Edible plants of the Batak Karo of Merdeka District, North Sumatra, Indonesia

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Database and Inventories

Abstract

Background: Batak Karo is one of Batak tribes reputed for their local knowledge about the use of plants for purposes such as food. The objectives of this ethnobotanical study were to document local knowledge related to the uses of wild edible plants and to provide ethnobotanical data on edible plants of the Batak Karo ethnic in order to contribute to the Indonesian traditional food knowledge. This paper presents part of the ethnobotanical research carried out in Merdeka District, North Sumatra, Indonesia.

Methods: Ethnobotanical information was obtained by interviewing 58 Karonese informants in Merdeka (28) and Jaranguda (30). Fifty-five percent of the interviewed people were men. Informants were determined through purposive sampling with the criteria of being married, using plants in the surrounding environment as food, farmers and having access to the forest. We conducted interviews (semi-structured and not closed questionnaire) during the fieldwork.

Results: A total of 53 food plants belonging to 27 families were documented. Thirty percent of the collected species are wild and used for food. Several of these edible plants are also referred as medicinal plants for local people so they could be classified as food medicines. *Begonia laruei* M. Hughes, *Medinilla speciosa* Blume, *Debregeasia longifoli* (Burm. f.) Wedd, *Zanthoxylum acanthopodium* DC and *Eugenia polyantha* Barb. Rord. need to be evaluated as potential crops. This study highlights the rich traditional knowledge on edible plants retained by Batak Karo people.

Conclusion: The consumption of wild edible plants is still alive in Batak Karo people. The importance of some of these plant species as wild crops must be outlined since they are a source of genetic resources to establish diversity food.

Key words: food plants, edible plants, traditional food, wild food plants, vegetables, fruits, Batak Karo

Ringkasna

Mula-mulana: Kalak Batak Karo melala pemetehna ibas kegunaan sinuan sinuan si lit ibas kerangen entah pe si lit ibas sekitarna si baci i pakeken guna kebutuhen pangan. Mepulung pemeteh maka baci i gunaken kalak si enterem. Tulisen enda encidahken pemeteh kalak Karo ibas kegunaan sinuan sinuan si lit ibas Kecamaten Merdeka, Kabupaten Karo, Sumatra Utara, Indonesia baik ia si lit ibas kerangen entah pe si suanna ibas jumana.

Cara: Cara pepulung pemeteh enda arah ngerana ngerana ras lima puluh waloh kalak Karo i kuta Merdeka ras telu puluh i kuta Jaranguda. Lima plima persen i sungkun enda emekap dilaki ras sisana diberu. Dilaki ras diberu si

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isungkuni ndai emekap jelma si enggo erjabu ras make ken sinuan sinuan si lit i sekitarna man pangan, si ku juma bage pe si ku kerangen.

Asilna: Lit lima puluh telu sinuan sinuan baci i golongken ku dua puluh pitu keluarga. Ibas kerina sinuan sinuan ndai, lit telu puluh empat persen i jumpai ibas kerangen nari si gunaken man adum kalak Karo ibas ia nanggerken panganna.

Kedungenna: Sinuan sinuan si lit turah ibas kerangen ndai asa gundari lit denga gunana ibas kalak Karo. Kerina sinuan sinuan si lit ibas kerangen ndai situdohken entah pe sikataken man kerina jelma maka enterem kalak singeteh sa pangan si lit ibas kerangen baci nge i pan.

Sipenting: sinuan sinuan man pangan, sinuan sinuan si baci pan, sinuan pangan kuta, sinuan sinuan si turah ibas kerangen, gulen, buah buahen, Karo

Background

Food plants are the main source of food used by humans to meet their nutritional needs. Ethnic groups in Indonesia have local wisdom in recognizing, processing and utilizing food plants (Purba *et al.* 2018), so that the types of food plants are very diverse. Local people's knowledge of food, especially wild plants is decreasing due to changes in lifestyle, decreasing availability, and limited knowledge of its nutritional value (Pawera *et al.* 2020). Abbassi *et al.* (2013) stated that there is a direct or indirect relationship between food ingredients and health, therefore currently consumers demand healthy, delicious and natural food.

Teklehaymanot and Giday (2010) state that wild plants are the mainstay of food when the environmental situation is not favorable for the production of cultivated plants. The local Batak community in North Sumatra utilizes four types of rattan (wild plants), namely *Calamus hookerianus* Becc., *Calamus metzianus* Schltdl., *Calamus thwaitesii* Becc and *Plectocomiopsis geminiflora* (Griff.) Becc. as an alternative source of alternative carbohydrates (Silalahi *et al.* 2021). The availability of wild food plants is very diverse in the environment, but it is often not liked because it is not tasty and its availability is uncertain (Silalahi *et al.* 2018), even though wild plants are healthier (Pawera *et al.* 2020, Silalahi *et al.* 2021). Utilization and processing of local community food is degraded due to factors such as the entry of information/technology, the presence of modern food (Sujarwo *et al.* 2014), food ingredients are difficult to find (Abbasi *et al.* 2013, Purba *et al.* 2018), information on nutritional value is lacking (Pawera *et al.* 2020).

Indonesian local communities, especially those who live around forests, use both cultivated and wild plants as food ingredients, such as the Karo ethnic group in North Sumatra (Purba *et al.* 2018). Batak Karo is one of Batak ethnics inhabiting Sumatra Island specifically in highlands of North Sumatra, **Taneh Karo** (Karo Land). They possess local knowledge on plants for food purposes (Purba *et al.* 2018). Compared to other Batak such as Toba, Simalungun, Angkola-Mandailing, and Pakpak, Karo tribe still maintains their knowledge about traditional medicine (Silalahi *et al.* 2015) and food (Purba *et al.* 2018), easily found in various traditional markets in North Sumatra. Some typical traditional dishes of Batak Karo ethnic include **terites** (Karo soup from beef rumen extract) (Purba *et al.* 2018), **cincang** (vegetables made from cassava leaves, pseudostem banana with various Karo spices) and **cimpa** (steamed snack made from glutinous rice flour with palm sugar) (Aini 2015).

