BIODIVERSITAS
Volume 19, Number 1, January 2018
Pages: 229-238

ISSN: 1412-033X
E-ISSN: 2085-4722
DOI: 10.13057/biodiv/d190131

The ethnobotanical study of edible and medicinal plants in the home garden of Batak Karo sub-ethnic in North Sumatra, Indonesia

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Manuscript received: 23 September 2017. Revision accepted: 6 January 2018.

Abstract. *Silalahi M, Nisyawati. 2018. The ethnobotanical study of edible and medicinal plants in the home garden of Batak Karo sub-ethnic in North Sumatra, Indonesia. Biodiversitas 19: 229-238.* The cultivation of plants in home gardens for self-sufficiency is a long tradition in Karo District, but the documentation of local knowledge about edible and medicinal plants in home gardens in Karo District is limited. This study aimed to (i) document the uses of the edible and medicinal plants in home gardens; (ii) to analyze the diversity of edible and medicinal plants in home gardens. Data were collected using the ethnobotanical surveys and interviews methods. The Shannon Weiner and Margalef indices were calculated to determine the diversity levels of medicinal and edible species in the home gardens of Karo ethnic. The surveys were conducted in 30 home gardens (7 villages), Karo District, North Sumatra. The 85 recorded species belonged to 43 families, and 73 genera were used as edible and medicinal plants. The plants studied in the home gardens used for human consumption were i.e. fruits, vegetables, spices, tubers and medicinal plants. Among 85 plant species growing in home gardens, 52 species were cultivated, and the rest were semi cultivated. Home gardens had the Shannon Wiener index ranging from 1.164 to 3.123 while Margalef index ranging from 0.929-2.531.

Keywords: Edible plants, *Flacourtia rukam*, Batak Karo, *Molineria latifolia*

INTRODUCTION

The home garden is a complex agroforestry system, which is rich in biodiversity including perennial and annual plants such as wild plants, semi-cultivation, and cultivation (Kumar and Nair 2004, Moreno-Calles et al. 2010). For local people, home garden plays an important role in many aspects including the economy, ecology, social, and culture (High and Shackleton 2000; Méndez et al. 2001; Senanayake et al. 2009). Economically, the plants in the home garden provide a source of various materials for medicinal materials and ceremonial materials. Therefore, it becomes a valuable source of direct or indirect income for the owner. Ecologically, it has a function as shade, erosion prevention (Senanayake et al. 2009; Larios et al. 2013), conservation of biodiversity (Kehlenbeck and Maass 2004; Kaswanto and Nakagoshi 2012), and carbon sinks (Kaswanto and Nakagoshi 2012). The home garden is also used by the community as a place to transfer of local knowledge about ecology and utilization of plants (High and Shackleton 2000; Méndez et al. 2001; Thomas et al. 2008).

The prospective researches of the home garden in Indonesia had been carried out since 1930 by the Dutch in Java (Kaswanto and Nakagoshi 2012), which were then comprehensively studied in 1987 (Soemarwoto 1987). The further researches on this project are conducted partially by other researchers on various ethnic groups such as Java (Kehlenbeck and Maass 2004; Kusumaningtyas et al. 2006), Bali Aga (Sujarwo and Caneva 2015), and Batak Angkola-Mandailing (Silalahi 2016). The focus of the study varied, but it was mostly related to the documentation of the use of plants by local communities. However, studies on the diversity and abundance of plant garden have not been done, although the garden has long been used as a source of fruits, vegetables, and traditional medicines (Soemarwoto 1987; Kaswanto and Nakagoshi 2012; Sujarwo and Caneva 2015; Silalahi 2016).

The plant garden diversity is very high in both types and benefits. However, this diversity is also depending on various factors such as distance from the forest (Larios et al. 2013), culture, ethnics, climate, and topography (Senanayake et al. 2009). The distance of the garden to the forest affects the diversity of garden plants (Wezel and Bender 2003; Cruz-Garcia and Struik 2015), while the topography has implications in the composition of perennial and annual plant (Senanayake et al. 2009). Garden plants also have functioned as the reservoir for food plants (edible plants) or drugs (Ashagre et al. 2016), maintaining native biodiversity/native (Blancas et al. 2010; Parra et al. 2012), and the native biodiversity of plants especially the wild plants from forests (Casas et al. 2006; Parra et al. 2012).

Batak ethnic is the indigenous ethnic in Sumatra consisting of five sub-ethnic groups i.e Karo, Simalungun, Phakpak, Toba, and Angkola-Mandailing (Bangun 2010). Karo Batak is a sub-ethnic that still use the traditional medicines (*oukup*, *tawar*, *parem*) to maintain their health (Silalahi 2014; Purba 2015; Silalahi 2016). They also have traditional cuisine such as *terites* (soup from the rumen of

cattle), *cimpa*, *cipera* (likes of curry chicken) (Purba 2015; Aini 2016). In oder to supply those traditional medicines and food ingredients, they began to plant in the home garden (Silalahi 2014; Purba 2015; Aini 2016). This study aimed (i) to document the local knowledge of ethnic Karo in utilizing garden plants as a source of food and medicine, (ii) to know the diversity of food plants and cultivation drugs and semi-cultivation by Karo ethnic, Indonesia.

