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Medicinal plants used by the Batak Toba Tribe in Peadundung Village, North Sumatra, Indonesia

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Abstract. *Silalahi M, Nisyawati, Pandiangan D. 2019. Medicinal plants used by the Batak Toba Tribe in Peadundung Village, North Sumatra, Indonesia. Biodiversitas 20: 510-525.* Research of the medicinal plants by the Toba Batak ethnic has limited, even though the globalization and modernization resulted to degradation of the local knowledge. The objectives of this study were (i) documentation of medicinal plants used in the traditional therapies by the Batak Toba tribe of Peadundung Village, North Sumatra, Indonesia, and (ii) analysing the data by quantitative ethnobotanical tools such as use value (UV), cultural significance index (CSI), relative frequency of citation (RCF) and informant consensus factor (ICF) to determine the cultural importance of medicinal plants in order to develop a tool for their conservation. Semi-structured interviews with 41 identified respondents was the methodology employed for qualitative data collection. A total of 149 medicinal species of plants, belonging to 131 genera and 55 families, were recorded in the study which are used in the treatment of 21 categories of ailments. Plants with the highest UV were *Eurycoma longifolia* (UV=3.44), *Curcuma longa* (UV=2.67) and *Zingiber officinale* (UV=2.60). Eight species, namely *Curcuma longa*, *Eurycoma longifolia*, *Allium cepa*, *Psidium guajava*, *Aleurites moluccanus*, *Piper betle*, *Citrus hystrix* and *Uncaria gambir* were found to be having the highest RCF value of 1.00. *Eurycoma longifolia* (CSI=126), *Curcuma longa* (CSI=112) and *Zingiber officinale* (CSI=105) emerged as the culturally most significant medicinal plants. Thrush and aphrodisiac use categories received the highest ICF of 1.00 each because the informants agreed of using only a single species for each of these category. *Eurycoma longifolia* was used as an aphrodisiac whereas *Averrhoa carambola* was used against thrush. All these important and significant plants suffer the greatest harvesting pressure, hence their conservation should be given priority.

Keywords: Batak Toba, Cultural Significance Index, *Eurycoma longifolia*, Informant Consensus Factor, Relative frequency of citation, Traditional medicinal plants, Use Value

INTRODUCTION

Research on medicinal plants used by indigenous ethnic groups is very interesting and useful because it has led to the development of many important modern drugs (Cox 2000). The current modern pharmacopoeias contain about 25% of the drugs derived from plants while many others are synthetic analogues built on prototype compounds isolated from plants (Fabricant and Farnsworth 2001).The Batak is an indigenous ethnic group of Sumatra Island, comprising of five tribes often referred to as Batak Karo, Batak Pakpak, Batak Simalungun, Batak Toba and Batak Angkola-Mandailing (Bangun 2010). The Batak Toba is the largest tribe with maximum population widely distributed in the highland of Toba District, Samosir in the Toba Lake region, North Tapanuli, and Humbang Hasundutan. The Batak people use plants as staple foods, vegetables, fruits, construction materials, spices, colouring substances and medicine.

Since ancient times, the Batak tribes have been using plants for the treatment of various ailments or in their traditional therapies. They possess basic knowledge about the use of medicinal plants in traditional health-related practices and products, such as *oukup* (traditional steam bath) (Nasution 2009), *kuning* and *parem* (powder or liquid used for traditional massage) (Silalahi 2014), *minak alun* (oil for traditional massage) (Purba et al. 2016), *tinuktuk* (traditional concotion for maintaining good stamina) (Sujarwo et al 2014), etc. Some of the notable medicinal plants that have been used by the Batak include *Eurycoma logifolia* Jack., *Etlingera elatior* (Jack.) R.M.Sm, *Areca vestiaria Blechu* L., and *Curcuma longa* L. (Nasution 2009; Silalahi et al. 2015; Sujarwo et al. 2014). Some researchers found that elderly people possess more detailed knowledge of medicinal plants than the young people (Silalahi et al. 2015; Begossi et al. 2002). The existence of medicinal plants in nature and the life-long maintenance of local knowledge point to the necessity of conservation of both plants and culture. (Sujarwo et al. 2014; Menendez-Baceta et al. 2015). However, most of the traditional knowledge about plants and their uses is fast disappearing owing to various factors like socioeconomic and land use changes (Segorini et al. 2009; Homerverge et al. 2014), increasing use of modern pharmaceuticals (Caniago et al. 2008) and increasing access to and use of biomedical health care (Ragupathy et al. 2008). Besides the loss of traditional