Ethnobotany deals with plants consumed by ethnic group in particular geographical and cultural contexts. The argument for the importance of ethnobotanical study is the need for documentation of plant resources utility. Nowadays Indonesia is losing local knowledge before it has not been documented well (Rifai 1994, Wardojo 2008). The local knowledge of communities has retained diversity of uses for plants such as food purposes. There is an increasing interest in functional foods, concerning both wild and cultivated plants (Heinrich *et al.* 2006). Specifically, for wild edible plants, and it is valuable to study the genetic resources in order to prevent their genetic erosion or for improvement or breeding purposes in cultivated plants (Bonet *et al.* 2002). Furthermore, wild food plants play an important role in times of scarcity and as supplementary foods to supply vitamins, minerals (Tardio *et al.* 2005, Tardio *et al.* 2006).

Most of ethnic communities of Indonesia depend on plant resources mainly for food, herbal medicine, ritual ornaments, forage, livelihoods, dye and fire woods. One of them is Batak Karo people who have inhabited Karo regency, North Sumatra since ancient times. They are highly dependent on their plant resources for most of their basic needs especially for traditional medicines and food (Kushnick 2010, Penny & Singarimbun 1967). As a reflection of the above-mentioned points, in the last few years some researches have been conducted specifically concerning food plants in Batak Karo people (Nisyawati *et al.* 2016, Purba *et al.* 2018). Documentation of food plants especially wild plants, serves as basic data for future studies of nutritional value and increasing food diversity

(Teklehaymanot & Giday 2010), conservation and sustainable use (Amusa *et al.* 2010). The general of the aim of the present study is to provide ethnobotanical data on edible plants of the Batak Karo ethnic, contributing to the Indonesian traditional food knowledge. Therefore, this study has sought to document local knowledge related to uses of wild edible plants.

Materials and methods

Study area

The ethnobotanical study was conducted in 2 villages: Merdeka and Jaranguda, Merdeka District, Karo Regency, North Sumatra, Indonesia (Fig. 1). Karo Regency has a tropical climate with a bimodal seasonality (dry season in February, June and July and rainy season from August to January and March to May) (Badan Pusat Statistik Kabupaten Karo 2020). Merdeka village is the capital of the district. These villages are located about 1162 – 1453 m above sea level. The average annual temperate is 16-17° C. The total annual rainfall is around 17-321 mm.

The population of Jaranguda was 2891 according to the 2020 census and Merdeka was 2389 (Badan Pusat Statistik Kabupaten Karo 2020). Batak Karo people in Merdeka and Jaranguda have access to forests close to Mt. Sibayak. Furthermore, most of Batak Karo in Merdeka District are horticultural farmers such as *Solanum lycopersicum* L., *Brassica oleracea* L., *Apium graveolens* L., *Daucus carota* L., and *Capsicum annuum* L. Living in highlands of North Sumatra provides Batak Karo people opportunity to explore the wild and gather some useful plants especially for food and traditional medicines. The interaction with environment leads them to know the utilization of plants. More than 90% of the population in the area are ethnic Karo and the rest are ethnic Simalungun, Toba and Javanese. Batak Karo people who live in Karo Regency speak Indonesian and Karonese.

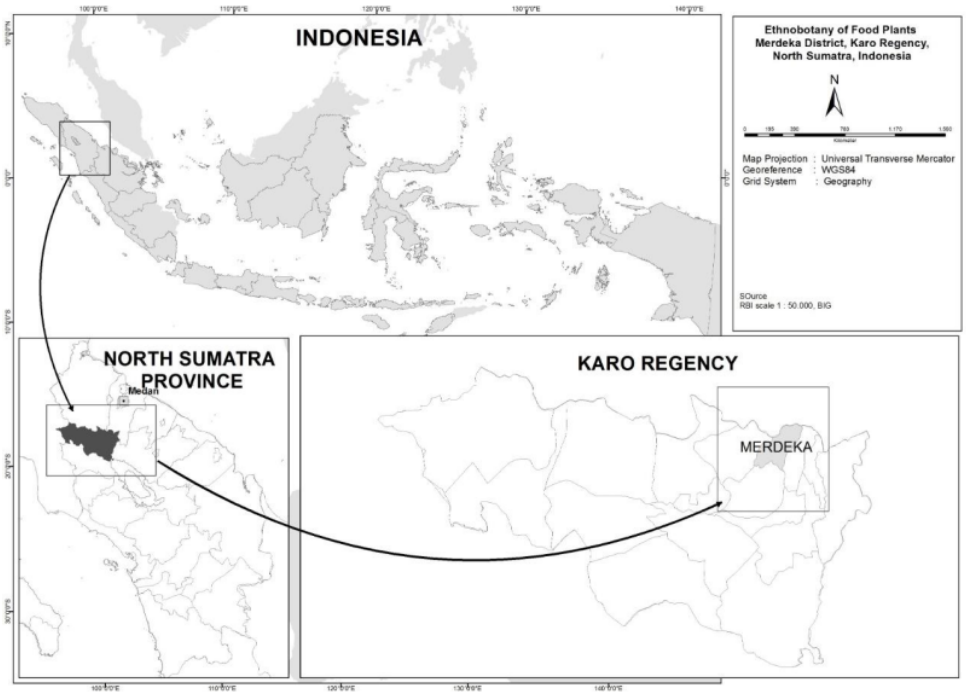

Fig. 1 Location of the study area in Merdeka District, North Sumatra, Indonesia.

Ethnobotanical survey

Ethnobotanical information was obtained by interviewing 30 Karonese in Jaranguda and 28 Karonese in Merdeka. Informants were determined by purposive sampling through snowball sampling technique. The criteria for determining the informants are: married, use plants in the surrounding environment as food, farmers and have access to the forest. Fifty-five percent of the interviewed people were men and remaining 45% were women with age 30-80 years of age (Table 1).