MATERIALS AND METHODS

Location of study

This study was conducted from April 2014 to August 2016 in seven villages in the Karo District, North Sumatra, Indonesia (Figure 1). There were three villages in Merdeka Sub-district i.e. Semangat Gunung Village, Cinta Rayat Village, and Merdeka Village; one village in the Berastagi Sub-district, i.e., Doulu Village; and three villages in the Simpang Empat Sub-district, i.e. Lingga Village, Pertegun Village, and Surbakti Village. Those villages are located in the Karo highlands surrounded by active volcanoes of Sinabung and Sibayak with altitude between 900 and 1,200 meters above sea level. More than 90% of the population work as horticultural farmers such as *Apium graveolens*, *Brassica* sp., *Capsicum annuum*, and *Citrus sinensis*.

Method

The information of this study was obtained using three type of interviews, i.e., semi-structured, in-depth, and participative observation). Interviews were conducted on 30 people were aged from 35-70 years old at seven villages in the Karo District, North Sumatra, Indonesia. The determination of respondents and home gardens were done by purposive sampling. Interview guidelines were modified from previous ethnobotany study conducted by Martin (1995), Alexiades (1996), and Silalahi et al. (2015). Medicinal and edible plants found in the home garden were recorded in terms of local names, habitus, uses, and parts of used, which were then made as voucher specimens. The number of plants of each species was calculated, and the size of the garden was measured. The voucher specimens were then identified in the botanical laboratory in the Universitas Indonesia, and also in Herbarium Bogoriense (BO), research center for Biology, Indonesian Institute of Sciences (LIPI). The identified scientific name of the plant was verified using online sources (www.theplantlist 2017).

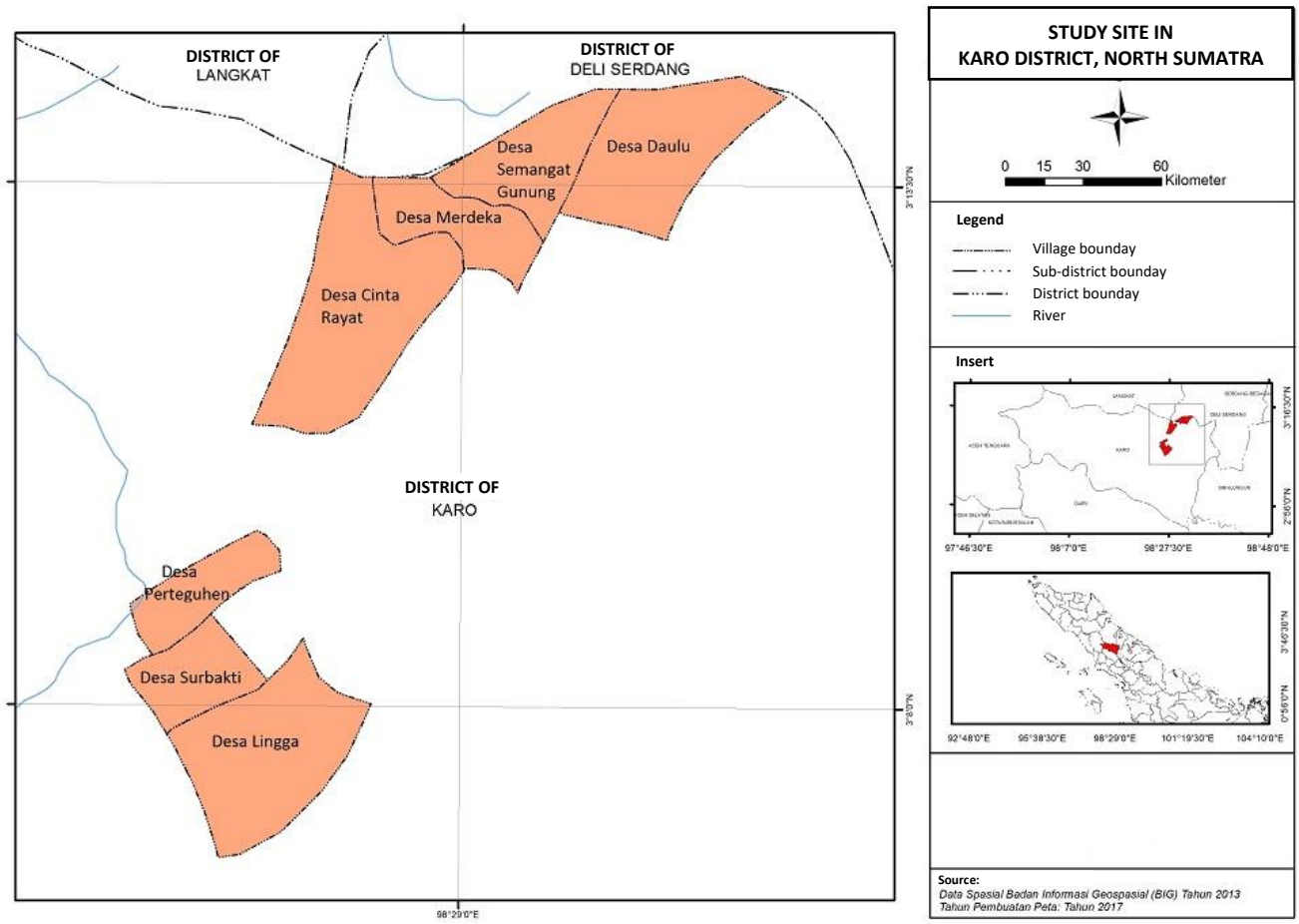

Figure 1. Research location in seven villages in Karo District, North Sumatra, Indonesia

