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Local knowledge of medicinal plants in sub-ethnic Batak Simalungun of North Sumatra, Indonesia

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Abstract. *Silalahi M, Supriatna J, Walujo EB, Nisyawati. 2015. Local knowledge of medicinal plants in sub-ethnic Batak Simalungun of North Sumatra, Indonesia. Biodiversitas 16: 44-54.* Research on the local knowledge of medicinal plants by sub-ethnic Batak Simalungun of North Sumatra was conducted, using an ethnobotanical approach. The sample consisted of 8 key informants and 32 general respondents, who were grouped into two, namely those who were 30-50 years old and >50 years old. Data were analyzed both qualitatively by descriptive statistics and quantitatively by calculating the index of cultural significance (ICS) and the use value (UVs). It was found that 239 species (170 genera, 70 families) of medicinal plants were used to cure 18 kinds of natural diseases and 2 kinds of supra natural diseases. Almost half of those plants (119 species) had leaves used as medicines. Among the diseases, gastrointestinal disorders had the highest number of medicinal plants used (72 species), followed by fever (64 species), and fractures (41 species). It seemed that younger generation had lost their knowledge in the medicinal plants because their knowledge of medicinal plants (48.19 ± 8.35 species) was lower than the that of older generation (170.19 ± 18.38 species), while our key informants had the highest knowledge of medicinal plants among respondents (202.00 ± 12.32 species).

Keywords: local knowledge, medicinal plants, North Sumatra, sub-ethnic Batak Simalungun.

INTRODUCTION

Man is known to have utilized plants as a source of drugs for thousand years. The World Health Organization (WHO) estimated that about 60-80% of the world population still relies on the traditional medicine derived from plants (Joy et al. 1998), and Indonesian population (60%) relies on traditional medicinal plants for their health care. Medicinal plants are species known to have efficacy to help maintain the health or to cure a disease. Medicinal plants are grouped into three: traditional, modern, and potential medicinal plants.

The local knowledge of medicinal plants is inherited orally or in written in ancient manuscripts. The main obstacle encountered in recovering local knowledge through ancient manuscripts is the difficulty in reading, because some parts of many manuscripts have been lost or damaged (Nawangningrum et al. 2004). To overcome this, it is necessary to look for more efficient alternative methods to recover the local knowledge. Ethnomedicine is an alternative that has been used because it may use both ethnology and medicinal science (Martin 1995).

Ethnomedicine is the study of perception and conception of local communities in understanding health or research that studies the traditional ethnic medical system. The high effectiveness of ethnomedicine research is due to reduction of time and costs in finding new chemical compounds used as drugs (Fabricant and Farnsworth 2001). Ethnomedicinal study is done through a community perspective approach (emic approach), which is then proved through scientific approach (ethic approach) (Walujo 2009).

The traditional medicine is related to cultural diversity, ethnic diversity, and biodiversity of plants. Indonesia has more than 300 ethnics, one of which is Batak, which consists of five sub-ethnics or tribes often referred to as sub-ethnics, namely Karo, Phakpak, Simalungun, Toba, and Angkola-Mandailing (Bangun 2010). Researches on the usage of plants by local communities or ethnic groups in Sumatra have been carried out, among others: Batak Toba (Simbolon 1994), Rejang (Darnaedi 1999), Malay (Setyowati and Siagian 2004; Setyowati and Wardah 2007; Sunesi and Wiryono 2007; Rahayu et al. 2007; Hariyadi and Ticktin 2011. Those studies show that the diversity of the medicinal plants used by local communities depends on the ethnicity, locality, age of respondent, and number of respondents.

It is really unfortunate that high deforestation in Indonesia that causes the loss of many plant species and understanding of local knowledge will hamper our efforts to find new drugs. The high rate of erosion of the local knowledge has been found everywhere in the world including Indonesia (Hoang et al. 2008). At the same time, our local knowledge of medicinal plants are kept only by the older people (>50 years old) and shamans (Darnaedi 1999). While the rate of species loss is also similar to the rate loss of local knowledge (Hoang et al. 2008).

Meanwhile, researches on the local knowledge of sub-ethnic in Sumatra have not been intensively carried out. For that purpose, we have done our research on the

ethnomedicine of sub-ethnic Batak Simalungun. This research had two objectives: (i) to understand the local knowledge of medicinal plants in sub-ethnic Batak Simalungun; (ii) to understand and preserve the value and cultural heritage of the medicinal plants.

MATERIALS AND METHODS

Study area

Our study site is located in Nagori Simbou Baru, Raya Sub-district, Simalungun District, North Sumatra, Indonesia. The total area of those villages is 2002.96 hectares, within the altitude of 650-700 m above sea level. Simbou Baru village is geographically located at N 2°57'05'' and E 98°57'84'' (Figure 1).

Data Collection

To obtain the local knowledge on medicinal plants in sub-ethnic Batak Simalungun, interviews were conducted with ethnobotanical approach (Martin 1995; Alexiades 1996). It was conducted through semi-structured and in-depth interviews. The interviews were conducted with 8 key informants (healers, ethnic chiefs), 32 general respondents with two age groups: the first group was 30-50 years old and the second group above 50 years old with a ratio of 1:1.

Data analysis

Data were analyzed using qualitative and quantitative methods. Qualitative analysis was done by grouping plants based upon usage category. Quantitative analysis was done by determining UVs, ICS, and calculating the differences of those parameters in statistical analysis, using Anova. The results consisted of: (i) Index of cultural significance (ICS), calculated using the formula of Turner (1988), (ii) use value (UVs) of each species was based on Prance et al. 1987, and Anova was calculated using software SPSS version 17.

RESULTS AND DISCUSSION

The concept of "disease" in Sub-ethnic Batak Simalungun

The local knowledge of sub-ethnic Batak Simalungun in making use of plants as medicine is related to the concept of diseases. The diseases are grouped into natural and supra natural diseases. Natural diseases are those caused by the malfunctioning of the body such as, fever, toothache, ulcers, and diarrhea. Sub-ethnic Batak Simalungun has known as many as 18 kinds of natural diseases (Table 1). The medicinal plants which have been used to cure diseases vary in number and species. The highest number of medicinal plants used were those to cure gastrointestinal disorders (72 species), followed by fever (64 species), and fractures (41 species).