Table 1. Socio-demographic characteristics of the informants

Characteristics	Jaranguda	Merdeka
Sex		
Female	14 women	12 women
Male	16 men	16 men
Age	30 -75 years old	33 -80 years old
Latest education	Senior high school	Senior high school
Religion	Christianity and Islam	Christianity and Islam

All the informants are native to Batak Karo. The head of the villages acted as key informants who provided information about the knowledge on plants. The Karo are one of the tribes in North Sumatra, most of whom live in the Karo highlands, possess local wisdom in food processing (Purba *et al.* 2018) and traditional medicine (Silalahi *et al.* 2015). The interviews were semi-structured and not closed questionnaire. Almost all the interviews were conducted during field walks which the outline of subjects to discuss was prepared. The informants were asked about the food plants such as its local names, use of plants, mode of preparation and plant parts used. The conversation was recorded with the permission of the informants and using Karonese and Indonesian. Plant collection was carried out together with the informants around their home gardens, farming area and woods to confirm the identity of the species. The specimen vouchers are only collected from wild plants and stored at the Herbarium Universitas Kristen Indonesia. Species identification was determined using the plant resources of South-East Asia and online sources (Plants of the World Online and The Tropicos). Ethnobotanical data was analyzed using descriptive statistics such as frequencies and percentages. Then, to complete the analysis, secondary data in the form of published literature were used.

Results

Food plants are plants that are used by humans for their nutritional intake. A total of 53 plant species belonging to 48 genera and 27 families were recorded (Fig. 2 and Table 2) to be used as food plants by Karo people in North Sumatra, Indonesia. The growth forms of the species include herb, tree and shrub. The results of the study reveal that the majority of the species were cultivated (35 species, 66%). Most of plant species were herbs (59%); trees and shrubs are 26% and 15% respectively. The Karo ethnic classify food plants as a source of carbohydrates (staple food), vegetables, sources of fruit, and spices (Fig. 3). A total of 3 species were used as a carbohydrate source, namely **gadong** *(Manihot esculenta Crantz)*, **page** *(Oryza sativa L.)* and **gadong jolor** (*Ipomoea batatas* (L.) Lam). Fig. 3 shows that as many as 22 species are used as vegetables and 20 species as spices. The vegetables used by the Karo people are vegetables that are widely used by other people such as *Brassica oleracea*, *Lactuca sativa* and *Daucus carota*. Several types of wild plants are used as vegetables, including **dekah kurmak** (*Enydra fluctuans* Lour), **ober** (*Ficus fistulosa* Reinw), and **buluh belin** (*Dendrocalamus asper* (Schult.) Backer).

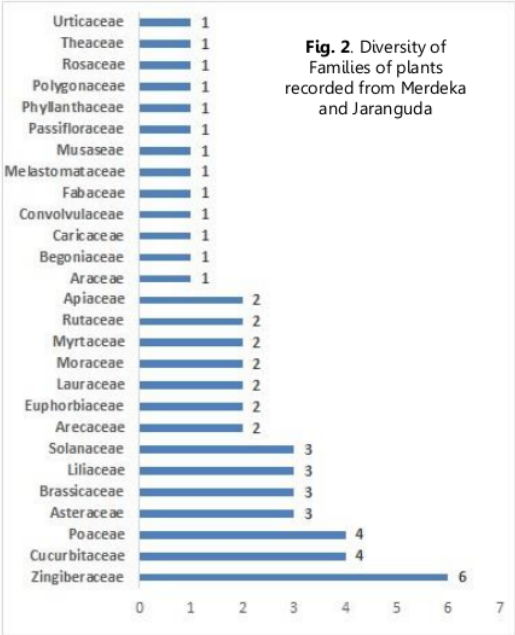

Fig. 2. Diversity of Families of plants recorded from Merdeka and Jaranguda

In terms of number of species, Zingiberaceae was the most important family with 6 species that were used as spices (Fig. 2). Cucurbitaceae and Poaceae recorded 4 species. Cucurbitaceae was commonly used for vegetables whereas Poaceae for staple food, vegetable and spice. Six major categories namely, spice, vegetable, staple food, drink, dessert, and fruit. Fig. 4 shows that the part used is dominated by fruit (23 species) followed by leaves (21 species) and rhizome (5 species). Some of the fruit sources recorded in this study are wild plants that are easily found in the surrounding environment on neglected land such as *Rubus moluccanus* L. and *Passiflora ligularis* Juss. Bark of *Bischofia javanica* and *Cinnamomum burmanni* (Nees & T. Nees) Blume as cooking spices are used from the forest by harvesting from one side of the plant stem.

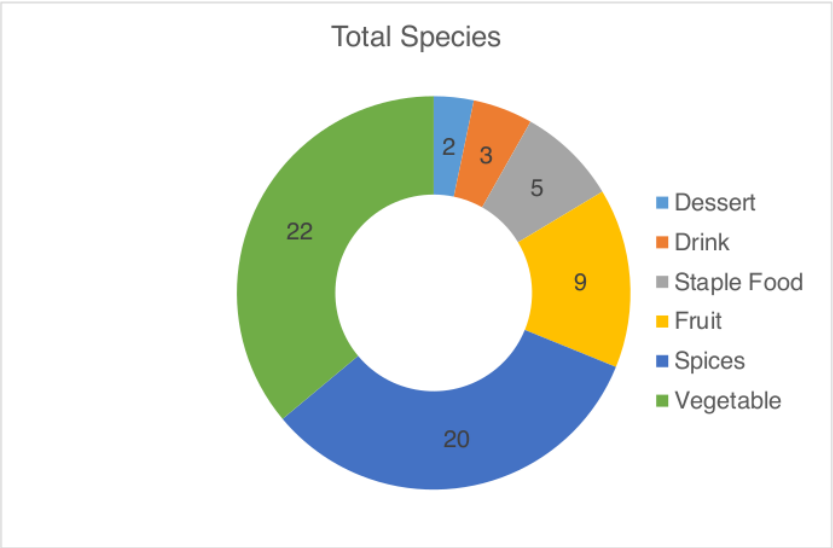

Fig. 3. Food categories and the number of plant species used as food by Karo tribe in the study area.