knowledge about medicinal plants, the loss of traditional ecological knowledge is considered as a major threat to the success of conservation of biological diversity (Keller et al. 2005; Ju et al. 2013; Xavier et al. 2014; Sujarwo et al. 2016).

Various authors have conducted studies on medicinal plants used by various ethnic groups in Sumatra, including the Minangkabau (Ardan 2000), Rejang (Darnaedi 1999), Malay (Mahyar et al. 1991; Grosvenor et al. 1995; Rahayu et al. 2000), Lahat (Harmida and Yuni 2010), Serampas (Hariyadi and Ticktin 2010), Batak Karo (Silalahi et al. 2013; Purba et al. 2016) and Batak Simalungun (Silalahi et al. 2015). But, no such studies have been conducted on the Batak Toba tribe. In addition, there are no quantitative ethnobotanical studies on the rich ethnomedicinal plant and cultural diversity of Sumatra. Such quantitative ethnobotanical studies have been used to compare the uses and the cultural importance of different plant taxa in local communities (Albuquerque et al. 2006; Camou-Guerrero et al. 2008; Guimbo et al. 2011), to evaluate which are the most important plants within a culture and to determine conservation requirements (Homerverge et al. 2014; Albuquerque et al. 2006; Guimbo et al. 2011; Torre-Cuadros et al. 2003) and immaterial cultural heritage (Camou-Guerrero et al. 2008; Sujarwo and Caneva 2016). In particular, quantitative indices, such as use value or UV (Prance et al. 1987; Phillips and Gentry 1993; Albuquerque et al. 2006; Camou-Guerrero et al. 2008; Guimbo et al. 2011), relative frequency of citation or RFC (Camou-Guerrero et al. 2008; Tardío and Pardo-de-Santayana 2008; Homerverge et al. 2014) index of cultural significance or CSI (Camou-Guerrero et al. 2008; Helida et al. 2015; Sujarwo and Caneva 2016; Silalahi and Nisyawati 2018) and informant consensus factor or ICF (Homerverge et al. 2014; Xavier et al. 2014; Sujarwo and Caneva 2016) are highly relevant in quantitative ethnobotanical study. They provide comprehensive and comparable information about the use of medicinal plants including their uses, conservation and cultural value (Guimbo et al. 2011; Helida et al. 2015; Sujarwo and Caneva 2016).

The present study aims at (i) documenting medicinal plant uses in the traditional therapies practiced by the Batak Toba tribe, and (ii) employing the quantitative ethnobotanical parameters, such as UV, CSI, RCF, and ICF, to determine the cultural importance of ethnobotanically valuable plants in order to develop a tool for their conservation.

MATERIALS AND METHODS

Study area

The ethnobotanical research and collection of botanical samples was conducted between August and December 2015 in Peadundung Village, Humbang District, North Sumatra, Indonesia (Figure 1). The Pedundung village lies at 02°07'62'' N latitude and 098°31'69'' E longitude, at an altitude of 400-645 m above the sea level, about 332 km from Medan, the capital of North Sumatra. The total area of the Peadundung village is 15,2 km^2 (1.527 ha) and is inhabited by 888 people belonging to 204 households of the Batak Toba. They were the descendants of the Proto Malay, and have been living there since about 100-200 years ago (personal communitation of the chief of village). About 99% of the population in this village are farmers, practicing rubber tree (*Hevea brasiliensis*) agroforestry. Peadundung village has a tropical climate with bimodal seasonality of dry season from April to July and rainy season from Agustus to April. The average annual temperature varies from 25 to 30°C.

