are used for food packaging; young fruit is used as a refreshing drink, old fruit is used for cooking curries, including the young coconut stem (called umbut) as a mixture in Gangan soup. Coconut (*Cocos nucifera*) also has the highest ICS species in other ethnicities, such as the Saibatin ethnic in Lampung, Indonesia (Wakhidah et al. 2020).

In contrast to the other four sub-districts, orange Konci (*Citrus microcarpa*) has the highest ICS value in the Selat Nasik Sub-district, which is located on Mendanau Island that surrounded by natural beaches. Most people in the Sub-district consume various marine products, such as fish, squid, and shrimp. To process those marine products, people in the Sub-district use orange Konci (*Citrus microcarpa*) to eliminate the fishy smell. The fruit of orange Konci is also used for making a drink of lime ice or hot lime juice, for giving a sour taste to grilled or fried salted fish, for replacing sour on fried fish (to make it crispy), and tamarind in chilli sauce if there is no orange limo, acid substitute for vinegar in meatball sauce, and flavor enhancer acid in a dipping sauce of fish cake. The orange Konci juice is rich in vitamin C because it contains citric acid and lactic acid, which give it a sour taste. In addition, it also has several secondary metabolites, namely alkaloids, flavonoids, saponins, tannins, and phenols. The dominant secondary metabolites are saponins (Yanti et al. 2021). Besides the juice, orange Konci (*Citrus microcarpa*)' s essential leaf oils exhibited antioxidant activity higher than that of vitamin C (Nguyen et al. 2018). Chen et al. (2017) detected 43 volatile compounds in the essential oil of orange Konci (*Citrus microcarpa*), and the limonene was the highest component (87.52%) of the volatile compound.

Table 5. The 10 highest ICS values of food plants in Membalong, Tanjung Pandan, Sijuk, Badau, and Selat Nasik Sub-districts (Indonesia)

Scientific name (ICS values)				
Membalong	**Tanjung Pandan**	**Sijuk**	**Badau**	**Selat Nasik**
Cocos nucifera (68)	*Cocos nucifera* (60)	*Cocos nucifera* (104)	*Cocos nucifera* (60)	*Citrus microcarpa* (64)
Oryza sativa (64)	*Musa paradisiaca* (44)	*Oryza sativa* (40)	*Oryza sativa* (50)	*Musa* sp. (50)
Piper nigrum (56)	*Garcinia mangostana* (32)	*Piper nigrum* (40)	*Musa paradisiaca* (48)	*Cratoxylum glaucum* (49)
Averrhoa carambola (56)	*Capsicum annum* (30)	*Pithecellobium jiringa* (40)	*Piper nigrum* (32)	*Spondias dulcis* (42)
Averrhoa bilimbi (44)	*Spondias dulcis* (30)	*Rhodomyrthus tomentosa* (40)	*Capsicum annum* (30)	*Oryza sativa* (36)
Garcinia parvifolia (42)	*Carica papaya* (24)	*Stenochlaena palustris* (40)	*Carica papaya* (24)	*Ipomoea batatas* (36)
Tamarindus indica (39)	*Cymbopogon citratus* (24)	*Dendrocalamus asper* (32)	*Ipomoea batatas* (24)	*Curcuma longa* (36)
Zingiber officinale (36)	*Cymbopogon nardus* (24)	*Ipomoea batatas* (32)	*Manihot esculenta* (24)	*Rhodomyrthus tomentosa* (36)
Syzygium polyanthum (36)	*Zingiber officinale* (24)	*Musa paradisiaca* (32)	*Rhodomyrthus tomentosa* (24)	*Alpinia galanga* (33)
Durio ziberthinus (36)	*Curcuma longa* (24)	*Parchia speciosa* (32)	*Cymbopogon citratus* (24)	*Garcinia mangostana* (32)

The white pepper (*Piper nigrum*) ICS value is relatively high in three sub-districts, Membalong, Sijuk, and Badau. The high value indicates that the white pepper is an essential part of the plantations of the Belitung Malay community. In the three sub-districts, the area for white pepper plantations is more extensive than in the other two sub-districts (Membalong 7,195 ha, Sijuk 771 ha, and Badau 809 ha). The highest production of white pepper from plantations was in Membalong (4,697,000 tons), followed by Sijuk (675,000 tons), and Badau (634,750 tons) (BPSKB 2021). The high ICS value of White pepper reflects the high preference level of the Malay people towards this species and is the reason for its popularity and continuous cultivation. White pepper is grown not only for self-consumption but more to be marketed outside the island and abroad, such as in Vietnam and other Southeast Asian regions. White pepper is used as a cooking spice.