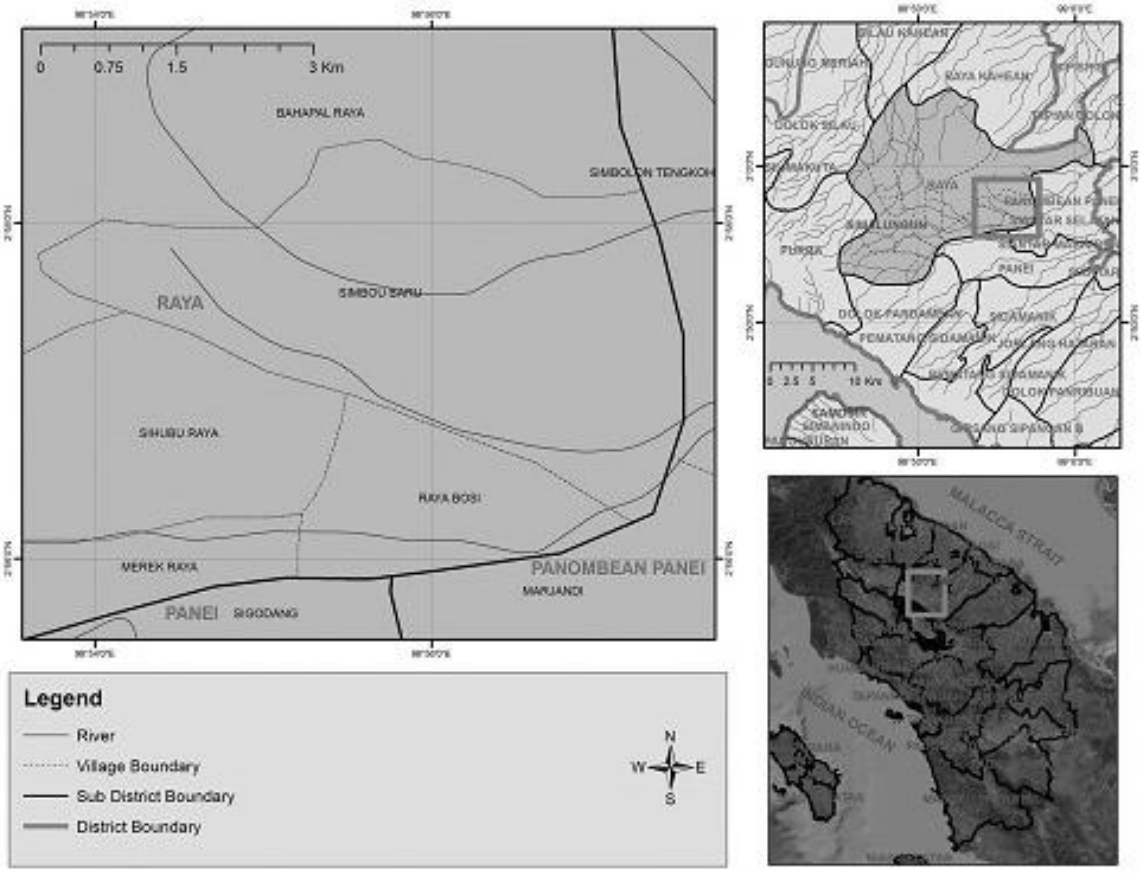

Figure 1. Study site of Nagori Simbou Baru, Raya Sub-district, Simalungun District, North Sumatra, Indonesia.

Table 1. Number of medicinal plants species used to cure the "diseases" in sub-ethnic Batak Simalungun of North Sumatra.

Characteristics	Name of diseases	Number of species
Natural disease	Hypertension	15
	Cough	10
	Asthma	24
	Diarrhea	22
	Gastrointestinal disorders	72
	Stomach ache	12
	Fractures	41
	Rheumatism	6
	Itch	8
	Ulcer	12
	Kidney disease	25
	Diabetes mellitus	21
	Aphrodisiac	13
	Injury	39
	Fever	64
	Eye infection	6
	Thrush	4
	Toothache	5
Supranatural disease	*Busung (liver disease)*	23
	Alogo-alogo ("malnutrition")	18
Traditional concoction	*Tinuktuk tawar* ("mashed concoction" to maintain stamina)	117
	Tinuktuk paranggetek ("mashed concotion" to maternity)	11

The high frequency of gastrointestinal disorder is caused by poor sanitation in their houses and in the surrounding villages, which may force local communities to explore any medicinal plants to cure the diseases. Medicinal plants which have bitter taste such as: *jambu batu* (*Psidium guajava*), *horis kotala* (*Eurycoma longifolia*), *ratusan* (*Ageratum conyzoides*), and *andor golat* (*Mikania cordata*) have been used to cure gastrointestinal disorders. The bitter taste in those plants is due to its chemical contents, namely tannin and flavonoid. The tannin has been proven to cure the diarrhea (de Padua et al. 1999). Tannin is able to form a thin layer on the lumen, therefore reducing irritation (Munim and Hanani 2011). Those plants can also prevent water secretion and also kill microbes (Achmad et al. 2008). Furthermore, Munim and Hanani (2011) say that the tannin causes the denaturation of protein whereas flavonoid causes the destruction of cell wall of bacteria. The extract of *Psidium guajava* leaves prevents the growth of *Escherichia coli* (Voravuthikunchai et al. 2004), *Staphylococcus aureus*, *Bacillus subtilis*, and *Pseudomonas aeruginosa* (Abdelrahim 2002).

A large number of plants species have been used to cure fever, a symptom caused by some deseases such as chicken pox, cough, and wounds. Those plants were identified as follows: *bunga raya* (*Hibiscus rosa-sinensis*), *habu-habu* (*Ceiba pentandra*), *silundad* (*Impatiens platypetala*), *rampas binei* (*Drymaria cordata*), *jarango* (*Acorus calamus*), and *horis kotala* (*Eurycoma longifolia*). The ability of plants to reduce fever is related to the content of bioactive compounds. Buenz et al. (2005) state that *Ceiba pentandra* has a chemical compound that serves as catechins, β-citosterol which serves as antipyretic and analgesic.

The local knowledge of curing fractures has presumably been adopted from the behavior of a bird called *siburuk*. They have learned from *siburuk* bird that when their chicks are fractured and hurt by communities, the mother will bring the herbs. There were 41 species of plants used to cure fractures. To cure fractures, those plants have to be cooked using coconot oil. The examples of plants used for curing fractures were *jengkol* (*Pithecolobium lobatum*), *sibaguri* (*Sida ungulata*), *ompu-ompu* (*Crinum asiaticum*), *kelapa* (*Cocos nucifera*), and *baru* (*Hibiscus similis*). The *ompu-ompu* leaves contain alkaloids, glycosides, triterpenes, coumarins which can serve as an analgesic (Asmawi et al. 2011) and anti-inflamantory (Rahman et al. 2013).

Supra natural diseases are those caused by supra natural spirits, bad person, and curse *(karma*) such as *busung* (liver disease) and *alogo-alogo* ("malnutrition"). Local communities believed that *busung* disease only occurs to people who commit a theft. *Busung* disease will be treated by shaman, through a series of rituals. Those plants used to treat *busung* have been identified as: *kelapa* (*Cocos nucifera*), *jarango* (*Acorus calamus*), *utte mungkur* (*Citrus hystrix*), *silinjuang* (*Cordyline fruticosa*), *bagot* (*Arenga pinnata*), and *demban* (*Piper betle*).

Alogo-alogo (*alogo* means wind) disease affects the children. Local communities believe that the *alogo-alogo* disease is caused by sin of their ancestors. The patients are characterized by thin body, pale face, bloated abdomen, and fever at night. Plants used to cure *alogo-alogo* disease were, among others, *demban* (*Piper betle*), *jarango* (*Acorus calamus*), and *lada* (*Piper nigrum*). Those plants are able to warm the body, so they can expedite the blood circulation, because *Acorus calamus* contains high potassium, which can be used to cure fever (Motley 1994).

Sub-ethnic Batak Simalungun has traditional concoction called *tinuktuk (tuntuk* = mashed). It is called *tinuktuk* because of the producing process, namely by mashing a variety of medicinal plants. The local communities can distinguish two different kinds of *tinuktuk*: *tinuktuk tawar* (to maintain stamina) and *tinuktuk paranggetek* (concoction for maternity). The plants that have been used to cure *tinuktuk tawar* were 117 species while for *tinuktuk paranggetek* were 11 species.

To cure *Tinuktuk* concoction, the roots, leaves, and tuber of 117 species of plants have been used. Roots of 7 species of bamboo (*Poaceae),* 7 species of palms (*Arecaceae*), 7 species of rattan (*Arecaceae*), and 7 species of *Citrus* (*Rutaceae*) were among the listed plants. While tubers that have been used were from ground orchid (*Orchidaceae*). The roots to be used were firstly cut into small pieces, dried, and crushed. The materials of leaves were mashed until fine and then squeezed to get the water out. The water resulted from squeezed materials was used to boil the roots until all the water evaporated and the material became dry and salt was used as preservative. Tuber of *Orchidaceae* such as: *salembar satahun* (*Nervillia plicata*), *salembar sabulan* (*Nervilia aragoana),* and *gadong harangan* (*Goodyera rubicunda)* have been used.