Data colection

Information on traditional uses of plants was gathered from a total of 41 informants, consisting of 9 key informants and 32 general respondents, ranging in age from 31-80 years. These respondents were selected with purposive snowball sampling methods. Key informants consist of folk healers (4 persons), midwifes (2 persons), chief of village (1 person) and head of customs (2 persons). The head of custom is a ceremonial leader who comes from the royal line, but the chief of village is the village leader in state administration. Information on uses and diversity of medicinal plants was obtained from interviews using the semi-structured, in-depth and participative observation methods, following the existing ethnobotanical guidelines (Martin 1995; Alexiades and Sheldon 1996; Silalahi et al. 2015a).

Voucher specimens of traditionally used medicinal plants were collected by way of exploration in the yards, agroforests, gardens, secondary forests and primary forests. and supplied with notes on life forms (tree, shrubs, herbs, ferns), local names, parts used, treatment and drug preparation methods. The initial identification of voucher specimens undertaken in the field and was later confirmed by taxonomists at the University of Indonesia Herbarium, Bogor and the Herbarium Bogoriense of the Indonesian Institute of Sciences (LIPI) at Cibinong, Bogor, Indonesia. The scientific names of the medicinal plants were verified online with www.the plantlist, 2017 (The Plantlist 2017).

Data analysis

Data were analyzed using qualitative and quantitative methods (Alexiades, 1996). Qualitative analysis used the descriptive statistics by grouping plants based upon usage category. In the present study, we compared the importance of each species using the following four indices: use value (UV), relative frequency of citation (RFC), cultural significance index (CSI) and informant consensus factor (ICF).

Use Value (UV)

The relative importance of each plant species known locally to be used as herbal remedy was expressed as the use value (UV), which was calculated using the following formula (Phillips 1996).

$$UV = \frac{\sum U}{n}$$

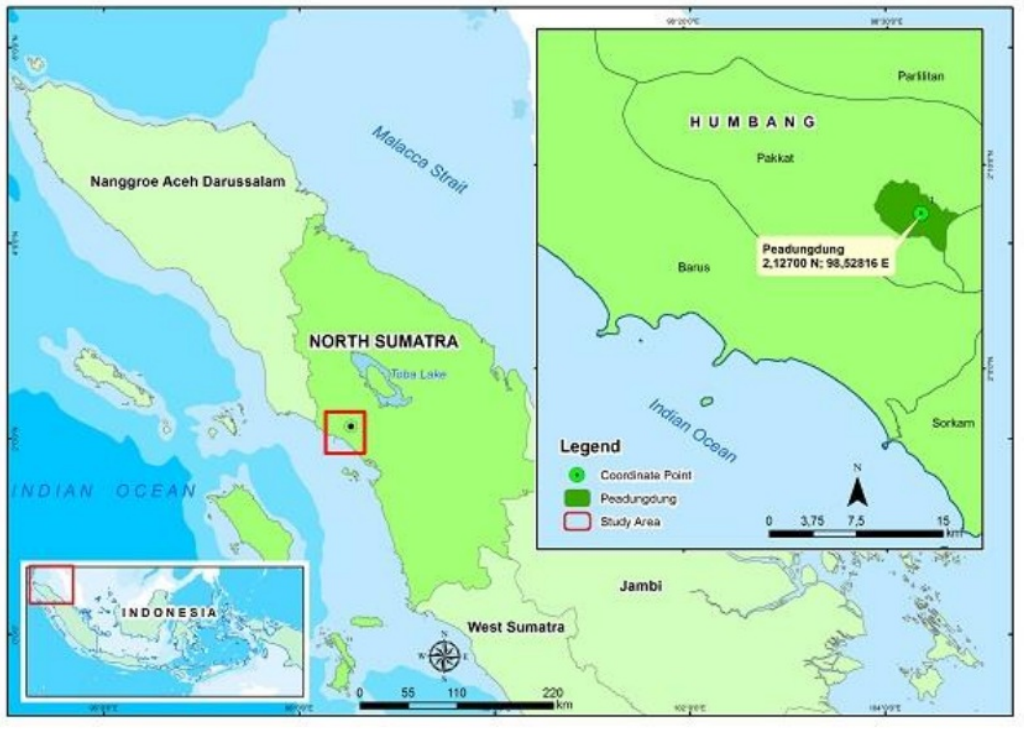

Figure 1. Peadundung village, North Sumatra, Indonesia (Map was reproduced from ArGIS 10.3)

The value of a species is UV, whereas the number of use-report cited by each informant is U, and the total number of informants interviewed for a given plant is n.