Rice (*Oryza sativa*) also has high ICS values in 4 districts. This species has a high ICS value because it has a very high use value and intensity of use and is the most preferred species by the community (high exclusivity value). The primary benefit of the species is as a staple food. There is no other staple food to replace rice. Rice is also an important crop for many tribes in Indonesia. In the Mandailing Tribe, who live around the batang Gadis National Park, North Sumatra, rice has the highest ICS value. Rice is considered the most valuable species because it is used for various needs, including staple food, animal feed, organic fertilizer (straw), and ritual material (Nasution et al. 2018). Rice is also the most important species of the indigenous people of Dusun Beleq, Gumantar Village, Kayangan District, North Lombok District, which is used for various uses, including as a staple food, livestock feed, and ritual plant (Jannaturrayyan et al. 2020). However, rice is not included in the high ICS value in Tanjung Pandan Sub-district. It is likely due to the Tanjung Pandan Sub-district being Belitung District's capital, which is inhabited by multi tribes who co-exist peacefully, such as Chinese, Javanese, Sundanese, Batak, Minangkabau, as well as the Malays. The cultures of different tribes have influenced the food consumption pattern of the Malay people, so even though rice is used as a staple food, it is not widely used for other utilization categories.

Plants are very close to the culture of the Malay community in the Belitung District. Typical cultural elements or traditions of the Belitung Malay people affect the utilization of plant resources for food, both in routine daily activities such as eating and drinking, as well as in special cultural activities (events and ceremonies) such as those related to various rituals and customs, village and religious celebrations, traditional farming (from land clearing, processing to harvesting), the cycle of life (birth, marriage to death), welcoming guests of honor, and the combination of these various elements. Several examples can be mentioned here, including Eating Bubor Nunu (compote made from cassava) during *'the Nunu Reba'* season (the activity of burning trees that have been cut down and withered (reba') in the *huma* (fields)) and *Maras Taun* (annual rice harvest celebration) with various regional arts and typical dishes from the harvest in the form of traditional cakes, rice chips, Javanese porridge, and especially sticky rice cake (lepat pulut) which can be brought home as a blessing. Many plant species used by the Malay community in the Belitung district illustrate the potential plant species to be developed as a food source.

In conclusion, the Malay community in Belitung District utilizes many plant species that grow around it, both cultivated and wild plants, as a food source. Plant utilization varies among sub-districts in terms of the number of species used, most used family, consumption form, food preparation, the part of the plant used, the location where the plant is collected, and the category of utilization. The forest area in sub-district, sub-district area, and distance between the sub-district and the urban mainly influence knowledge of local plant diversity. The Malay community in Belitung District utilizes the plants they traditionally find in nature, meaning that it is based on their experience and natural abilities with a pattern of utilization based on the knowledge that has been passed down from generation to generation and has not been touched by modern equipment. Plant utilization is only intended to meet the subsistence needs of the community. These results indicate that wild plants have enormous potential for developing local food to meet their daily needs. Therefore, wild plants as a food source must be given more attention considering that wild plants can be alternative food sources to meet local food needs.

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REFERENCES

Abera M. 2022. Ethnobotanical study of wild edible plants and their indigenous knowledge in Sedie Muja District, South Gondar Zone, Northwestern Ethiopia. Amer J Plant Sci 13: 241-264. DOI: 10.4236/ajps.2022.132015.

Backer CA, van den Brink RCB. 1968. Flora of Java (Spermatophytes only). P. Noordhoff, Groningen.

Badan Pusat Statistik (BPS). 2010. Statistik Indonesia 2010. BPS, Jakarta. [Indonesian]

Badan Pusat Statistik Kabupaten Belitung (BPSKB). 2021. Belitung District in Figures. CV Sejati, Belitung. [Indonesian]

Boesi A. 2014. Traditional knowledge of wild food plants in a few Tibetan communities. J Ethnobiol Ethnomed 10: 75. DOI: 10.1186/1746-4269-10-75.