Whereas rattan from both genus *Daemonorops* and *Calamus*, have been utilized more often. Other tribes such as *Anak Dalam* tribe in Jambi have used *Daemonorops* to cure wounds and headache (Sulasmi et al. 2012).

In the process of producing *tinuktuk*, some local communities (7-10 people) cooperate because they have to find plants from the forests, farms, and plantations. Due to difficulties in finding the plants, the young generation (<50 years old) tend to ignore this kind of treatment and consider those practices are out of date.

Diversity of medicinal plants

The sub-ethnic Batak Simalungun has used as many as 239 species (170 genera, 70 families) of medicinal plants. Those plant species which have been used by local communities were spermatophyta (230), pterydophyta (8) and lichens (1). Figure 2 shows that the main families of medicinal plants that have been used consisted of *Arecaceae* (20 species), followed by *Poaceae* (16 species), *Rutaceae* (13 species) and *Zingiberaceae* (12 species). The highest number of genera was found in *Arecaceae* (13 genera), followed by *Euphorbiaceae* (12 genera), *Poaceae* (11 genera), *Fabaceae* and *Asteraceae* (10 genera).

At least 20 species of *Arecaceae* have been used as medicinal plants by sub-etnis Simalungun, , most of which were rattans and palms. Some of the palms mainly used for medicines were *kelapa* (*Cocos nucifera*), *bagot* (*Arenga pinnata*), and *pining* (*Areca catechu*). *Cocos nucifera* was used to cure fever, fractures and as a component of *tinuktuk* concoction because it has anti bacterial, anti fungal, anti-viral, immunostimulant, antioxidant, and hypoglycemia (Debmandal and Mandal 2011).

It was found that 18 spesies of medicinal plants belong to *Poaceae*, especially bamboo. Most parts of bamboo both leaves and roots have been used as medicinal plants. The leaves of bamboo have been used to cure injury and fever. The same usage of bamboo leaves is found in Chinese medicines (Wang et al. 2012).

Utte bunga (*Citrus aurantium*), *utte mungkur* (*Citrus hystrix*), and *tuba* (*Zanthoxylum acanthopodium*) belong to *Rutaceae* and they were commomly used. Out of 15 spesies of *Rutaceae*, 13 spesies are from genus *Citrus* and 2 more spesies are from other genera. The number of species of *Rutaceae* was relatively small in comparation to the other families, however, the frequency of species used was relatively high. Simalungun and Karo Districts are the centers of *Citrus* cultivation in North Sumatra.

Sub-ethnic Batak Simalungun used eight species of *Lamiaceae* as medicinal plants, some of those were *sibabi dalu* (*Paraphlomis javanica*), *silanglang kabungan* (*Coleus scutellarioides*), *simarihur-ihur niasu* (*Pogostemon auricularius*), and *terbangun* (*Coleus amboinicus*) which have been known to be rich in essential oils, so they can be used to cure gastrointestinal disorders and fever. *Solanaceae* has been used to cure fractures *latting* (*Solanum verbascifolium*), and injury *timbaho* (*Solanum nicotiana*). In Brazil, *Solanum nigrum* have been used to cure anti depression (Giorgetti and Negri 2011).

Our research also found that orchids (*Orchidaceae)* have been used for medicinal plants such as, *salembar sabulan* (*Nervilia aragoana*), *salembar satahun* (*Nervilia plicata*), and *gadong harangan* (*Goodyera rubicunda*). Tuber of orchids can be used to make traditional concoction (*tinuktuk*), which is to enhance stamina.

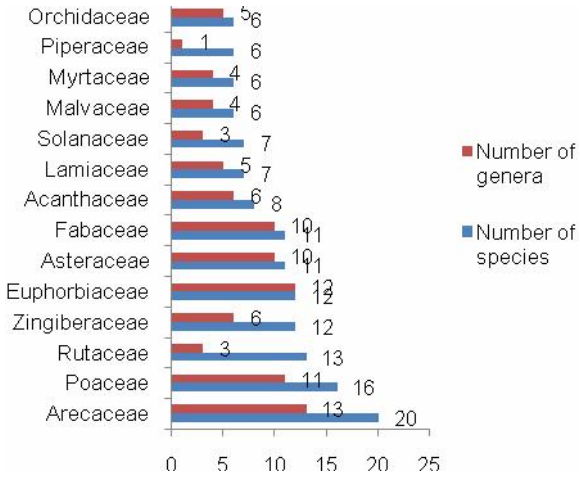

Figure 2. Composition of species and family used for medicinal plants by sub-ethnic Batak Simalungun.

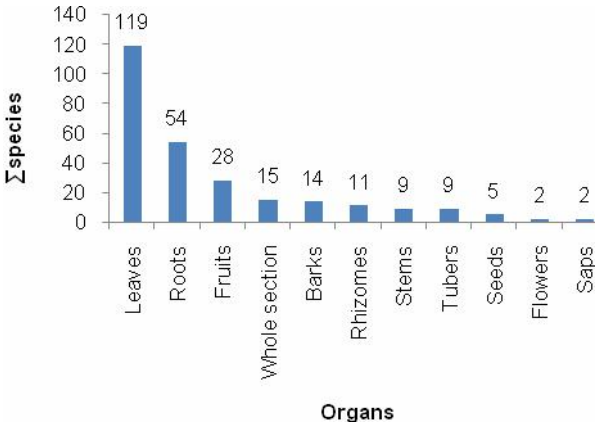

Figure 3. Parts of medicinal plants used as medicines in sub-ethnic Batak Simalungun, North Sumatra.

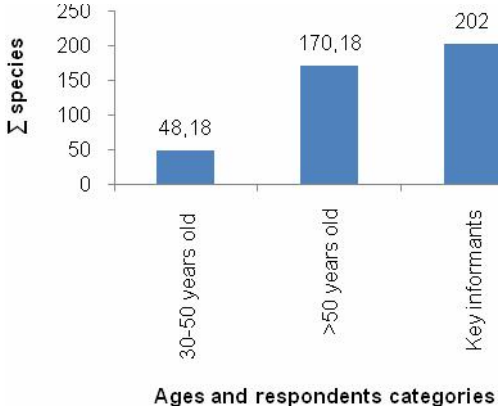

Figure 4. The corelation between age of respondents and means of medicinal plants known.

Table 2. Local and scientific names of medicinal plants in sub-ethnic Batak Simalungun of North Sumatra, Indonesia.