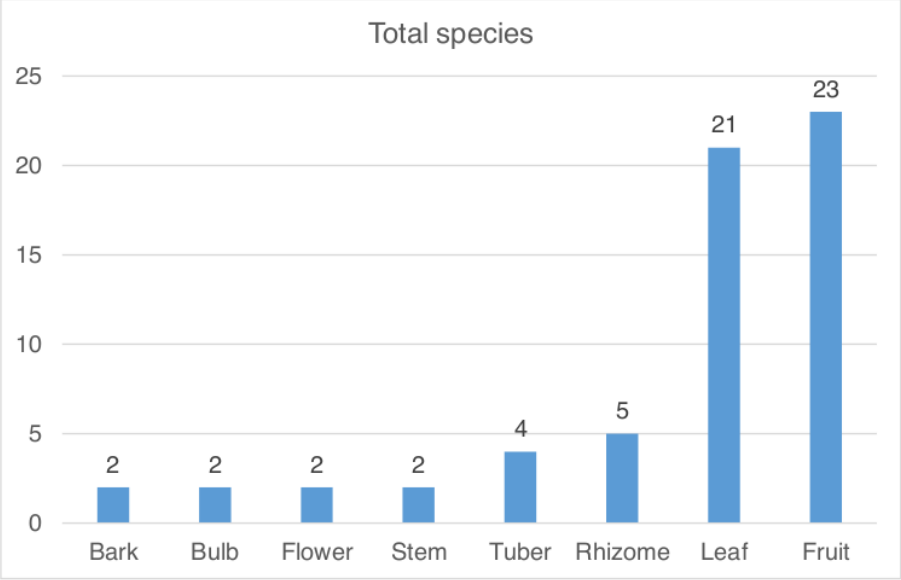

Fig. 4. Plant parts consumed as food by the Karo people of North Sumatra, Indonesia.

Table 2. Plant species reported by the Batak Karo in Merdeka District, North Sumatra

Family	Scientific Name (No vouchers)	Local Name	Habitat	Life form	Use for	Parts used	Villages
Apiaceae	*Apium graveolens* L.	**Daun sop**	C	Herb	Spice	Leaf	Me, Ja
	Daucus carota L	**Wortel**	C	Herb	Vegetable	Tuber	Me, Ja
Araceae	*Xanthosoma sagittifolium* (L.) Schott	**Bewan**	C	Herb	Staple food	Tuber	Me, Ja
Arecaceae	*Arenga pinnata* (Wurmb) Merr. (ECP 0015)	**Pola**	W	Tree	Drink, Dessert	Fruit, Stem	Me, Ja
	Cocos nucifera L.	**Tualah**	C	Tree	Drink, Vegetable	Fruit	Me, Ja
Asteraceae	*Enydra fluctuans* Lour (ECP 0063)	**Kurmak ndekah**	W	Herb	Vegetable	Leaf	Me, Ja
	Lactuca sativa L	**Selada**	C	Herb	Vegetable	Leaf	Me, Ja
	Strobilanthes sp. (ECP 0089)	**Paris**	W	Herb	Spice	Leaf	Me, Ja
Begoniaceae	*Begonia larueí* M. Hughes (ECP 0090)	**Riang-riang**	W	Herb	Spice	Leaf	Me, Ja
Brassicaceae	*Brassica oleracea* L	**Kol**	C	Herb	Vegetable	Leaf	Me, Ja
	Brassica cretica Lam.	**Brokoli**	C	Herb	Vegetable	Leaf	Me, Ja
	Nasturtium officinale R.Br. (ECP 0094)	**Kurmak parit**	W	Herb	Vegetable	Leaf	Me, Ja
Caricaceae	*Carica papaya* L	**Bertik**	C	Tree	Fruit, Vegetable	Leaf, Fruit, Flower	Me, Ja
Convolvulaceae	*Ipomoea batatas* (L.) Lam.	**Gadong jolor**	C	Herb	Staple food	Tuber	Me, Ja
Cucurbitaceae	*Benincasa hispida* (Thunb.) Cogn.	**Gundur**	C	Herb	Vegetable	Fruit	Me, Ja
	Cucumis sativus L.	**Cimen**	C	Herb	Vegetable	Fruit	Me, Ja
	Cucurbita moschata Duchesne	**Jambe**	C	Herb	Vegetable	Leaf, Fruit	Me, Ja
	Sechium edule (Jacq.) Sw.	**Jipang**	C	Herb	Vegetable	Leaf, Fruit	Me, Ja
Euphorbiaceae	*Manihot esculenta* Crantz	**Gadung**	C	Shrub	Vegetable, Staple food, Dessert	Leaf, Tuber	Me, Ja
	Aleurites moluccanus (L) Willd. (ECP 0060)	**Kembiri**	W	Tree	Spice	Fruit	Me, Ja
Fabaceae	*Phaseolus lunatus* L.	**Kacang koro**	C	Herb	Vegetable	Fruit	Me, Ja
Lauraceae	*Cinnamomum burmanni* (Nees & T.Nees) Blume (ECP 0061)	**Kulit manis**	W	Tree	Spice	Bark	Me, Ja
	Persea Americana Mill.	**Pokat**	C	Tree	Fruit	Fruit	Me, Ja
Liliaceae	*Allium cepa* L.	**Bawangmerah**	C	Herb	Spice	Bulbs	Me, Ja
	Allium fistulosum L.	**Daun pere**	C	Herb	Spice	Leaf	Me, Ja
	Allium sativum L.	**Lasuna**	C	Herb	Spice	Bulbs	Me, Ja
Melastomataceae	*Medinilla speciosa* Blume. (ECP 0078)	**Kambing-kambing**	W	Shrub	Spice	Leaf	Me, Ja
Moraceae	*Ficus fistulosa* Reinw (ECP 0079)	**Ober**	W	Tree	Vegetable	Leaf	Me, Ja