Chen MH, Yang KM, Huang TC, Wu ML. 2017. Traditional Small-Size Citrus from Taiwan: Essential oils, bioactive compounds, and antioxidant capacity. Medicines 4 (2): 28. DOI: 10.3390/medicines4020028.

Dudonné S, Vitrac X, Coutière P, Woillez M, Mérillon JM. 2009. Comparative study of antioxidant properties and total phenolic content of 30 plant extracts of industrial interest using DPPH, ABTS, FRAP, SOD, and ORAC assays. J Agric Food Chem 57 (5): 1768-1774. DOI: 10.1021/jf803011r.

Ghorbani A, Langenberger G, Sauerborn J. 2012. A comparison of the wild food plant use knowledge of ethnic minorities in Naban River Watershed National Nature Reserve, Yunnan, SW China. J Ethnobiol Ethnomed 8: 17. DOI: 10.1186/1746-4269-8-17.

Harisha RP, Gowthami R, Setty RS. 2021. Vocal to local: Indigenous dietary practices and diversity of wild food plants in Malai Mahadeswara Wildlife Sanctuary, South India. Ethnobot Res Appl 22: 1-27. DOI: 10.32859/era.22.22.1-27.

He YH, Yan M, Zhang QD, Zhang ZF, Miao YM, Bi RC. 2013. Altitudinal pattern of plant species diversity in the Wulu Mountain Nature Reserve, Shanxi, China. Acta Ecol Sin 33 (8): 2452-2462. DOI: 10.1371/journal.pone.0174231.

Henri, Fatansyah F, Alita, Lestari Y, Sonia A, Putri JE, Rahmasari. 2022. Community's local wisdom and its relationship with environmental conservation efforts in Bangka Belitung, Indonesia. IOP Conf Ser: Earth Environ Sci 1115: 012036. DOI: 10.1088/1755-1315/1115/1/012036.

Ijaz S, Perveen A, Ashraf S, Abid R, Kousar S, Abbas Z, Arslan M. 2022. Traditional knowledge of wild edible plants used by the people of Lawat, District Neelum, Azad Jammu & Kshmir, Pakistan. Ethnobot Res Appl 23: 1-16. DOI: 10.32859/era.23.24.1-16.

Ismail A, Ahmad WA. 2019. *Syzygium polyanthum* (Wight) Walp: A potential phytomedicine. Pharmacog J 11 (2): 429-38. DOI: 10.5530/pj.2019.11.67.

Jannaturrayyan S, Sukenti K, Rohyani IS, Sukiman. 2020. Ethnobotanical study on plants used by local people in Dusun Beleq, Gumantar Village, North Lombok Regency. Biosaitifika 12 (2): 203-212. DOI: 10.15294/biosaintifika.v12i2.23807.

Jia X, Zhao Y Zhu Y, Zen X, Liang X, Xie X. 2022. Ethnobotany of wild edible plants in multi-ethnic areas of Gansu-Ningxia-Inner Mongolia junction zone. J Ethnobiol Ethnomed 18 (53): 1-14. DOI: 10.21203/rs.3.rs-1694601/v1.

Knorr D, Khoo CSH, Augustin MA. 2018. Food for an urban planet: Challenges and research opportunities. Front Nutr 4 (73): 1-6. DOI: 10.3389/fnut.2017.00073.

Kolosova V, Belichenko O, Rodionova A, Melnikov D, Sõukand R. 2020. Foraging in Boreal Forest: Wild food plants of the Republic of Karelia, NW Russia. Food 9 (8): 1-47. DOI: 10.3390/foods9081015.

Łuczaj Ł, Jug-Dujaković M, Dolina K, Jeričević M, Vitasović-Kosić I. 2019. The ethnobotany and biogeography of wild vegetables in the Adriatic islands. J Ethnobiol Ethnomed 15 (18): 1-17. DOI: 10.1186/s13002-019-0297-0.

Malan DF, Litta AL, Kougbo MD, Diop AL, Kouassi KG. 2020. Wild edible plants in four Agni tribes of Central-east and Northeast of Côte d'Ivoire: A comparative study. Biodiversitas 21 (10): 4896-4902. DOI: 10.13057/biodiv/d211056.

Mallick SN, Sahoo T, Naik SK, Panda PC. 2020. Ethnobotanical study of wild edible food plants used by the tribals and rural populations of Odisha, India for food and livelihood security. Plant Arch 20 (1): 661-669.