Family	Scientific name	Local name	Part used	Use*	ICS	30-50 years old	UVs > 50 years old	Key infor-mants
Acanthaceae	*Clinacanthus nutans*	*Siborutiktik*	Leaves	Gas, Fev	6.0	-	1.2	1.5
	Graptophyllum pictum	*Silastom*	Leaves	Ulc, Kid	36.0	1.0	1.2	1.5
	Justicia gendarussa	*Sangke sempilit*	Leaves	Fev, Bus	30.0	0.8	1.0	1.0
	Parastrobilanthes parabolica	*Andalotung*	Leaves	Gas, Fev	6.0	0.6	1.6	2.0
	Psedeanthemum acumiinatisimun	*Topu arang*	Leaves	Ash, Aph, Fev, Tt	36.0	-	2.2	2.8
	Strobilanthes crispus	*Kecibeling*	Leaves	Gas, Kid, Tt	30.0	0.8	1.0	0.8
	Strobilanthes sp.1	*Pijor holing*	Leaves	Ash, Kid	42.0	0.6	1.4	1.5
	Strobilanthes sp.2	*Topu ringring*	Leaves	Kid	33.0	-	0.6	0.8
Actinidiaceae	*Saurauia vulcani*	*Sopsopan*	Leaves	Dia, Gas, Inj, Tt	12.0	-	1.8	2.5
Amaranthaceae	*Celosia cristata*	*Rudang*	Leaves	Fev, Bus, Alg	13.5	-	1.4	2.0
Amaryllidaceae	*Crinum asiaticum*	*Ompu-ompu*	Tuber	Fra, Fev	45.0	1.2	1,6	1.8
Annonaceae	*Cyathocalyx virgatus*	*Paet tandang*	Leaves	Gas, Inj	9.0	-	0.4	0.5
Apiaceae	*Centella asiatica*	*Papaga*	Leaves	Gas, Kid, Inj	45.0	1.2	2.0	2.5
Apocynaceae	*Alstonia pneumatophora*	*Rahu*	Bark	Dia, DM	24.0	0.8	1.2	1.3
Araceae	*Acorus calamus*	*Jarango*	Stem	Fev, Bus, Alg	30.0	1.0	1.8	2.0
	Colocasia esculenta	*Suhat sabah*	Stem	Fev	6.0	0.8	0.4	0.8
	Colocasia sp.1	*Hau sangggir*	Tuber	Fev	12.0	-	0.6	0.8
Arecaceae	*Areca catechu*	*Pining*	Fruit	Fra, Bus, Tt,	60.0	1.0	1.6	1.6
	Arenga pinnata	*Bagot*	Root	Fra, DM, Tt	30.0	0.4	0.8	2.0
	Calamus caecius	*Malno*	Root	Tt	9.0	-	0.8	0.8
	Calamus cf. *javensis*	*Hotang pulogos*	Root	Fra, Tt	6.0	-	0.8	1.0
	Calamus sp.1	*Hotang aek*	Root	Tt	6.0	0.6	0.6	1.0
	Calamus sp.2	*Hotang kiskisan*	Root	Fra, Tt	6.0	-	0.8	1.0
	Calamus sp.3	*Hotang rusrus*	Root	Tt	6.0	-	0.8	0.8
	Caryota cf. *maxima*	*Riman*	Root	Tt	24.0	0.6	0.6	1.0
	Caryota cf. *mistis*	*Andudur*	Root	Tt	24.0	0.2	1.0	1.0
	Cocos nucifera	*Kelapa*	Root, fruit	Fra, DM, Bus, Tt	60.0	1.8	1.6	2.0
	Cyrtostachys lakka	*Simarpining-pining*	Root	Ash, Kid, Fev	4.5	-	1.6	1.3
	Daemonorops sp.1	*Hotang rutti*	Root	Tt	6.0	-	0.8	0.8
	Daemanorops sp.2	*Boar-boar*	Root	Tt	24.0	-	1.0	0.8
	Korthalsia junghuhnii	*Hotang dadahanan*	Root	Fra, Tt	6.0	-	1.6	0.8
	Livistona sp.1	*Baluhur*	Root	Tt	24.0	-	0.8	1.0
	Livistona sp.2	*Biruh*	Root	Tt	12.0	-	0.8	1.0
	Nypa fruticans	*Nipah*	Root	DM, Tt	24.0	-	0.6	1.0
	Plectocomia cf. *elongata*	*Hotang Boar-boar*	Root	Tt	6.0	-	0.8	1.0
	Oncosperma filamentosum	*Libung*	Root	Fra, Tt	15.0	1.0	1.4	1.5
	Salacca zalacca	*Salak*	Fruit	Gas	18.0	0.8	1.0	0.8
Asclepiadaceae	*Hoya* sp.1	*Simanisia*	Leaves	Fra, Kid, Aph, Tt	12.0	-	0.4	2.0
	Hoya sp.2	*Tukkok matua sabungan*	Leaves	Ash, Fra, Aph, Tt	109.0	1.6	2.0	3.3
	Hoya sp.3	*Tukkot matua boru-boru*	Leaves	Ash, Aph, Tt	93.0	-	2.4	2.8
Asteraceae	*Ageratum conyzoides*	*Ratusan*	Leaves	Ulc, DM, Inj	24.0	2.2	1.8	2.3
	Blumea balsamifera	*Galunggung*	Leaves	Gas, Inj, Bus	24.0	1.2	1.6	2.0
	Clibadium surinamense	*Longa begu somarittop*	Leaves	Dia, Gas, DM, Fev	45.0	1.6	2.4	2.5
	Chromolaena odorata	*Sihampir safari*	Leaves, fruit	Hyp, Dia, Gas, Ulc, Fev, Inj, Tt	106.0	-	4.8	6.0
	Chromolaena sp.1	*Suwawa*	Leaves	Gas, Fra, Rhe	45.0	3.0	1.8	2.5
	Elephantopus scaber	*Malehan*	Leaves	Inj	3.0	-	0.8	1.0
	Eupatorium inulifolium	*Longa bengu marittop*	Leaves	Dia, Gas, DM	45.0	1.8	1.8	2.5
	Gynura crepidioides	*Payon baru*	Leaves	Gas, Kid, Inj, Fev	45.0	1.6	1.8	2.5
	Gynura sp.1	*Sihorhor*	Leaves	Gas, Fev	42.0	2.0	2.0	2.0
	Mikania cordata	*Andor golat*	Leaves	Dia, Gas	55.0	2.4	2.2	2.5
	Spilanthes iabadicensis	*Sihampir*	Leaves	Too	9.0	0.6	0.8	0.8
Balsaminaseae	*Impatiens platypetala*	*Silundad*	Leaves	Fev	9.0	0.8	0.8	1.0
Blechnaceae	*Blechnum orientale*	*Padung-padung*	Leaves	Fra, Fev	9.0	-	1.0	1.5
	Blechnum sp.1	*Pahu lipan*	Leaves	Gas, Kid, Fev	6.0	-	1.2	1.8