Relative Frequency of Citation (RFC)

RFC is value of the a species by local communities (Tardío and Pardo-de-Santayana 2008).

$$RFC = \frac{Fc}{N}$$

Fc= the number of informants mentioning the use of the species
N= informants N

The value of RFC varies is 0-1, if the value 0 mean nobody known of the use of plant, if the value 1 mean everybody know it uses.

Cultural Significance Index (CSI)

CSI is calculated using the through by Turner (1988) following formula:

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

The values of CSI is from 1 to n, with n representing the last use described; the subscript k represents the value 1 through n, consecutively. For each use given, q = quality value, i = intensity value, e = exclusivity value (Turner 1988).

Informant Consensus Factor (ICF)

The informant consensus factor (IFC) was used to see if there was agreement in the use of plants in the ailment categories between the plant users in the study area. The IFC was calculated by the following formula (Heinrich et al. 1998).

$$ICF = \frac{Nur - Nt}{Nt - 1}$$

Nur is the number of use-reports for a particular ailment category and Nt is the number of taxa used for a particular ailment category by all informants.

RESULTS AND DISCUSSION

Medicinal plants characteristics

The present study documented the uses of 149 medicinal plant species belonging to 131 genera and 60 families for 21 different ailments. Among them, three

species used were pterydophytes (*Angiopteris avecta*, *Platycerium coronarium, Pteridium aquilinum*). A total of 79 species (53%) belong to 12 families, i.e., Asteraceae (10 species), Poaceae (10), Fabaceae (7), Solanaceae (7), Arecaceae (6), Myrtaceae (6), Zingiberaceae (6), Cucurbitaceae (5), Euphorbiaceae (5), Malvaceae (5), Rubiaceae (4), Araceae (4) and Lamiaceae (4) (Table 1). Out of 149 species recorded, the highest uses were recorded for abdominal pain (54), fever (45), injury (39) and fractures (19). The most common methods of preparation included boiling or soaking the plant parts in water, drying and grinding while the preferred route of administration was oral.

The medicinal plants, utilized for relieving abdominal pain and curing diarrhea, fever and malaria contain bitter substances, such as *Eurycoma longifolia* Jack, *Clerodendrum chinense* (Osbeck) Mabb, *Lansium domesticum* Corrêa, *Durio zibethinus* L., *Dryobalanops aromatica* C.F. Gaertn. and *Artocarpus heterophyllus* Lam. About 15 species of medicinal plants were also consumed as vegetables, 18 species as fruits, 14 as spices and 5 as staple foods. The species that were used as vegetables are *Vigna unguiculata* (L.) Walp., *Cucumis sativus* L., *Cucurbita moschata* Duchesne, *Parkia speciosa* Hassk. and *Solanum melongena* L. (Shrub). The carbohidrate resources such as: *Clidemia hirta* (L.) D. Don, *Colocasia esculenta* (L.) Schott., *Melastoma malabathricum* L. *Pachyrhizus erosus* (L.) Urb, *Physalis angulata* L. are used as wild fruits.

Analysis of medicinal plants based on their parts used as medicinal revealed that leaves are the highly used part (in 92 species), fruits are used in 20 species, stems or barks in 18 species and rhizomes in 6 species (Figure 2). In cases of some of the following species, more than one part may be used as medicine: *Eurycoma longifolia* Jack (leaves, stems, roots), *Etlingera elatior* (Jack.) R.M.Sm (stems and leaves) and *Alpinia galanga* L. (rhizomes and leaves). The species whose stems are used as medicinal materials included *Lansium domesticum* Corrêa, *Artocarpus heterophyllus* Lam, *Durio zibethinus* L. and *Vatica pauciflora* Blume. The species whose roots were used as medicinal materials are *Eurycoma longifolia* Jack, and *Curculigo latifolia* Dryand. ex W.T.Aiton.