	Artocarpus heterophyllus Lam.	**Nangka**	C	Tree	Vegetable, Fruit	Fruit	Me, Ja
Musaceae	*Musa acuminata* Colla	**Galuh**	C	Herb	Vegetable, Fruit	Fruit	Me, Ja
Myrtaceae	*Psidium guajava* L.	**Galiman**	C	Tree	Fruit	Fruit	Me, Ja
	Eugenia polyantha Barb. Rord. (ECP 0056)	**Salam**	W	Tree	Fruit	Leaf	Me, Ja
Passifloraceae	*Passiflora ligularis* Juss.	**Markisa kerangen**	C	Herb	Fruit	Fruit	Me, Ja
Phyllanthaceae	*Bischofia javanica* Blume. (ECP 0057)	**Cingkam**	W	Tree	Spice	Bark	Me, Ja
Poaceae	*Dendrocalamus asper* (Schult.) Backer (ECP 0058)	**Buluh belin**	W	Tree	Vegetable	Stem	Me, Ja
	Cymbopogon citratus (DC.) Stapf	**Sereh**	C	Herb	Spice	Leaf	Me, Ja
	Oryza sativa L.	**Page**	C	Herb	Staple food	Fruit	Me, Ja
	Zea mays L.	**Jong**	C	Herb	Staple food, Vegetable	Fruit	Me, Ja
Polygonaceae	*Polygonum chinense* Linn (ECP 0080)	**Siang-siang**	W	Shrub	Spice	Leaf	Me, Ja
Rutaceae	*Citrus hystrix* DC.	**Rimo mungkur (purut)**	C	Shrub	Spice	Leaf, Fruit	Me, Ja
	Zanthoxylum acanthopodium DC (ECP 0081)	**Tuba**	W	Shrub	Spice	Fruit	Me, Ja
Rosaceae	*Rubus moluccanus* L. (ECP 0083)	**Kopi-kopi kerangen**	W	Shrub	Fruit	Fruit	Ja
Solanaceae	*Capsicum annuum* L.	**Cina**	C	Herb	Spice	Fruit	Me, Ja
	Solanum lycopersicum L.	**Tomat**	C	Herb	Vegetable, Fruit	Fruit	Me, Ja
	Solanum torvum Sw	**Rimbang**	C	Shrub	Vegetable	Fruit	Me, Ja
Theaceae	*Camellia sinensis* (L.) Kuntze	**Teh**	C	Tree	Drink	Leaf	Me
Urticaceae	*Debregeasia longifolia* (Burm.f.) Wedd (ECP 0121)	**Cepira**	W	Shrub	Vegetable	Leaf	Me, Ja
Zingiberaceae	*Alpinia galanga* L. (Willd.)	**Kelawas**	C	Herb	Spice	Rhizome	Me, Ja
	Curcuma domestica Valeton	**Kuning gersing**	C	Herb	Spice	Rhizome	Me, Ja
	Etlingera elatior (Jack.) R.M.Sm.	**Asam Cekala** (fruit), **Kincung** (Flower)	C	Herb	Spice	Fruit, Flower	Me, Ja
	Kaempferia galanga L.	**Kaciwer**	C	Herb	Spice	Rhizome	Me, Ja
	Zingiber officinale Roscoe	**Bahing**	C	Herb	Spice	Rhizome	Me, Ja
	Zingiber sp.	**Alia**	C	Herb	Spice	Rhizome	Me, Ja

C-Cultivated; W- Wild; Me- Merdeka; Ja- Jaranguda

Discussion

In this study, we recorded 53 species of food plants used by the Karo ethnic group, which included wild plants. Pawera *et al.* (2020) state that because wild plants are deemed healthier, it is necessary to study their nutritional content and prospects for cultivation. Empirically, people's desire to use wild plants is decreasing for various reasons, some of which are difficult to find and are considered less prestigious. Most of the recorded and identified species are reported to be edible elsewhere in Indonesia such as West Java (Abdiyani 2008, Rahayu & Harada 2004), Central Sulawesi (Anam *et al.* 2014), Central Kalimantan (Chotimah *et al.* 2013), Central Java (Lianah *et al.* 2015),

Gorontalo (Nurani 2013), Bali (Sujarwo & Caneva 2015), West Kalimantan (Rike *et al.* 2018) and Batak Toba (Silalahi *et al.* 2021).

Zingiberaceae, Cucurbitaceae and Poaceae are the families with the highest number of species as shown Fig. 2. Zingiberacee is the most common family which is used as spice, medicine and food additive in Indonesia. It is also known as the most important source of medicinal plants in Batak Karo. They use the stems or the rhizomes. Normally they use Zingiberaceae stems for **oukup** (traditional Karo steam-bathing) because it produces distinctive aromas when boiled (Silalahi & Nisyawati 2019). Whereas, the rhizomes are commonly used for food purposes.

The Cucurbitaceae have an important economic and cultural role among many societies (Rafael & Caballero 2002, Yang & Walters 1992). *Benincasa hispida* (Thunb.) Cogn., *Cucumis sativus* L., *Cucurbita moschata* Duchesne and *Sechium edule* (Jacq.) Sw. were common vegetables in Karo regency. All the species were used as a vegetable. Batak Karo people usually plant them in their home garden and farming. Cucurbitaceae are easy to be planted because they do not need fertilizer like others common families such as Brassicaceae. Batak Karo people cook these vegetables for daily cuisine or special cuisine such as wedding, cultural festival. They also used the seeds of *Cucumis sativus, Cucurbita moschata,* and *Benincasa hispida* as medicinal plants to prepare a traditional concoction **tawar**. It is normally mixed with hot tea as tonic. Dayak people in West Kalimantan and Central Kalimantan are familiar with Cucurbitaceae as food (Chotimah *et* al. 2013, Rike *et al.* 2018). *Cucumis sativum* is reported as a familiar species in almost every tribe of Indonesia such as Javanese (Nahdi *et al.* 2016), Sundanese (Cita 2020). It is consumed raw normally informs such as **rujak** and pickle.