Mao QQ, Xu XY, Cao SY, Gan RY, Corke H, Beta T, Li HB. 2019. Bioactive compounds and bioactivities of ginger (*Zingiber officinale* Roscoe). Foods 8 (6): 1-21. DOI: 10.3390/foods8060185.

Martin GJ. 1998. Ethnobotany: A People and Plants Conservation Manual. Chapman And Hall, London (GB).

Meitei LR, De A, Mao AA. 2022. An ethnobotanical study on the wild edible plants used by forest dwellers in Yangoupokpi Lokchao Wildlife Sanctuary, Manipur, India. Ethnobot Res Appli 23: 1-22. DOI: 10.32859/era.23.15.1-25.

Nair KP. 2019. Ginger as a Spice and Flavorant. Springer Nature Switzerland AG, Switzerland. DOI: 10.1007/978-3-030-29189-1_26.

Nasution A, Chikmawati T, Walujo EB, Zuhud EAM. 2018. Ethnoecology of Mandailing Tribe in Batang Gadis National Park. IOP Conf Ser: Earth Environ Sci 197: 012017. DOI: 10.1088/1755-1315/197/1/012017.

Nedelcheva A. 2013. An ethnobotanical study of wild edible plants in Bulgaria. Eurasian J Biosci 7: 77-94. DOI: 10.5053/ejobios.2013.7.0.10.

Nguyen TNT, Huynh TGN, Tran VT, Dang CH, T, Hoang KD, Nguyen TD. 2018. Physicochemical characterization and bioactivity evaluation of essential oils from *Citrus microcarpa* Bunge leaf and flower. J Essent Oil Res 30 (4): 285-292. DOI: 10.1080/10412905.2018.1435428.

Noori S, Zeynali F, Almasi H. 2018. Antimicrobial and antioxidant efficiency of nanoemulsion-based edible coating containing ginger (*Zingiber officinale*) essential oil and its effect on safety and quality attributes of chicken breast fillets. Food Control 84: 312-320. DOI: 10.1016/j.foodcont.2017.08.015.

Oktavia D, Pratiwi SD, Munawaroh S, Hikmat A, Hilwan I. 2022. The potential of medicinal plants from heath forest: Local knowledge from Kelubi Village, Belitung Island, Indonesia. Biodiversitas 23 (7): 3553-3560. DOI: 10.13057/biodiv/d230731.

Pandiangan FI, Oslo EA, Destine F, Josephine, Anwar RA. 2022. A review on the health benefits of kalakai (*Stenochlaena palustris*). JFFN 4 (1): 1-16. DOI: 10.33555/jffn.v4i1.98.

Pei SJ. 2013. Ethnobotany and sustainable use of biodiversity. Plant Divers Res 35 (4): 401-406. DOI: 10.7677/ynzwyj201313002.

Phatlamphu N, Saensouk S, Saensouk P, Jungsongduang A. 2021. Ethnobotany of edible plants in Muang District, Kalasin Province, Thailand. Biodiversitas 22: 5432-5444. DOI: 10.13057/biodiv/d221226.

Pieroni A, Sõukand R, Amin HIM, Zahir H, Kukk T. 2018. Celebrating multi-religious co-existence in central Kurdistan: The bio-culturally diverse traditional gathering of wild vegetables among Yazidis, Assyrians, and Muslim Kurds. Hum Ecol 46: 217-227. DOI: 10.1007/s10745-018-9978-x.

Pieroni A, Sõukand R. 2019. Ethnic and religious affiliations affect traditional wild plant foraging in central Azerbaijan. Genet Resour Crop Evol 66: 1495-1513. DOI:10.1007/s10722-019-00802-9.

Pramitha AR, Wulan SN. 2017. Detoxification of cyanide in Gadung tuber (Dioscorea hispida Dennst.) by a combination soaking in ash suspension and boiling. JPA 5 (2): 58-65. [Indonesian]

Prianwari C, Lindarto D, Syafril, S. 2019. Comparison bay leaf (*Syzygium Polyanthum* (wight) walp) extract with 400 mg and 600 mg dose on Lipoprotein(a) Concentration in Dyslipidemic patients. Intl J Res Sci Manag 6 (9): 21-27. DOI: 10.5281/zenodo.3465769.