Bombacaceae	*Ceiba pentandra*	*Habu-habu*	Leaves	Fev	24.0	-	1.0	1.0
	Ceiba sp.1	*Kabu-kabu*	Leaves	Fev	24.0	0.6	0.6	1.0
	Durio zibethinus	*Durian*	Bark	Gas	6.0	0.6	0.8	0.8
Caricaceae	*Carica papaya*	*Botik*	Leaves	Dia, Gas, Fev	54.0	1.2	1.8	2.0
Caryophyllaceae	*Drymaria cordata*	*Rampas binei*	Whole	Fev	18.0	0.4	0.6	1.0
Convolvulaceae	*Ipomoea batatas*	*Gadong suwawa*	Leaves	Gas, Ulc, Tt	99.0	1.0	3.0	3.0
	Ipomoea sp.1	*Hanawi*	Leaves	Gas, Tt	3.0	-	0.6	1.0
Costaceae	*Costus speciosus*	*Sibalik humosing*	Rhizome	Aph	30.0	0.4	0.6	1.0
	Costus sp.1	*Tabar-tabar*	Rhizome	Fev	9.0	-	0.8	1.0
Crassulaceae	*Kalanchoe pinnata*	*Hatengget*	Leaves	Ulc, Fev	18.0	-	1.8	1.5
Cucurbitaceae	*Benincasa hispida*	*Gundur*	Fruit	Gas, Sto	24.0	1.2	1.6	2.0
	Cucumis sativus	*Ancimun*	Fruit	Hyp	24.0	1.0	1.0	1.0
	Lagenaria siceraria	*Tatabu*	Fruit	Ash, Dia, Fra, Inj	9.0	0.8	1.4	1.8
Cyatheaceae	*Cyathea* sp.1	*Tanggiang*	Leaves	Fev, Inj	24.0	0.8	1.0	1.5
Cyperaceae	*Cyperus rotundus*	*Sitomu dalan*	Root	Hyp, Ash, Kid	9.0	-	1.4	1.8
Dilleniaceae	*Tetracera scandens*	*Pastulan*	Stem	Eye	9.0	0.6	0.8	1.0
Euphorbiaceae	*Aleurites moluccana*	*Gambiri*	Seed	Dia, Gas, Sto, Kid, Fev, Tt	129.0	2.2	3.2	4.5
	Bischofia javanica	*Sinkam*	Root, bark	Dia, Gas, Sto, DM, Inj	102.0	2.0	2.2	3.8
	Claoxylon indicum	*Topu hayu*	Leaves	Ash, Alg, Tt	36.0	1.2	1.4	2.3
	Euphorbia heterophylla	*Katemas*	Sap	Gas	6.0	-	0.8	0.8
	Homalanthus populneus	*Andulpak*	Leaves	Fev, Bus	4.5	-	0.8	1.0
	Jatropha curcas	*Dulang jawa*	Leaves	Gas, Fev, Too	18.0	-	2.4	2.5
	Mallotus philippinensis	*Sira lada*	Leaves	Tt	4.5	-	0.6	0.5
	Manihot utilissima	*Gadong hau*	Leaves	Inj	6.0	0.6	0.8	0.8
	Phyllanthus urinaria	*Tanduk erbuah*	Whole	Hyp, Kid	24.0	-	1.6	1.5
	Pimeleodendron griffithianum	*Sibunbun*	Leaves	Fra, Fev	3.0	-	0.4	0.8
	Ricinus communis	*Dulang bajora*	Leaves	Gas, Fev	18.0	1.4	2.0	2.0
	Sauropus androgynus	*Nasi-nasi*	Leaves	Gas, Fev	36.0	1.0	1.8	1.8
Fabaceae	*Cassia alata*	*Galinggang*	Leaves	Itc	15.0	0.6	0.6	1.0
	Cassia juncea	*Simarabal-abal*	Leaves	Fra, Inj, Fev, Tt	90.0	-	1.8	2.3
	Leucaena leucocephala	*Palia moka*	Leaves, seed	Itc	4.5	-	0,6	0.8
	Mimosa pudica	*Podom-podom*	Root	Fra, Kid	15.0	-	1.4	1.4
	Mimosa sp.1	*Sihirput*	Root	Cou, DM	1.5	0.8	1.2	1.8
	Parkia speciosa	*Palia*	Bark, leaves	Gas, Itc	13.5	0.6	1.2	1.5
	Pithecolobium lobatum	*Jengkol*	Root, leaves	Gas, Fra	15.0	-	1.6	1.5
	Pterocarpus indicus	*Sona*	Sap	Fev, Too	4.5	-	0.8	1.0
	Psophocarpus tetragonolobus	*Borong*	Leaves	Inj, Tt, Tp	9.0	-	2.2	2.5
	Uraria lagopodioides	*Sibalince*	Leaves	Fev	4.5	-	0.4	0.8
	Vigna unguiculata	*Kacang safari*	Leaves	Tt	30.0	0.8	1.0	1.0
Gesneriaceae	*Aeschynanthus horsfieldii*	*cf. Hariari sendok*	Leaves	Fev	9.0	-	0.4	0.8
	Cyrtandra sp.1	*Dilah swara*	Leaves	Fra, Tt	18.0	-	0.8	0.8
	Aeschynanthus sumatranus	*Simarhappilis*	Leaves	Bus, Tt	24.0	-	1.4	2.0
Guttiferae	*Garcinia atroviridis*	*Galugur*	Fruit	Gas	24.0	-	0.6	1.0
Lamiaceae	*Coleus amboinicus*	*Terbangun*	Leaves	Ash, Gas, Inj, Tt, Tp	45.0	2.4	2.6	2.8
	Coleus scutellarioides	*Silanlang kabungan*	Leaves	Gas, Inj, Fev, Tt	66.0	-	3.2	3.3
	Ocimum americanum	*Ruhu-ruhu*	Root	Cou, Rhe	24.0	-	1.2	1.8
	Paraphlomis javanica	*Sibabi dalu*	Root	Aph, Tt	30.0	-	1.0	2.0
	Pogostemon cablin	*Nilam*	Leaves	Inj	12.0	0.8	1.0	1.0
	Pogostemon auricularius	*Simarihur-ihur niasu*	Leaves	Fra, Fev, Alg, Tt	24.0	1.2	1.4	2.3
	Orthosiphon stamineus	*Kumis kucing*	Leaves	Kid	30.0	1.0	0.6	1.0
Lauraceae	*Cinnamomum burmanii*	*Kulit manis*	Leaves, Bark	Alg	24.0	0.4	0.8	1.0
	Cinnamomun cassia	*Sabal*	Bark	Kid	24.0	-	1.0	1.0
	Persea gratissima	*Pokat*	Leaves	Kid	6.0	-	1.0	1.0
Liliaceae	*Allium cepa*	*Bawang merah*	Tuber	Cou, Dia, Gas, Rhe, Ulc, Inj, Fev, Bus, Alg, Tt	96.0	2.2	3.6	8.0
	Allium chinense	*Hosaya*	Tuber	Hyp, Dia, Gas, Itc, Ulc, DM, Fev, Tt	90.0	3.8	4.8	6.0
	Allium sativum	*Bawang putih*	Tuber	Hyp, Dia, Bus Tt	90.0	2.6	2.4	3.0