A total of 55 species of Poaceae in Indonesia are considered as medicinal plants. It is one of 22 families that has many medicinal plants after Fabaceae, Euphorbiaceae, Lauraceae and Rubiaceae (Zuhud 2009). Batak Karo people cook young shoots of *Bambusa* sp. as vegetables. One of traditional Batak Karo cuisine is **gulai. Gulai** is a curry soup that is commonly cooked with chicken, coconut milk and spices, and usually served in special occasions such as harvesting festival and wedding. Poaceae is one of common families after Zingiberaceae in Bali where the young shoot is used as an ingredient of vegetable soups (Sujarwo & Caneva 2015).

A total of 20 plant species of the Karo tribe have been used as spices. The spices serve to improve the taste of food and some have a good effect on health. Some of the spices recorded in this study are those easily found in various traditional and modern markets such as *Allium sativum* L., *Allium fistulosum* L., *Allium cepa* L., *Capsicum annum*, *Zingiber officinale* Roscoe and *Curcuma longa* L. Some spices recorded were declared as special spices in Karo tribe cuisine, including **cingkam** (*Bischofia javanica* Blume), **riang-riang** (*Begonia laruei* M. Hughes), **tuba** (*Zanthoxylum acanthopodium* DC.), **siang-siang** (*Polygonum chinense* L.), **salam** (*Euginia polyantha* Barb. Rord.), and **cekala** (*Etlingera elatior* (Jack.) R. M. Sm.). They are used in a variety of traditional Karo cuisine such as **terites**, **cipera** (a kind of chicken curry cooked with maize flour) and **cincang** (cassava leaves and spices roasted in bamboo stem).

Consumed parts and modes of consumption

Fruit is the most common part used in Merdeka and Jaranguda villages (Fig. 4). Whereas, the percentage of bulb, flower, stem and bark were the lowest. Both flowers and fruits of *Etlingera elatior* (Jack.) R. M. Sm. are used as condiments to aromatize or to add flavor to dishes such as vegetable soup. One of the famous traditional dishes is **terites. Terites** is a vegetable soup which is cooked with a juice of partly digested food (chime) of slaughtered cattle (Purba *et al.* 2018). The flowers of *E. elatior* has values of antimicrobial (de Guzman & Siemonsma 1999), antibacterial, antifungal, antioxidant, antibacterial (Indra *et al.* 2013, Purba *et al.* 2016) and anticancer (Ghasemzadeh *et al.* 2015). Batak Karo people use the stem of *E. elatior* as one of herbs for **oukup** the Batak Karo traditional sauna. **Oukup** is normally applied after postparthum. The stems also have potential as raw material for the manufacture of paper (de Guzman & Siemonsma 1999).

Twenty species are cooked (boiled or stewed) as vegetables. The cooked vegetables are frequently combined with common spices such as *Capsicum annum, Solanum lycopersicum, Allium sativum* and *Allium cepa.* These plants are commonly cooked in Indonesia specially to prepare *sambal,* the Indonesian spicy sauces. *Lactuca sativa* L. and *C. sativus* are directly eaten in raw state. Plants were also used to prepare beverages. Not only drinks from *Cocos nucifera,* Batak Karo people also use the fresh water from stem of *Arenga pinnata* (Wurmb) Merr. which is named **nira**. **Nira** is usually served in special occasion, such as wedding or harvesting festival. Batak Toba use **raru** as a fermentation agent to convert **nira** into a traditional liquor that is called **tuak** (Ikegami 1997, Pasaribu 2011). They use barks of *Cotylelobium melanoxylon* (Hook. f.) Pierre, *Cotylelobium lanceolatun* Craib and *Shorea*

balanocarpoide Symington as a **raru** (Pasaribu 2011). It is believed that **tuak** is good for postpartum recovery and to increase milk production.

Foods for medicine

Batak Karo people believe that all disease can be cured with healthy food prepared from natural products that have medicinal properties (Purba *et al.* 2018). It is reflected on one of its traditional food, **terites.** They use 10 wild edible plants to prepare **terites** which are used as medicinal plants (Purba *et al.* 2018). Among the 53 gathered food plant species, 24 were use in folk medicine (17 cultivated and 7 wild plants). *Arenga pinnata*, *Aleurites moluccanus*, and *Cinnamomum burmanni* were the common wild plants used for food and as medicinal plants. *Arenga pinnata* is used to cure fever, *A. moluccanus* is for abscesses, and *C. burmani* is for cold and diabetics.

Zingiberaceae is the commonly used spices and medicinal plants family. *Alpinia galanga* L. (Willd.) is used for to curing weakness, cough; *Curcuma domestica* Valeton is for gastritis, cough, weakness, diabetes; *Etlingera elatior* is for weakness; *Kaempferia galanga* L. is for liver, diarrhea, stomach ache; *Zingiber officinale* is for fever; and *Zingiber* sp. is for gastritis (Purba *et al.* 2016). Batak Karo people in Merdeka and Jaranguda state that using the rhizome of Zingiberaceae makes healthy foods more delicious and improves human health. Not just as spices, Zingiberaceae is used for traditional concoction such as **kuning, tawar** and **oukup** for improving health.