Data analysis

The data obtained in this research was analyzed qualitatively and quantitatively. Qualitative data included the uses of plants, the part of used, sources of acquisition, and life form were recorded. The diversity index was calculated using Shannon-Wiener Index (H') equation; the index of similarity was calculated using Jaccard Index (Ji) (Mueller-Dumbois and Ellenberg 1974), and the wealth index calculated using Margalef index (DMg) (Mueller-Dumbois and Ellenberg 1974; Magurran 1988; Magurran 2003) with the equation patterns as follows:

Margalef index (DMg)

$$\mathrm{DMg} = \frac{S-1}{\ln(n)}$$

where S is the number of taxon, and n is the total number of individuals in all taxon.

Shannon-Wiener index (H')

$$\mathrm{H}' = -\sum_{i=1}^{n} (\mathrm{pi}) \ln(\mathrm{pi})$$

where ni is the number of taxon, and n the total number of individuals in all taxon.

Jaccard index (Ji)

$$\mathrm{Ji} = \frac{a}{a+b+c}$$

a = The number of species found in A and B villages

b = The number of species found in A village but it is not found in B village

c = The number of species found in B village and it is not found in A village

RESULTS AND DISCUSSION

Utilization of botanical plants by Batak Karo Sub-ethnic

In this study, the location of home garden belongs to the Karo Batak sub-ethnic community was relatively narrow with a size of 20-300 m^2. Initially, the home garden was used by local people for family activities and social activities so that the home garden size was limited. The activities undertaken in the home garden included parenting, socializing with neighbors, and drying agricultural products. The residential centers at Batak Karo sub-ethnic surrounded by *Bambusa* sp, which used as a barrier, windbreaker, construction materials, and a food ingredient (Silalahi 2014). In this study, many plants found in the home garden were mostly used as food and drug ingredients (Figure 2).

In this study, 85 plant species collected from home garden consisting of 43 families and 73 genera were used by sub-ethnic Batak Karo as food or medicines. Those families were, i.e., Solanaceae (10 species), Zingiberaceae (6 species), Myrtaceae (4 species), Rutaceae (3 species), Rosaceae (3 species), Poaceae (3 species), Fabaceae (3 species), Arecaceae (3 species), and Acanthaceae (3 species). Most of those families had the largest number of species, representing over 41% of the species utilized in this study.

Table 1 shows the ethnobotanical information of each species found in the study. The results showed that most of plant species found in the garden were used for many purposes such as food (60 species), medicinal plants (30 species), and other benefits (7 species). Foodstuffs include vegetables (20 species), fruit (30 species), spices (11 species), carbohydrate sources (10 species), and other benefits (7 species).

More than 25 species of plants listed in table 1 had multiple benefits such as *Etlingera elatior* was used as a spice, vegetable, medicine; while *Musa paradisiaca* was used as a vegetable, fruit, medicine. Plants used as fruit sources (*Eriobotrya japonica*, *Psidium guajava*, *Persea americana*), vegetables (*Brassica* sp., *Solanum melongena*, *Capsicum annuum*), medicinal ingredients and spices (*Alpinia galanga*, *Curcuma longa*, *E. elatior*, *Cymbopogon citratus*), ornamental plants and medicines (*Hibiscus rosa-sinensis*, *Crinum asiaticum*, *Barberis* sp. and *Equisetum debile*) were easily found in the yard. The plants found in this study are similar to those of the study conducted by Sujarwo and Cavera (2015) on the garden of Bali Aga ethnic, which mostly used as a source of vegetables (46%), drugs (23%), food (20%), spices (9%), and the edible seeds (2%).

In this study, 30 species of home garden plants used as medicine such as to overcome the fever (*H. rosa-sinensis*, *Ceiba pentandra*, *E. elatior*), digestive tract disorders (*C. longa*, *Curcuma xanthorrhiza*, *Zingiber officinale*), traditional steam-bathing (*Z. officinale*, *E. elatior*, *C. longa*, *Cymbopogon citratus*), and kidney disease (*E. debile*) (Table 1). In Batak Karo sub-ethnic, more food plants were planted in home garden (species) compared with medicinal plants. Community used home garden as a source of food and income (Galhena et al. 2013), especially fruit, vegetable, staple food (Sujarwo and Cavera 2015). Farmers always ensure the availability of food plants in the garden (Lok 2001), especially in the difficult plant season times. The home garden is an easy and accessible place for a food source (Sujarwo and Cavera 2015).