	Cordyline fruticosa	*Silinjuang*	Leaves	Hyp, Fev, Alg, Bus	45.0	1.2	2.0	2.5
Lomariopsidaceae	*Bolbitis heteroclite*	*Pahu sayu*	Leaves	Tt	18.0	-	0.6	0.8
Loranthaceae	*Loranthus* sp.1	*Sarindan kopi*	Leaves	Kid, DM	36.0	0.8	0.8	1.3
Lycopodiaceae	*Lycopodium proliferum*	*Limut-limut mangolu*	Whole	App, Tt	9.0	-	1.8	1.3
Lythraceae	*Lawsonia inermis*	*Hatirongga hau*	Leaves	Gas	3.0	0.6	0.8	1.0
Malvaceae	*Abelmoschus moschatus*	*Purba jolma*	Root, bark	Fra, Tt	18.0	-	0.8	1.0
	Hibiscus rosa-sinensis	*Bunga-bunga*	Leaves	Fev, Tt	57.0	1.0	1.6	2.0
	Hibiscus similis	*Baru*	Root	Fra, Tt	18.0	0,8	1.6	2.0
	Sida rhombifolia	*Sibaguri safari*	Root	Fra, Inj	30.0	-	1.6	2.0
	Sida ungulata	*Sibaguri*	Root	Fra, Inj	39.0	1.6	1.8	2.0
	Urena lobata	*Sampelulut*	Root, leaves	Fra	9.0	0.8	1.0	1.0
Maranthaceae	*Donax cannaeformis*	*Banban*	Leaves	Ulc, Fev	12.0	0.4	1.4	1.5
Marattiaceae	*Angiopteris evecta*	*Ingol*	Leaves	Ulc	9.0	-	0.6	1.0
Melastomataceae	*Clidemia hirta*	*Sanduduk*	Leaves	Gas, Inj	36.0	1.0	1.6	2.0
	Melastoma malabathricum	*Sanduduk*	Root, leaves	Gas, Inj	36.0	-	1.6	1.8
	Melastoma sylvaticum	*Sanduduk harangan*	Leaves	Gas, Inj	24.0	-	1.4	1.8
Meliaceae	*Lansium domesticum*	*Langsat*	Root, bark	Gas	9.0	0.6	0.8	1.0
Menispermaceae	*Cyclea barbata*	*Lakkup-lakkup*	Leaves	Gas, Kid, Inj, Tt	15.0	1.2	1.4	1.8
	Cycles sp.1	*Andor hondali*	Leaves	Fra, Tt	24.0	0.4	0.8	1.0
	Tinospora crispa	*Raja panawar*	Stem	Ash, Gas, Fra, DM, Tt	54.0	1.0	1.8	2.3
	Tinospora sp.1	*Siraja enus*	Leaves	Gas	30.0	-	0.8	1.0
Moraceae	*Artocarpus communis*	*Sukun*	Bark	Hyp, Ash, Gas	72.0	1.0	1.4	2.5
	Artocarpus elastica	*Torop*	Bark	Dia, Gas, DM, Inj	36.0	1.4	2.4	2.5
	Artocarpus heterophyllus	*Pinasa*	Fruit	Gas	6.0	-	1.0	1.0
	Ficus cf. deltoidea	*Siraja landong*	Leaves	Ash, Tt	30.0	0.6	2.0	2.0
Musaseae	*Musa paradisiaca*	*Pisang sitabar*	Stem	Fev, Gas	38.0	1.2	1.4	1.4
Myrtaceae	*Eugenia aromatica*	*Bunga lawang*	Flower	Cou, Tp	39.0	1.6	1.6	2.0
	Eugenia polyantha	*Salam*	Leaves	Gas, Sto, Fev, DM	30.0	-	1.2	2.0
	Eugenia sp.1	*Murak*	Leaves	Gas, Tt	45.0	1.4	0.8	1.5
	Myristica fragrans	*Pala*	Seed	Tt, Tp	36.0	1.4	1.2	1.8
	Psidium guajava	*Jambu batu*	Leaves	Gas, Sto, DM	42.0	1.4	1.4	2.0
	Syzygium aromaticum	*Cengkeh*	Flower	Cou, Ash, Alg, Tt	56.0	3.2	4.0	4.0
Myrsinaceae	*Ardisia* sp.1	*Gompang batu*	Leaves	Eye	6.0	-	0.6	1.0
Nepentheceae	*Nepenthes garcilis*	*Takkul-takkul*	Leaves	Too	9.0	0.6	1.0	1.0
Ophioglossaseae	*Ophioglossum pedunculosum*	*Sonduk-sonduk*	Whole	Hyp, Fev, Tt	30.0	-	1.2	1.8
Orchidaceae	*Anoectochilus reinwardtii*	*Suratan ilik*	Whole	Hyp, Ash, Aph, Bus, Tt	96.0	1.8	3.6	3.3
	Macodes sp.1	*Suratan ilik*	Whole	Tt	96.0	1.8	3.6	3.3
	Goodyera rubicunda	*Gadong harangan*	Tuber	Dia, Tt	54.0	-	1.4	2.0
	Nervilia aragoana	*Salembar sabulan*	Tuber	Tt	35.0	-	0.6	1.0
	Nervilia plicata	*Salembar satahun*	Tuber	Ash, Tt	30.0	-	1.4	2.0
	Phaius callosus	*Sukkit katari*	Tuber	Hyp, Ash, Tt	18.0	-	1.6	2.8
Oxalidaceae	*Oxalis corniculata*	*Saripitpit gawang*	Whole	Cou, Fev, Thr, Tt	12.0	-	1.8	2.8
	Oxalis sp.1	*Saripitpit*	Whole	Kid, Fev, Alg, Tt	30.0	-	1.8	2.5
Phyllataceae	*Breynia cerma*	*Podom-podom*	Whole	Fev	3.0	-	0.6	0.6
Piperaceae	*Piper betle*	*Demban*	Leaves	Itc, Inj, Fev, Eye, Thr, Bus	120.0	-	2.6	4.8
	Piper crocatum	*Demban siangir*	Leaves	Itc, Inj, Eye, Bus	24.0	-	1.4	2.0
	Piper nigrum	*Lada*	Seed	Rhe, Fev, Bus, Tt, Tp	120.0	1.0	2.4	3.5
	Piper umbellatum	*Gombalayo*	Leaves	Bus, Tt	24.0	0.6	0.8	0.8
	Piper sp.1	*Dilah horbo*	Leaves	Fra, Tt	24.0	-	0.8	0.8
	Piper sp.2	*Bursik horbo*	Leaves	Fra, Tt	24.0	-	0.8	1.0
Plassifloraceae	*Adenia cordifolia*	*Ancimen riris*	Whole	Hyp	9.0	0.4	1.0	0.8
Poaceae	*Andropogon nardus*	*Sangge-sangge dipar*	Stem	Fev	24.0	-	0.8	0.8
	Bambusa horsfieldii	*Bulu bolon*	Root	DM, Tt	18.0	0.2	1.8	1.8
	Bambusa spinosa	*Bulu duri*	Root	Fra, Bus, Tt	18.0	0.4	1.6	2.0
	Cymbopogon citratus	*Sangge-sangge*	Stem	Alg, Tt, Tp	45.0	1.8	1.6	2.5
	Dendrocalamus asper	*Bulu sonduk*	Root	Tt	9.0	-	0.8	0.8
	Lophatherum gracile	*Sidayok jagur*	Root	Tt	30.0	-	0.4	0.8