Wild edible plants and cultivated plants

Batak Karo people in Jaranguda and Merdeka use 30% wild and 70% cultivated plants as food purposes. Most of them are horticulture farmers. They plant on agricultural fields and gardens. The gardens provide food for household consumption easily such as *Capsicum annum, Etlingera elatior*, *Cucurbita moschata* and *Manihot uttilissima.* These cultivated plants are the main species planted because they are easy to grow and can be used in a wide variety of dishes. The leaf of *M. uttilissima* is the most commonly used one as vegetables in many tribes of Indonesia such as Sasak (Sukenti *et al.* 2016), Bentong (Amboupe *et al.* 2019), Sundanese (Cita 2020), and Saibatin (Wakhidah *et al.* 2020). Batak Karo people cooke them for vegetable soups, **daun ubi tumbuk**, which is prepared by pounding the leaves and adding spices such as *Capsicum annum, Allium cepa, Allium sativum, Solanum lycopersicum*, coconut milk, the flower of *Etlingera elatior* and the fruit of *Solanum torvum* Sw. Whereas, wild plants were used only if they prepare traditional dishes for special occasion, cure some diseases or on a diet due to convalescence. Among the wild plants recorded and categorized as local food plant, *Bischofia javanica* was identified the most important spice. It is used as a main spice for **terites** soup and also used as medicinal plants to treat diabetes and hypertension. We also documented certain plant species, which are uncommon edible food: *Begonia laruei* M. Hughes, *Medinilla speciosa* Blume, *Debregeasia longifolia* (Burm.f.) Wedd, *Zanthoxylum acanthopodium* DC and *Eugenia polyantha* Barb. Rord. They were cited as highly valued plants because they have an impressive range of medicinal uses with high nutritional value. We consider these species should be extended to human societies in general, in view of the edible plants.

Begonia laruei M. Hughes

Begonias have been commonly used for purposes such as ornamental plants, food and medicinal plants. There are 1,600 species of Begonias in the world (Kiew 2005). Indonesia has 200 species spread in Sumatra, Java, Kalimantan, Sulawesi and Papua among which Papua has the most species (Nurani 2013). The flowers, leaves and stems of Begonias have been used for food (Basurto-Pena *et al.* 2003, Bhattarai 2018, Ogle *et al.* 2003). The leaves, roots and tubers of certain species have been used to treat colds, fever, fever sores and stomach ache (Basurto-Pena *et al.* 2003, Ogle *et al.* 2003). Some investigation has revealed that Begonias have compounds that are useful for medicinal purposes such as alkaloids, glycosides, saponins, tannins, flavonoids and polyphenols (Bhattarai 2018, Mobarak *et al.* 2018). In Indonesia, Begonias have been used as medicinal plants e.g. to treat sprue, cold, fever and cancer (Abdiyani 2008, Anam *et al.* 2014, Nurani 2013). Batak Karo people usually use leaves of *B. laurei* as one of ingredients of **terites. Terites** is a traditional soup that uses chyme of ruminants as the stock and mixed with pork or beef and some vegetables such as *Manihot esculenta* and *Solanum torvum*. It is always served in special occasions such as harvest festival and ceremonial marriage. Batak Karo people believe the sour taste of *B. laurei* would neutralize the chyme smell and tenderize the meats. Begonia contains oxalic acid that cause the sour taste (Hodgkinson 1977). The acid of Begonias is also used by people of Sikkim in India to prepare some pork and other greasy meats (Hooker 1855).

Medinilla speciosa Blume

Medinilla speciosa normally is used as ornamental plant in Indonesia. Some ethnobotanical documents have showed that *M. speciosa* has been used by communities in Indonesia for traditional medicine or food such as

Manggarai (Iswandono *et al.* 2015) and Javanese (Wijayanti & Ardigurnita 2018). The fruit of *M. speciosa* is used to treat mouth ulcer and diarrhea by Javanese (Lianah *et al.* 2015). Nowadays some researches show that it can be used as medicinal plants for specific purposes such as antibacterial function and potentially could be used as hand sanitizer (Laraswati & Sugiarti 2017), antidiabetic (Febrilian & Pujiastuti 2017), antihyperlipidemic and anti-obesity (Sa'adah *et al.* 2002). The fruits contain tannin, saponin, flavonoid and glycoside (Wachidah 2013). Considering *M. speciosa* as medicinal plants, it can be used as food purpose. Batak Karo people use the leaves to prepare **terites.** Batak Karo people believe cooking **terites** with *M. speciosa* will decrease pathogens from chyme of rumens. The fruits of *Medinilla speciosa* exhibited activity against *Escherichia coli* and *Staphylococcus aureus* (Laraswati & Sugiarti 2017).

Debregeasia longifolia (Burm. f.) Wedd

The Batak Karo use leaves of *Debregeasia longifolia* for vegetables. **Cincang** is a traditional cuisine that uses *Debregeasia longifolia*. **Cincang** literally means mince. They prepare leaves of *Manihot esculenta*, young stems and flowers of *Musa paradisiaca, Etlingera elatior* to cook **cincang**. All the ingredients are minced, mixed then cooked in bamboo. **Cincang** is served in special occasion such as wedding and harvest festival. In India, *Debregeasia longifolia* is used for purposes such as fruits, vegetables, medicinal plants and ritual plants (Khan *et al.* 2010, Pramod *et al.* 2003, Singh *et al.* 2012). The *Garo* tribes of India comsume *D. longifolia* as fruits and vegetables (Singh *et al.* 2012). The fruits of *D. longifolia* contain fiber that is richer than *Mangifera indica, Ananas comosus, Carica papaya*, *Malus domestica* and *Artocarpus heterophyllus*; minerals that higher than *Artocarpus heterophyllus*, *Psidium guajava* and *Punica granatum*; and iron that is higher than *Ananas comosus*, *Punica granatum*, *Mangifera indica*, *Manilkara zapota*, *Phyllanthus emblica*, *Malus domestica*, *Artocarpus heterophyllus*, *Carica papaya*, *Psidium guajava* and *Garcinia mangostana* (Nazarudeen 2010). Furthermore, the roots of *D. longifolia* is also used as antidiabetic plants by boiling it (Khan & Yadava 2010).