Figure 2. The home garden structure of Batak Karo sub-ethnic in Karo District, North Sumatra, Indonesia

Table 1. List of cultivated plants in Batak Karo sub-ethnic home garden, Karo District, North Sumatra, Indonesia

Family	Scientific name	Annual/perennial	Local name	Parts used and how to uses	Villages	Life form
Acanthaceae	*Graptophyllum pictum* (L.) Griff.	Perennial	Daun ungu	Water decoction of leaves as a medicine for kidney disease	SG	Shrubs
	Andrographis paniculata (Burm.f.) Nees	Perennial	Sambiroto	Water boiled leaves as cough medicine, fever, and increase appetite	SG, L	Herb
	Justicia gendarussa Burm.f.	Perennial	Sangkil sempilit	Fever and mythical medicine leaves	L	Herb
Anacardiaceae	*Mangifera foetida* Lour	Perennial	Mbacang	Fruit that has been cooked directly eaten	L	Tree
Annonaceae	*Annona muricata* L.	Perennial	Tarutung Bulanda	Fruit that has been cooked directly eaten; leaf boiling water for kidney disease medicine	S	Tree
Apiaceae	*Apium graveolens* L.	Annual	Daun sop	Leaves are used for vegetables, anti-hypertensive drugs, and cooking spices.	CR, SG	Herb
	Daucus carota L.	Annual	Wortel	Bulbs are used as vegetables	S	Herb
Araceae	*Acorus calamus* L.	Perennial	Jrango	Rhizoma for fever and cough medicine	L, D	Herb
	Colocasia esculenta (L.) Schott.	Perennial	Talas	Tubers are cooked as a source of carbohydrates	S, SG, L, D	Herb
Arecaceae	*Arenga pinnata* Merr.	Perennial	Poula	Fruit for "kolang kaling"; juice water to make brown sugar.	L	Palm
	Areca catechu L.	Perennial	Mayang	The roots for medicinal aphrodisiac; ripe fruit to mix betel meal	D	Palm
	Salacca zalacca (Gaertn.) Voss	Perennial	Salak	Fruit that is cooked directly eaten	P, SG, L	Palm
Asteraceae	*Blumea balsamifera* (L.) DC.	Perennial	Sembung	Air leaf stew for diarrhea, fever, cough, and asthma	D	Herb
Asparagaceae	*Asparagus officinalis* L.	Annual	Asparagus	Stems that are still young used as a vegetable	S	Herb
	Dracaena angustifolia (Medik.) Roxb.	Perennial	Suji	Leaves as a food coloring	S, L	Shrubs
Berberidaceae	*Barberis* sp.	Perennial	Daun Mutiara	Water decoction leaves to overcome kidney pain	SG	Shrubs
Basellaceae	*Anredera cordifolia* (Ten.) Steenis	Perennial	Binahong	Water decoction of leaves for cough medicine	SG	Herb
Brassicaceae	*Brassica oleracea* L.	Annual	Bunga kol	Flowering is used as a vegetable	D	Herb
	Brassica rapa L.	Annual	Sawi	Young leaves are used as vegetables	CR, M, P, S, L	Herb
Bombaceae	*Durio zibethinus* L.	Perennial	Durian	The old fruit is eaten immediately		Tree
	Ceiba pentandra (L.) Gaertn.	Perennial	Kapas	Leaf juice is used as a fever medicine	L, P	Tree
Bromeliaceae	*Ananas comosus* (L.) Merr.	Perennial	Kenas	Fruits that are cooked directly eaten, young fruit for abortion	L	Herb
Campanulaceae	*Isotoma longiflora* (L.) C.Presl	Annual	Bunga katarak	Flower water to cope with cataracts	L, SG	Herb
Caricaceae	*Carica papaya* L.	Perennial	Mbetik	Boiled leaf is used as a vegetable and drug diabetes mellitus, fruits that are cooked directly eaten while the young fruit is used as a vegetable	L	Herb
Convolvulaceae	*Ipomoea batatas* Poir.	Annual	Gadong enjolor	Young leaves are boiled as vegetables, tubers as a source of carbohydrates	L	Herb
Cucurbitaceae	*Cucurbita moschata* Duchesne	Annual	Jambe	Fruit that has been boiled as a vegetable and seeds as a drug malnutrition	SG, L, D	Herb
	Sechium edule (Jack.) Sw.	Annual	Ropah	The leaves are easy and the fruit is boiled into vegetables	SG, L, D	Herb