Quave CL, Pieroni A. 2015. A reservoir of ethnobotanical knowledge informs resilient food security and health strategies in the Balkans. Nat Plants 1: 14021. DOI: 10.1038/nplants.2014.21.

Rahim ENAA, Ismail A, Omar MN, Rahmat UN, Ahmad WANW. 2018. GC-MS analysis of phytochemical compounds in *Syzygium polyanthum* leaves extracted using ultrasound-assisted method. Pharmacog J 10 (1): 110-9. DOI: 10.5530/pj.2018.1.20.

Sansanelli S, Ferri M, Salinitro M, Tassoni A. 2017. Ethnobotanical survey of wild food plants traditionally collected and consumed in the Middle Agri Valley (Basilicata region, southern Italy). J Ethnobiol Ethnomed 13: 50. DOI: 10.1186/s13002-017-0177-4.

Sari RK, Prayogo YH, Rozan SA, Rafi M, Wientarsih I. 2022. Antioxidant activity, sun protection activity, and phytochemical profile of ethanolic extracts of *Daemonorops acehensis* resin and its phytosomes. Sci Pharm 90 (1): 1-10. DOI: 10.3390/scipharm90010010.

Sarman. 2016. Representation of the local wisdom of the Belitung people in the sacred story Pianag Gading. Sirok Bastra, Jurnal Ilmiah Kebahasaan dan Kesastraan 4 (2): 153-160. DOI: 10.37671/sb.v4i2.85. [Indonesian]

Saynes-Vásquez A, Vibrans H, Vergara-Silva F, Caballero J. 2016. Intracultural differences in local botanical knowledge and knowledge loss among the Mexican Isthmus Zapotecs. PLoS ONE 11(3): e0151693. DOI: 10.1371/journal.pone.0151693.

Simpson MG. 2006. Plant Systematics. Elsevier Inc, Burlington USA.

Singletary K. 2014. Clove: Overview of potential health benefits. Culinary Nutrit 49 (4): 207-224. DOI: 10.1097/NT.0000000000000036.

Sulistyaningsih YC, Dorly, Djuita NR, Ariyanti NS, Akmal H, Putra HF, Fakhrurrozi Y, Mustaqim WA. 2019. A Field Guide to the Potential Plants of Belitung Islands. IPB Press, Bogor. [Indonesian]

Syariful S. 2018. Creative economy based on local wisdom in Bangka Belitung. Activa 1 (2): 1-17.

Tinello F, Lante A. 2020. Accelerated storage conditions effect on ginger- and turmeric-enriched soybean oils with comparing a synthetic antioxidant BHT. LWT 131: 109797. DOI: 10.1016/j.lwt.2020.109797.

Turner NJ, Łuczaj LJ, Migliorini P, Pieroni A, Dreon AL, Sacchetti LE, Paoletti MG. 2011. Edible and tended wild plants. Crit Rev Plant Sci 30 (1): 198-225. DOI: 10.1080/07352689.2011.554492.

Turner NJ. 1988. The importance of a rose: Evaluating the cultural significance of plants in thompson and lillooet interior salish. J Am Anthropol 90 (2): 272-290. DOI: 10.1525/aa.1988.90. 2.02a00020.

Wakhidah AZ, Chikmawati T, Purwanto Y. 2020. Homegarden ethnobotany of two Saibatin Villages in Lampung, Indonesia: Species diversity, uses, and values. For Soc 4 (2): 338-357. DOI: 10.24259/fs.v4i2.9720.

Xu M, Ma L, Jia Y, Liu M. 2017. Integrating the effects of latitude and altitude on the spatial differentiation of plant community diversity in a mountainous ecosystem in China. PLoS ONE 12 (3): e0174231. DOI: 10.1371/journal.pone.0174231.

Yangdon P, Araki T, Rahayu YYS and Norbu1 K. 2022. Ethnobotanical study of wild edible fruits in eastern Bhutan. J Ethnobiol Ethnomed 18 (27): 1-17. DOI:10.1186/s13002-022-00526-8.

Yanti SN, Chandra VE, Vanesa. 2021. Study of secondary metabolites in jeruk sambal juice (*Citrus microcarpa* Bunge) from Desa Kalimas, Kalimantan Barat. JPS 4 (2): 105-110. DOI:10.36490/journal-jps.com.v4i2.66.