	Paspalum conjugatum	*Sarang buaya*	Leaves	Inj	12.0	0.8	0.8	1.0
	Scleria laevis	*Bonang sawi*	Leaves	Tt	9.0	-	0.8	0.8
	Schizostachyum blumei	*Bulu hayan*	Root	DM, Tt	18.0	-	1.6	2.0
	Schizosstachyum brachycladum	*Bulu suling*	Root	Tt	9.0	0.6	1.0	1.0
	Schizostachyum sp.1	*Bulu laga*	Root	DM, Tt	18.0	-	1.6	2.0
	Schizostachyum sp.2	*Bulu lomang*	Root	Tt	18.0	0.4	1.0	1.0
	Schizostachyum sp.3	*Bulu balakki*	Root	Fra, Tt	9.0	0.6	1.0	1.0
	Scleria purpurascens	*Ria-ria*	Leaves	Fra, Kid, Tt	1.5	-	0.8	1.8
	Scleria sp.1	*Oma-oma*	Leaves	Inj, Tt	6.0	-	1.2	1.3
	Thysanolaena sp.	*Bulu moria*	Root	Fra, Tt	18.0	-	1.8	2.0
Polypodiaceae	*Pyrrosia sphaerotrichia*	*Pandukkap naburuk*	Leaves	Tt	30.0	-	0.6	1.0
	Platycerium coronarium	*Raja pinayungan*	Leaves	Bus, Tt	3.0	-	0.6	1.0
Primulaceae	*Ardisia japonica*	*Sibukkar*	Leaves	Tt	3.0	-	0.6	0.8
Rosaceae	*Robus moluccanus*	*Hupi-hupi*	Leaves	Dia, Gas, Sto, Tt	54.0	-	2.0	2.5
Rubiaceae	*Morinda citrifolia*	*Mengkudu*	Fruit	DM	9.0	0.6	0.6	0.8
	Neonauclea calycina	*Algit*	Leaves	Fra, Kid	33.0	0.2	1.4	1.3
	Paederia verticillata	*Salaun bulung*	Leaves	Fev	9.0	0.6	0.6	0.5
	Uncaria gambir	*Gambir*	Leaves	Dia, Gas, Sto, Bus	96.0	1.6	1.2	3.0
Rutaceae	*Citrus aurantium*	*Utte bunga*	Root, fruit	Fra, Fev, Tt	36.0	1.6	2.4	1.8
	Citrus hystrix	*Utte mungkur*	Root, fruit	Fra, Bus, Alg, Tt	90.0	2.0	2.8	2.8
	Citrus maxima	*Utte bolon*	Root, fruit	Fra, Tt	18.0	-	1.4	1.5
	Citrus medica	*Utte gawang*	Root, fruit	Fra, Tt	12.0	-	1.0	1.0
	Citrus mitis	*Utte kasturi*	Root, fruit	Fra, Fev, Bus, Tt	9.0	-	1.6	1.5
	Citrus nobilis	*Utte puraga*	Root, fruit	Tt	9.0	-	0.8	1.0
	Citrus sp.1	*Utte begu*	Root, fruit	Fra, Bus, Tt	18.0	-	1.2	2.0
	Citrus sp.2	*Utte hajor*	Root, fruit	Tt	12.0	-	0.8	1.5
	Citrus sp.3	*Utte hayu*	Root, fruit	Fra, Tt	9.0	-	1.0	1.5
	Citrus sp.4	*Utte kejaren*	Root, fruit	Fra, Tt	9.0	-	0.8	1.0
	Citrus sp.5	*Utte rihit*	Root, fruit	Tt	9.0	-	0.8	0.8
	Ruta angustifolia	*Soriangin*	Leves	Gas, Fev	9.0	0.8	1.2	1.0
	Zanthoxylum acanthopodium	*Tuba*	Fruit	Cou, Tt	60.0	1.4	2.0	2.0
Sapindaceae	*Nephelium lappaceum*	*Rambutan*	Leaves, bark	Gas, Fev	9.0	-	1.2	1.8
Sapotaceae	*Achas zapota*	*Sawo*	Fruit	Gas	6.0	0.6	0.6	1.0
Schisandraceae	*Kadsura scandens*	*Sibau sira*	Leaves	Gas, Fra, Inj	4.5	-	0.6	1.0
	Kadsura sp.1	*Lendir sidarih*	Leaves	Fev	12.0	-	0.6	1.0
Scrolphulariaceae	*Lindernia crustacea*	*Simaragong-angong*	Leaves	Inj, Fev, Thr, Alg	24.0	-	2.2	1.3
	Lndernia liman	*Siang-siang*	Whole	Fev	9.0	-	1.2	1.0
	Lindernia viscosa	*Pogu ni tano*	Leaves	Gas, Kid, Alg	24.0	-	2.2	2.2
Simaroubaceae	*Eurycoma longifolia*	*Horis kotala*	Whole	Ash, Fra, Aph, Fev, Tt	72.0	-	2.6	3.3
Smilaceae	*Smilax* sp.1	*Udut tulan*	Whole	Ash, Aph	72.0	-	1.0	1.0
Solanaceae	*Capsicum frutescens*	*Lasina*	Leaves	Ulc	24.0	0.8	1.0	1.0
	Solanum lycopersicum	*Tomat*	Leaves, fruit	Hyp, Inj, Fev	18.0	1.4	1.2	2.3
	Physalis angulata	*Pultak-pultak*	Whole	Fev	30.0	1.4	1.6	1.8
	Solanum nicotiana	*Timbaho*	Leaves	Inj, Too, Bus	60.0	0.8	1.6	2.0
	Solanum schiffnerianum	*Saur paet*	Fruit	Gas, Inj, Fev	24.0	1.2	1.0	2.0
	Solanum torvum	*Rimbang*	Leaves, fruit	Ulc, Eye	36.0	-	1.8	2.0
	Solanum verbascifolium	*Latting*	Leaves, fruit	Gas, Fra, Tt	72.0	2.0	2.4	2.8
Theaceae	*Eurya japonica*	*Samoja*	Leaves	Tt	12.0	-	0.6	1.0
	Eurya sp.1	*Raru*	Bark	Gas, DM	45.0	-	1.4	1.8
Urticaceae	*Elatostema strigosum*	*Sisik naga*	Leaves, fruit	Hyp, Ash, Gas Inj, Fev	30.0	0.4	2.8	3.3

	Elatostema sp.1	*Sihip*	Root	Kid, Alg, Tt	18.0	-	1.8	1.8
	Leucosyke capitellata	*Simarhambing-hambing*	Leaves	Kid, Alg, Tt	30.0	1.0	1.2	1.5
Usneaceae	*Usnea barbata*	*Tois alogo*	Whole	Alg, Tt	12.0	-	0.8	1.5
Verbenaceae	*Clerodendrum calamitosum*	*Simarbakkudu*	Leaves	Ash, Gas, Fev, Alg, Thr	9.0	-	1.6	2.3
	Clerodendrum fragrans	*Burta-burta*	Leaves	Cou, Gas, Itc, Inj	30.0	-	3.0	3.3
	Stachytarpheta indica	*Odor-odor*	Leaves	Fev	4.5	-	0.8	0.8
	Vitex trifolia	*Sialagundi*	Leaves	Hyp, Gas, Kid	33.0	-	2.2	2.0
Vitaceae	*Ampelocissus thyrsiflora*	*Sibalik kortas*	Leaves	Ash, Gas, Sto, Aph, Tt	45.0	-	2.0	4.0
	Pterisanthes polita	*Siporgis laga*	Leaves	Aph, Fev, Tt	30.0	-	1.8	2.5
Zingiberaceae	*Alpinia galanga*	*Halaos*	Rhizome	Fev, Itc, Dia, Gas, Rhe, Tt, Tp	56.0	2.2	2.8	3.8
	Alpinia sp.1	*Laja*	Rhizome	Dia, Gas, Tt	112.0	-	2.6	2.8
	Boesenbergia pandurata	*Sitomu hursi*	Rhizom, leaves	Fev, Gas, Tt, Tp	30.0	1.2	1.4	2.3
	Curcuma domestica	*Hunik*	Rhizome	Dia, Gas, Sto, Inj, Fev, Eye, Alg, Tt, Tp	142.0	3.2	2.6	4.0
	Curcuma xanthorrhiza	*Tomulawak*	Rhizome	Ash, Sto, DM, Fev, Inj, Tt	108.0	3.6	3.6	4.8
	Etlingera eliator	*Rias*	Leaves, stem	Cou, Ulc, Tt, Tp	54.0	1.2	1.4	2.0
	Etlingera sp.1	*Sihala*	Rhizom, stem	Ash, Tt	30.0	2.6	4.0	3.8
	Etlingera sp.2	*Kambing bajar*	Rhizome	Tt	30.0	-	0.6	1.0
	Kaempferia galanga	*Hasohor*	Rhizome	Cou, Ash, Gas, Sto, Rhe, Aph, Fev, Alg, Tt	90.0	1.6	3.2	5.8
	Zingiber americanus	*Lampuyang*	Rhizome	Dia, Gas, Tt	18.0	1.6	2.2	2.8
	Zingiber officinale	*Pege*	Rhizome	Gas, Sto, Inj, Fev, Aph, Tt, Tp	112.0	2.2	2.6	4.6
	Zingiber purpureum	*Bungle*	Rhizome	Dia, Gas, Tt	114.0	2.2	1.8	2.5

Note: Alg (*Alogo-alogo*), Aph(Aphrodisiac), Ash (Ashma), Bus (*Busung*), Cou (Cough), Dia (Diarrhea), DM (Diabetes mellitus), Eye (Eye infection), Fev (Fever), Fra (Bone fractures), Gas (Gastrointestinal disorders), Hyp (Hypertension), Inj (Injury), Itc (Itchy), Kid (Kidney disease), Rhe (Rheumatism), Sto (Stomach ache), Thr (Thrush), Too (Toothache), (Tp) *Tinuktuk paranggetek*, Tt (*Tinuktuk tawar*), Ulc (Ulcer).

Plant parts used as medicinal

Parts of the plants used as medicinal plants were the leaves, stems, roots, bark, sap, flowers, fruits, seeds, and whole sections. The species composition consisted of leaves (119) and roots (54), flowers and the sap (2), as it is shown in Figure 3. Bioactive compounds used as medicinal plants are produced and stored in leaves, stems, roots, flowers, and seeds. For example, asiaticoside of *Centella asiatica* utilized as anti-inflammantory is stored in the leaves, whereas ajmalicine of *Catharanthus roseus* used as antihypertensive medicine is stored in the roots (Joy et al. 1998).