Dryopteridacae	*Polystichum setiferum* (Forssk.) Moore ex Woyn.	Perennial	Tenggiang	Young leaves for fever medicine	D	Tree
Euphorbiaceae	*Sauropus androgynus* (l.) Merr.	Perennial	Daun katuk	The young leaves are used as a vegetable and boost breast milk	L	Shrubs
	Manihot esculenta Crantz.	Perennial	Gadung	Young leaves are boiled as vegetables, tubers as a source of carbohydrates	S, SG, L, D	Shrubs
Fabaceae	*Pachyrhizus erosus* (L.) Urb.	Annual	Bengkoang	Tuber is directly eaten without being processed	L	Herb
	Phaseolus lunatus L.	Annual	Kacang koro	Young fruit is boiled and used as vegetable	SG, L	
	Leucaena leucocephala (Lam.) De Wit	Perennial	Pote-pote	Young seeds as *lalaban*	S	Tree
Flacourtiaceae	*Flacourtia rukam* Zoll. & Moritzi	Perennial	Tenggolan	Fruit that has been cooked directly eaten	D	Tree
Hypoxidaceae	*Molineria latifolia* (Dryand. Ex WT Aiton) Herb. ex Kurz	Perennial	Singkut	Leaves are used as a wrapper crop	S, SG, D, L	Herb
Lamiaceae	*Ocimum basilicum* L.	Annual	Kumangi	Leaves as *lalaban* and spices arsik	L	Herb
Lauraceae	*Persea americana* Mill.	Perennial	Pokat	Fruit that is cooked and is directly eaten	SG, L, S	Tree
	Cinnamomum burmannii Blume	Perennial	Kulit manis	Stem bark for spices	SG, D	Tree
Liliaceae	*Crinum asiaticum* (L.) Urb.	Perennial	Ompu-ompu	Leaves and pseudostem for fractures	SG, P, D	Herb
	Allium tuberosum Rottler ex Spreng.	Annual	Gundara belang	Leaves boiled as vegetables	L	Herb
Lythraceae	*Punica granatum* L.	Perennial	Delima	Fruit that has been cooked directly eaten	L	Tree
Malvaceae	*Hibiscus rosa-sinensis* L.	Perennial	Waren gegeh	Leaf juice to overcome fever	CR, M, P, SG, D, L	Shrubs
Moraceae	*Artocarpus heterophyllus* Lam.	Perennial	Nangka	Fruit that has been cooked directly eaten, fruit that is still used as a vegetable	D	Tree
Musaceae	*Musa paradisiaca* L.	Perennial	Galuh	Fruit that has been cooked directly eaten; pseudostem young cooked vegetables and drugs broken bones	SG, L, D	Herb
Myrtaceae	*Syzygium aqueum* (Burm.f.) Alston	Perennial	Jambu air	Fruits that have been cooked is then directly eaten	SG, L, D	Tree
	Psidium guajava L.	Perennial	Galiman	Fruits that have been cooked and is directly eaten; young leaves are directly eaten as a medicine for diarrhea	P, S, SG, L, D	Tree
	Syzygium malaccense (L.) Merr & LM Perry	Perennial	Jambu bol	Fruits that have been cooked and is directly eaten	S, L	Tree
	Melaleuca leucadendra (l.) L.	Perennial	Kayu putih	Leaves are used to make *minak alun*		Tree
Orchidaceae	*Hylocereus undatus* (Haw) Britton & Rose	Perennial	Buah naga	Fruits that have been cooked and is directly eaten	L, D	Herb
Oxalidaceae	*Averrhoa carambola* L.	Perennial	Balimbing	Fruits that have been cooked and is directly eaten	S, L	Tree
Equisetiaceae	*Equisetum debile* Roxb. ex Vaucher	Perennial	Sendep-sendep	the boiled leaves to overcome kidney stones	SG	Herb
Pandanaceae	*Pandanus amaryllifolius* Roxb.	Perennial	Pandan	Leaves to give aroma and food color, and also for Oukup	L, D	Herb
Piperaceae	*Piper betle* L.	Perennial	Belo	Boiled leaves for medicine fever, wounds, *sprue*	L	Herb
Poaceae	*Zea mays* L.	Annual	Jong	Flour seeds used for spice cipera, and carbohydrate sources	S, SG	Herb
	Cymbopogon citratus (DC.) Stapf.	Perennial	Sereh	Pseudostem for seasoning, Oukup, square Minak	P, S, SG, D, L	Herb
	Saccharum officinarum L.	Perennial	Tobu	Juice water used sugar	L, D	Herb