Zanthoxylum acanthopodium DC.

Tuba (*Zanthoxylum acanthopodium*) is a famous wild spice in North Sumatra which is widely used for traditional Batak ethnic cuisine (Fig. 5). **Terites** is one of the traditional Karo foods using *Z. acantopodium* as one of the main spices. The other traditional cuisine of Batak tribe that uses *Z. acanthopodium* as the main or additional seasonings are **arsik** (a type of carp curry), and **sangsang** (a type of spicy pork) (Lumban Raja& Hartana 2107), **pinadar** chicken (a type of grilled chicken), **ikan tombur** (a type of grilled fish), and **niura** (a type of sushi). *Zanthoxylum acanthopodium* gives a spicy sensation with a distinctive aroma so it is also called 'Batak pepper'. Traditional dishes have added mashed *Z. acanthopodium* fruit which has a unique taste (Sibero *et al.* 2020) and causes food to last longer than those without *Z. acanthopodium*. Wijaya *et al.* (2002) stated that *Z. acanthopodium* is a wild herb or shrub that has a very sharp aroma similar to that of citrus (*Citrus* sp.) and is very popular in North Sumatra. For the Batak ethnic, *Z. acanthopodium* has a high economic value and has long been traded in various traditional markets with the selling price for fresh fruit as 200000 – 300000 IDR/kg (Fig. 5). Until now, this plant is difficult to cultivate and is a wild plant in the highlands around Lake Toba and Samosir Island.

Zanthoxylum acanthopodium has several biological activities such as larvicidal, anti-inflammatory, analgesic, antinociceptive, antioxidant, antibiotic, hepatoprotective, anti-plasmodial, cytotoxic, antiproliferative, anthelminthic, antiviral and antifungal (Negi *et al.* 2011). The essential oils are the main bioactive compounds of *Z. acanthopodium* (Negi *et al.* 2011) such as citronelle and limonene which give their distinctive aroma (Wijaya *et al.* 2002). The fruits of *Z. acanthopodium* has 29 types of essential oils, which the main compounds are geranyl acetate, lemongrass, citronellol, nerol, limonene, geraniol, caryophyllene, citronellol acetate, and pinene (Moektiwardoyo *et al.* 2014, Wijaya *et al.* 2002). The essential oil of *Z. acanthopodium* essential oil has antioxidant activity and cytotoxic effect in vitro on breast cancer cells. The essential oil of *Z. acanthopodium* has activity as a xanthine oxidase inhibitor with an IC50 of 9.9 g/mL and cytotoxic activity in T47D cancer cells with an IC50 of 149.4 g/ml (Kristanty & Suriawati 2011). Majumder *et al.* (2014) stated, *Z. acanthopodium* extract has antimicrobial activity to *Escherichia coli, Staphylococcus aureus, Bacillus subtilis* and *Streptococcus* spp.

Fig. 5. Habit of *Zanthoxylum acanthopodium* with fruits (Left), Fruits of *Zanthoxylum acanthopodium* sold in the traditional markets, North Sumatra, Indonesia (Right).

Eugenia polyantha Barb. Rord.

Euginia polyantha is a spice very intensively used by the Karo tribe (Fig. 6). The leaves are used for various food such as **cincang**, **terites,** and **cipera.** Whereas, the fruit is used as a fruit source. The addition of *E. polyantha* leaves as a spice in various dishes produces a distinctive aroma and color that enhances the taste of the food. The leaves of *E. polyantha* contain essential oils in the form of citric acid, eugenol, methyl chavicol (Sumono & Agustin 2008), cis-4-decenal, octanal, pinene, farnesol, ocimene and nonanal (Wartini 2009) which are thought to produce the aroma. The main essential oil of *E. polyantha* is a monoterpene hydrocarbon group with a concentration of 28.78% in fresh leaves and 34.15% in dry leaves (Ahmad 2013).

The other function of using *E. polyantha* leaves by Karo ethnic is to treat diabetes mellitus and cholesterol. The activity of *E. polyantha* leaves as anti-cholesterol agent causes these leaves to be used in all processing of meat-based dishes because they are considered to reduce the impact of cholesterol due to consuming meat. The methanolic extract of *E. polyantha* leaves has antihyperglycemic activity by inhibiting glucose absorption from the small intestine and increasing glucose uptake in muscle tissue (Widyawati *et al.* 2015). The bioactivity of *E. polyantha* as anti-cholesterol is related to flavonoids such as quercetin. Quercetin inhibits macrophage-modified Low-density lipoprotein (LDL) oxidation by reducing the tocopherol content in LDL particles (Michael 2017), and inhibits the action of the HM-CoA reductase enzyme (Prahastuti *et al.* 2011).

Fig. 6 **Daun salam** (*Eugenia polyantha* Barb. Rord.)

Conclusions

This study documents the cultivated and wild food plants used by Batak Karo people in North Sumatra, Indonesia. It is found that that Batak Karo ethnic uses wild edible plants widely for food preparation and medicine. They are used in various cuisine as staple food and to flavor or to complement other foods. They are also a good source of medicine. Most of this traditional knowledge only survives in the memory of the elderly and is now in danger of vanishing. This paper attempts to compile and disseminate that knowledge in order to help maintain cultural traditions and facilitate research into food history and new food sources. To best contribute to the well-being of Batak Karo people through plants utilization, it is imperative to evaluate the compounds of wild edible plants to ensure their effectiveness in food and medicine.

Declarations

List of abbreviations: The abbreviations used to refer the villages where this research took place are Me for Merdeka and Ja for Jaranguda. The others abbreviations are C for Cultivated and W for Wild.

Ethical approval and consent to participate: Permissions were obtained from the local government and local elders before collecting data at the villages. Besides, each respondent was informed about the purpose of the interview prior to study.

Consent for publication: Not applicable.

Conflict of interests: The authors declare that they have no conflict of interests.

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