The usage of medicinal plant parts depends on the purpose of curing. It seemed that the local communities knew exactly the efficacy of every part of plants. For example: flowers and leaves of *sampelulut* (*Urena lobata*) were used to cure fever, while the root was used as a medicine for fractures. One of the bioactive compound of *Urena lobata* leaves is acetic acid which serves as analgesic (Islam et al. 2012), so that it can be used as a fever medicine.

There were 119 species or about 50% of the medicinal plants whoseleaves were used, such as: *galunggung* (*Blumea balsamifera*), *ratusan* (*Ageratum conyzoides*), *papaga* (*Centella asiatica*), *gombalayo* (*Piper umbellatum*), and *salam* (*Eugenia polyantha*). Leaves have been used as medicines for injuries (*Ageratum conyzoides*, *Centella asiatica*), gastrointestinal disorders (*Blumea balsamifera*, *Coleus ambonicus*, *Eugenia polyantha*), and kidney diseases (*Strobilanthes crispus*, *Orthosiphon stamineus*). The medicinal plants used by local communities to cure kidney diseases and injuries were those whose leaves have rough-surface. Those leaves have been identified to be able to destroy kidney stones and stop bleeding in injuries. Flanol of leaves of *Ageratum conyzoides* has been known to cure injuries (de Padua 1999).

The number of medicinal plants whose whole parts were used, were relatively fewer than those whose only some parts (leaves, roots, or fruits) are utilized. Factors that encourage the use of whole plants parts were the relatively small size of the plants (*Anoectochilus reinwardtii*, *Ophioglossum pedunculosum*) and the difficulty in separating the parts of plant organs (*Phyllanthus urinaria*). The utilization of whole plant has resulted in the death of the plants, so that some of these medicinal plants, for example *suratan ilik* (*Anoectochilus reinwardtii*) and *sonduk-sonduk* (*Ophioglossum pedunculosum*) have been hard to find in the wild.

There were 11 species of medicinal plants whose rhizomes were used as medicines, and 9 species whose tubers were used as medicines. Medicinal rhizomes were derived mainly from *Zingiberaceae* (*Boesenbergia pandurata*, *Curcuma xanthorrhiza*, *Curcuma domestica*, *Zingiber officinale*), while the tubers from *Orchidaceae* (*Nervilia aragoana*, *Nervilia plicata*) and *Liliaceae* (*Allium cepa*, *Allium sativum*). The rhizomes of *Zingiber officinale* contain gingerol, shagaol, and gingerdion that has strong effect to cure gastrointestinal disorder (Achmad et al. 2008).

The local communities know the growth of medicinal plants in nature. For example, *Nervilia aragoana* is plant in the local languange called *salembar sabulan* (has only one piece of leaf in a month), while *Nervilia plicata* is called *salembar satahun* (has only one piece of leaf in a year). Naturaly both of the orchids grow very slowly; therefore utilization of these plants may lead to their extinction. IUCN (2010) noted that *Nervillia plicata* and *Nervillia aragona* have been categorized as protected plant.

The roots of *horis kotala* (*Eurycoma longifolia*), *sinkam* (*Bischofia javanica*), *andudur* (*Caryota* cf. *mitis*), and *pining* (*Areca catechu*) grow above ground. Those species have only one main root; therefore taking their roots kills them. This kind of harvesting accelerates the extinction of *Eurycoma longifolia*. In sub-ethnic Batak Simalungun roots of *Eurycoma longifolia* were used as medicines for fever and aphrodisiac. Bioassay of root extract of *Eurycoma longifolia* improves sexual activity in mice and make their coitus longer. That makes this plant appropriate to be used as aphrodisiac (Ang and Ngai 2001).

There were 14 species of plants whose bark was used as medicines, such as *raru* (*Eurya* sp.), *kulit manis* (*Cinnamomum burmanii*), and *sinkam* (*Bischofia javanica*). *Raru* and *Sinkam* have been used primary as medicines for diabetes mellitus. The usage of *raru* as medicine for diabetes mellitus has been derived from the custom of local communities habit of drinking *tuak* (traditional beverage of sub-ethnic Batak). After having dinner they will drink *tuak* with seasoning made from the bark of *Sinkam*. *Tuak* is sap of *Arenga pinnata*, which is mixed with the bark of *raru*. It is believed to decrease blood sugar level. To prove the medicinal effect of *Bischofia javanica* and *Eurya* sp., phytochemistry and bioassay analysis need to be conducted. Over exploitation of the plants, especially their bark harvested directly from the forest may cause extinctions.

Index of Cultural Significance (ICS) and Use Value (UVs) of medicinal plants

The ICS of medicinal plants is a quantitative method used by ethnobotanists to determine the cultural value of plants. Based on their uses, the plants were grouped into 5 categories, namely: >200 (very high), 100-199 (high), 20-99 (medium), 5-19 (low), and <5 (very low) (modified from Pieroni 2011). The medicinal plants with medium values of ICS had the highest number of species (113), and followed by low categories (98), very low categories (16), and high categories (11) (Tabel 2).

The value of medicinal plants in the sub ethnic Batak Simalungun varied between 1.5 to 142.0 (Table 2). The medicinal plants with the highest value of ICS (142.0) was *hunik* (*Curcuma domestica*) and the lowest value (1.5) were *ria-ria* (*Scleria purpurascens*) and *sihirput (Mimosa* sp.). Medicinal plants that show high value on ICS are those which have many usages and are utilized frequently by local communities, while those having low value on ICS have fewer usage and are rarely used.

The plants with medium ICS value were, among others, garlic (*Allium sativum*), *ompu-ompu* (*Crinum asiaticum*), and *poyon baru* (*Gynura crepidioides*). The value of ICS on sub-ethnic Batak Simalungun was higher than that of ethnic Malays (Susiarti et al. 2005), but lower than that of sub-ethnic Batak Karo (Silalahi et al. 2013). The usage of medicinal plants is strongly influenced by culture, spiritual beliefs of local communities (Cocks and Dold 2006), and geography (Pieroni 2001).

Correlation between age and utilization

One of the approaches used to determine usage value of medicinal plants is carried out by calculating the use value (UVs). The UVs depends on the number of medicinal plants used and known by respondents or the local communities. Age structure seemed to influence on the sub-ethnic Batak Simalungun UVs of the medicinal plants, the younger (30-50 years old) having lower value than the older age group (>50 years old). For example, the UVs of *Allium cepa* was 2.2 in the younger group, 3.6 in the older group, and 8.0 for key informants (Table 2). The differences of UVs (Table 2) shows the degradation of the local knowledge in terms of traditional medicines.

Beside having lower Uvs, the younger group knew significantly (P=0.05 on Anova) fewer species of medicinal plants (48.19 ± 8.35 species) than the older (170.19 ± 18.38 species), and key informants (202. 00 ± 12.32 species) as shown in Figure 4.

The number of medicinal plants species known by the younger group was only 28.31% of those by the older group and only 23.85% of those by the key informants. Therefore, it is clear that local knowledge of the usage of medicinal plants has declined and has not been passed into the younger generation. This degradation is due to: (1) difficulty in passing this information through oral ways to the young generation (2) Changes in cultural value, (3) the availability of modern medical system. That the younger age had less interest in local knowledge on medicinal plants was also found by Caniago and Siebert (1998), Voeks (2007), Guimbo et al. (2011).. The documentation of local knowledge in a written form is considered to be the best alternatives to avoid the degradation of the local knowledge and as a first step for the conservation of medicinal plants (Suryadharma 2010).

A total of 239 species of medicinal plants (170 genera, 70 families) were used by sub-ethnic Batak Simalungun of North Sumatra, to cure 20 diseases (18 natural disease, 2 supra natural disease) and to make 2 kinds of traditional concoction. The local knowledge of medicinal plants was lower in the younger generation (between 30-50 years old) than that of the older group (>50 years old) and key informants (mostly shamans) both in number of known species and use

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