Rosaceae	*Eriobotrya japonica* (Thunb.) Lindl.	Perennial	Mbiwa	Fruit that has been cooked and is directly eaten	S, SG, D, L	Tree
	Diospyros kaki Lf	Perennial	Kesemek	Fruits that have been cooked and is directly eaten	SG	Tree
	Fragaria virginiana Mill.	Annual	Stroberi	Fruits that have been cooked and is directly eaten	L, D	Herb
Rutaceae	*Murraya koenigii* (L.) Spreng	Perennial	Daun kari	Leaves as a spice ingredient	SG	Shrubs
	Citrus sinensis (L.) Obsbect	Perennial	Rimo	Fruits that have been cooked and is directly eaten, fruits and leaves used as a sufficient material	L	Tree
	Citrus aurantifolia (Christm.) Swing	Perennial	Rimo bunga	Fruit for cooking spices, k-stone and leaf medicine as a sufficient ingredient	SG, D	Tree
Rubiaceae	*Coffea arabica* L.	Perennial	Kopi	Seeds to make coffee	CR, M, SG, L, D	Shrubs
Sapindaceae	*Dimocarpus longan* Lour.	Perennial	Leci	Fruits that have been cooked and is directly eaten	L, D	Tree
	Nephelium lappaceum L.	Perennial	Rambutan	Fruits that have been cooked and is directly eaten	L, CR	Tree
Solanaceae	*Capsicum annuum* L.	Annual	Lasina	Fruit for seasoning	CR, S, SG, D, L	Herb
	Solanum tuberosum L.	Annual	Potato	Bulbs are boiled as a vegetable and a source of carbohydrates	L	Herb
	Solanum melongena L.	Annual	Terong	The fruit is cooked as a vegetable		Shrubs
	Solanum verbascifolium L.	Perennial	Lancing	Leaf juice as a drug broken bones	L	Tree
	Solanum americanum Mill	Annual	Leuh	Leaves are cooked as vegetables	D	Herb
	Solanum betaceum Cav	Perennial	Terong Bolanda	Fruit that has been cooked directly eaten	SG, L	Shrubs
	Solanum nigrum L.	Perennial	Leunca	Young fruit is used as lalaban	SG, L	Herb
	Solanum Lycopersicum L.	Annual	Tomat	Fruit that has been cooked directly eaten	SG, D, L	Herb
	Nicotiana tabacum L.	Annual	Mbako	Leaves are used as a cigarette and wound medicine	SG	Herb
	Physalis peruviana L.	Annual	Depuk-depuk	Fruit that has been cooked directly eaten and the whole part is boiled to deal with smallpox	SG	Herb
Sapotaceae	*Achras zapota* L.	Perennial	Sapo	Fruit that has been cooked directly eaten	L	Tree
Sterculiaceae	*Theobroma cacao* L	Perennial	Kopi coklat	Seeds for cocoa powder	L	Tree
Zingiberaceae	*Curcuma longa* L.	Annual	Kuning gersing	The juice rhizoma used as medicine for diarrhea, dye eat; the leaves are used materials Oukup	SG, D	Herb
	Curcuma xanthorrhiza Roxb.	Annual	Lempuyang	The juice of rhizoma diarrhea and overcome malnutrition	SG, L, D	Herb
	Etlingera elatior (Jack) RM Sm.	Perennial	Cekala	Pseudostem fluid is used for cough, fever, enough, sambal; leaves for enough; flowers for spices arsic, chopped, terites; fruit for terites and arsik	P, S, SG, D, L	Herb
	Hedychium coronarium J. Koenig	Perennial	Pincouli	Leaves as a spice arsik	SG	Herb
	Zingiber officinale Rosc.	Annual	Alia	Rhizoma for wound drugs, fever, cough, ingredients, rheumatism; leaves for sufficient material	P	Herb
	Zingiber zerumbet (L.) Rosc. ex Sm.	Annual	Lempuyang	Rhizoma for rheumatic drugs and adequate	L, D	Herb
	Alpinia galanga (L.) Sw.	Perennial	Kelawas	Rhizoma used for itch and seasoning, Oukup; leaves ingredient Oukup	SG, D	Herb

Note: CR (Cinta Rayat), D (Doulu), L (Lingga), M (Merdeka), P (Pertegun), SG (Semangat Gunung), S (Surbakti)

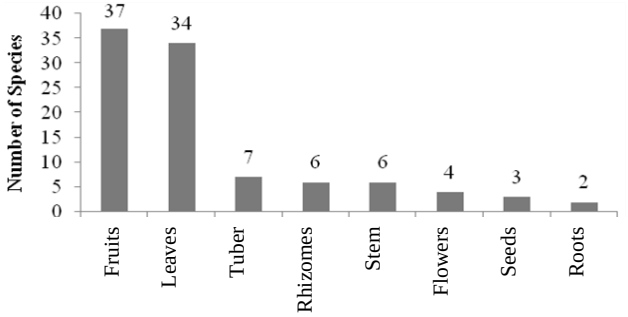

Figure 3. Parts of plants used as food and medicines by the Batak Karo Sub-ethnic community in North Sumatra, Indonesia.

Part of plant used as food and medicines included fruit (37 species), leaves (34 species), tubers (7 species), and stems (6 species) (Figure 3). Leaves are used as medicine (*Andrographis paniculata, Justicia gendarussa, Blumea balsamifera, Anredera cordifolia, Solanum verbascifolium*) and vegetables (*Brassica rapa, Carica papaya, Sauropus androgynus, Ipomoea batatas*). Part of plant known as rhizoma is used as a medicine and spices i.e (*A. galanga, C. longa,* and *Z. officinale*), while tubers are used as a source of carbohydrates or staple foods (*I. batatas, Colocasia esculenta, Manihot utilissima, S. tuberosum*). Some plants found on the grounds of Batak Karo sub-ethnic typically from tropical regions were *M. paradisiaca*, *M. indica*, *P. americana*, *C. papaya*, *C. sinensis*, *M. utilissima*, and *I. batatas* (Wezel and Bender 2003; Sunwar et al. 2006; Sujarwo and Caneva 2015).

Specific type of Plants found in the home garden of Karo Batak sub-tribe garden

In this study, there were several plants in Karo ethnic garden, but rarely found in other Indonesian ethnic such as Bali Aga (Sujarwo and Caneva 2015), Java (Kusumaningtyas et al. 2006) such as *tenggolan* (*Flacourtia rukam*), *singkut* (*Molineria latifolia*), and cekala (*Etlingera elatior*).

Flacourtia rukam Zoll. & Moritzi

Flacourtia rukam is a plant wild found in the forest around of the Sibayak Mount, but it has been cultivated in the home garden by the community especially in the Doulu Village. Although only found in the village of Doulu, but most respondents recognize that this plant provides a source of fruit. The reasons people didn't cultivate of *tenggolan* because it's easy and widely found in the forest and most of them didn't know how to cultivate. Moreover, it is rarely found the saplings of the plant, and it is difficult to be grown although it grows well most of it rarely bears fruit. These findings were in line with the function of the garden as an important location for the process of plant domestication and also the development and cultivation of economic value crops (Miller and Nair 2006; Ashagre et al. 2015). *F. rukam* fruits contain other secondary metabolites which were very useful for medicinal purposes such as saponins, flavonoids, polyphenols, and tannins (Barcelo 2015). This fruit became a source of fruit for tribal of Anak Dalam in Jambi (Setyowati 2003).

Molineria latifolia (Dryand. Ex WT Aiton) Herb. ex Kurz

Molineria latifolia synonymous with *Curculigo latifolia* is a plant which is easily cultivated and found in five villages in this study. Batak Karo sub-ethnics used *singkut* leaves as wrapper of *cimpa* (the traditional cuisine from glutinous rice) and as drug of the fracture. The *M. latifolia* leaves used as a food wrapper because it has a strong fiber, bending, a distinctive flavour, and more durable. Empirically, *M. latifolia* is cultivated in the home garden which can be also used to facilitate access. The utilization of *M. latifolia* in this study for medicinal purposes is different from other ethnic such as anti-cancer (Ismail et al. 2010), anti-diabetes (Kant 2005), and anti-hepatitis B (Mohamed et al. 2007).

Benefits of the leaves and roots *singkut* for fractures medicines had also been known widely by the local communities of Borneo. As a drug fracture, the leaves are applied as wrapping in the sick bone so that the bone can re-seal. The bioassay results showed that the leaves and roots of *M. latifolia* had anti-microbial properties (Hong and Ibrahim 2012), while fruits and roots had activity as an anti diabetic, anti cholesterol (hypolipidemic) through regulation of glucose and lipid metabolism (Ishak et al. 2013). In addition, fruits have a high potential as a natural low-calorie sweetener (Suzuki et al. 2004) because they contain curculin and neoculin compounds (Suzuki et al. 2004; Kant 2005). Curculin and neoculin is a sweet protein with a unique flavor (Suzuki et al. 2004; Kant 2005), and has the quality taste 500-9000 times sweeter than sucrose (Yamashita et al. 1995). Therefore, it is very potential to be developed in the industry scale as a low-calorie sweetener. However, singkut has relatively small fruits, and the amount is relatively small so it is important to do further research to increase the size and number of fruits.

Etlingera elatior (Jack) RM Sm.

In this study, *E. elatior* was found in five villages from seven villages research location. This plant was used as traditional medicine and food. The flowers and fruit of *E. elatior* are used as a mixture of *cincang* and *terites*. The *cincang* is a traditional cuisine of Batak Karo sub-ethnic made from a mixture of cassava leaves (*M. utilissima*), banana pseudostem (*M. paradisiaca*), and flowers of *E. elatior*. The *terites* is a traditional soup of Karo Batak sub-ethnic, which is also known as *pagit-pagi*t (pagit = bitter) obtained from grass extract from rumen of ruminant animals (cattle and goats). The addition of *E. elatior* on terites serves to neutralize the "smell" of fermented grass on the rumen. *E. elatior* contains essential oil derived from sesquiterpenoid class (Jaafar et al. 2007; Azemi 2008; Abdelmageed et al. 2011), which is volatile (Croteau et al. 2000), resulting in a distinctive aroma. The addition of *E. elatior* to various foods makes food more delicious, fresher, more durable, and has a distinctive aroma. *E. elatior* has a bioactive compound of phenolic and fla vonoid (Cushnie and Lamb 2005; Xie et al. 2015), which could apparently inhibit bacterial growth (Abdelwahab et al. 2010) such as

Staphylococcus aureus, Bacillus subtilis, Listeria monocytogenes, Escherichia coli, Salmonella typhimurium, and *Pseudomonas aeruginosa* (Ghasemzadeh et al. 2015), resulting in more durable food .

Diversity and abundance of plants in home garden

A total 85 species of plants (43 families, 71 genera) were grown as traditional medicine and foodstuffs by sub-ethnic Batak Karo. A total of 43 species of plants were found in the Semangat Gunung Village, 54 species in the Lingga Village, 36 species in the Doulu Village, 18 species in the Surbakti Village, 8 species in the Pertegun Village, 11 species in the Cinta Rayat Village, and 5 species in the Merdeka Village (Table 1). *C. esculenta, B. rapa, M. esculenta, M. latifolia, P. guajava, C. citratus, E. japonica, C. arabica, C. annuum,* and *E. elatior* were the most common crop in more than 50% of surveyed villages. The differences in the number of species and the individual number of these plants found in each village had implications on the differences in the similarity index and the index of diversity. Table 2 shows the similarity index of medicinal plants and food plants found in each village.

In this study, it was found that the adjacent villages had the high similarity of Jaccard index (Ji) of the medicinal and edible plants compared to others. Table 2 shows that the highest similarity index of the medicinal and edible plants was shown between the Merdeka Village and the Cinta Rayat Village (0.600), followed by the Doulu Village with the Semangat Gunung Village (0.418). The number of plants found in the Merdeka Village (5 species) and in the Cinta Rakyat Village (11 species) was fewer than the other villages, but the plant species was relatively similar such as *Brassica* sp, *H. rosa-sinensis,* and *C. annuum*. The lowest commonality index of the medicinal and edible plants is owned by the Merdeka Village and the Doulu Village (0.030), followed by the Semangat Gunung Village and the Merdeka Village (0.048). The Jaccard equality index is influenced by the species as well as the number of species found in the two different villages. If the number of found species is much different, the index of similarity is small. The number of plant species found in the research location was relatively different, i.e., the Doulu Village (36 species), the Semangat Gunung Village (43 species), while the Merdeka Village (5 species). Coffee (*C. arabica*) is the only one species found in the three villages.

The number of individuals and the number of species found in the home garden also affect the diversity index and the abundance index. Average of Shannon-Wiener index of garden plants in the Karo ethnic group were moderate at 1.164-3.123 (Table 3). The Shannon-Wiener index obtained in this study was higher than that obtained in the home garden of Bali Aga ethnic in Bali island with the value of 0.92-1.13 (Sujarwo and Caneva 2015), and Cuba ethnic with the value of 1.63-1.79 (Wezel and Bender 2003). However, it was lower than in the home garden of ethnics in Nepal with the value ranging from 4.03 to 4.42 (Sunwar et al. 2006). Plant species found in the garden was influenced by various factors such as culture (Cruz-Garcia and Struik 2015), ethnics, climate, and topography (Senanayake et al. 2009). Cruz-Garcia and Struik (2015) state that the plant diversity in the home garden was higher during the dry season than rainy season.

The average index of Margalef showed that the abundance of plants located in Batak Karo sub-ethnic was ranging from 0.929 to 2.531. This was in contrast to Sujarwo and Cuneva (2015) who found that the abundance index of home garden in Bali Age was a lower with the value of 0.85-1.87. Each home garden has a unique structure, function, and composition depending on the natural ecological research sites (Galhena et al. 2012).

Table 2. The similarity of Jaccard (Ji) of the medicinal and edible plants in home garden used by Batak Karo sub-ethnic in North Sumatra

Village	Doulu	Semagat Gunung	Lingga	Merdeka	Cinta Rayat	Surbakti	Pertegun
Doulu	-	0.418	0.364	**0.030**	0.081	0.130	0.075
Semangat Gunung		-	0.352	0.048	0.017	0.184	0.128
Lingga			-	0.054	0.088	0.200	0.088
Merdeka				-	**0.600**	0.053	0.222
Cinta Rayat					-	0.110	0.154
Surbakti						-	0.182
Pertegun							-

Table 3. The diversity index (Shannon-Wiener) and the abundance index (Margalef) of medicinal and edible plants in 7 villages of Batak Karo sub-ethnic, North Sumatra

Villages	Number of species	The Margalef abundance index			The Shannon Wiener diversity index
		Minimum	Average	Maximum	
Doulu	43	0	0.929	7.116	3.123
Lingga	66	0	1.896	22.859	3.150
Semangat Gunung	43	0	2.531	43.667	2.395
Surbakti	19	0	1.164	5.582	1.164
Pertegun	13	0	1.032	5.649	1.840
Merdeka	5	0.063	1.148	1.595	1.575
Cinta Rayat	11	0.016	2.116	14.339	1.579

Batak Karo Sub-ethnic had the local wisdom to benefit the home garden as a source of food and traditional medicine. The plants used as local staple food had been widely cultivated in home garden including *singkut* (*M. latifolia*) as a material for *cimpa* (the traditional cuisine from glutinous rice) and *cekala* (*E. elatior*) the main ingredient for *terites* (soup from grass extract from the rumen of ruminant). The diversity index obtained in home garden of Batak Karo sub-ethnic was in moderate level. The plants in the home garden of Batak Karo sub-ethnic was relatively different among other villages. The adjacent village had a greater similarity index compared to other villages. *F. rukam* is one of wild plant, which had a high potential to be developed as a source of fruit, while *M. latifolia* had a potential as a low-calorie sweetener.

ACKNOWLEDGEMENTS

Authors would like to thanks the local society and the head villages of the Cinta Rayat Village, the Doulu Village, the Lingga Village, the Merdeka Village, the Pertegun, the Semangat Gunung Village, and the Surbakti Village, at Karo District in North Sumatra, Indonesia especially for their assistance and information during the study. Thanks also to Endang Cristine Purba, Rani Nur Aini, Avif, Fajri, and Jiro for their assistance to data collection and Higher Education (DIKTI) No: 2709/UN2.R3.1/HKPO5.00/2017 for research funding.

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