The life forms of medicinal plants used by the Batak Toba consisted of herbs (72 species), trees (46 species), shurb (24 species) and climbers (7 species). The herbaceous species used by the Batak Toba included *Blumea chinensis* (L.) DC., *Centella asiatica* (L.), *Emilia sonchifolia* (L.) DC. ex DC., and *Eryngium foetidum* L.,). Notable examples for shrubs are *Clibadium surinamense* L., *Sida rhombifolia* L, *Urena lobata* L. and *Melastoma malabathricum* L. The recorded medicinal herbs were found mainly in disturbed plant communities while shrubs were found in advanced successional communities. In the present study, the medicinal plants were found in a wide range of habitats including home gardens, yards, fields, agroforests and forests. The majority of the plants were growing in wild (53% species) and cultivated (35%). 39 species of wild medicinal plants were otherwise considered as weedswhereas 40 are forest plants.

A total of 93 species (55%) of the medicinal plants cited by 20 respondents (50%) were easily found in the habitats around the village (*Acorus calamus* L. *Centella asiatica* (L.) Urb. and *Areca catechu* L.) or they were frequently used by the local communities (*Blumea balsamifera* (L.) DC., *Hibiscus rosa-sinensis* L. *Lansium domesticum* Corrê and *Melastoma malabathricum* L.). A total of 43 species were cited only by eight respondents (20%) and they were *Dryobalanops aromatica* C.F.Gaertn., *Imperata cylindrica* (L.) Raeusch., *Paspalum conjugatum* P.J.Bergius, *Physalis angulata* L. and *Platycerium coronarium* (Mull.) Desv. Most of the local communities recognized *Imperata cylindrica* (L.) Raeusch. and *Paspalum conjugatum* P.J.Bergius as invaders or exotic plants.

Quantitative analysis of medicinal plants

Some the analytical tools can be used for a quantitative assessment of the cultural importance of individual medicinal plant species for Batak Toba community and also the degree of agreement among healers regarding the use of plants for specific disease categories. In this study, we compared the importance of each species using the following three indices: use value (UV), relative frequency of citation (RFC) and cultural significance index (CSI). Table 2 shows the top 20 plant species for each such index studied. The table shows a high variation among species emerging as important across the studied indices.

A total of 33 species, belonging to 31 genera and 20 families, share the top 20 positions of important medicinal plants based on their higher CSI, UV and RCF values.. They included 17 cultivated species, 12 wild species and 4 ruderal species. The wild and ruderal species should be given a priority in conservation, because they are more vulnerable and over-exploitated. They included *Eurycoma longifolia* Jack. *Melicope glabra* (Blume) T.G. Hartley, *Rhodamnia* sp., *Styrax benzoin* Dryand. and *Timonius sericeus* (Desf.) K.Schum. The local communities used them also as other economically useful commodities (*Styrax benzoin* Dryand), building materials (*Melicope glabra* (Blume) TG, *Styrax benzoin* Dry and *Timonius sericeus* (Desf.) K.Schum., Hartley) and firewood (*Rhodamnia* sp). Styrax benzoin Dryand has a distinctive aroma that can have a relaxing effect and has been traded by the public as a medicinal ingredient hundreds of years ago.

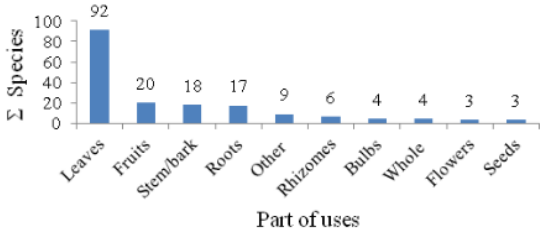

Figure 2. Medicinally useful parts and number of species in the medicinal practice of Batak Toba in North Sumatra, Indonesia.

Table 1. The diversity of medicinal plants and their uses by the Batak Toba Tribe in Peadundung village, North Sumatra, Indonesia, along with quantitative values (UV, RCF and CSI)

Family and botanical name	Life-form	Local name	Uses	Mode of application	Cultivation status	Part used	UV	RFC	CSI
Acanthaceae									
Justicia gendarussa Burm.F.	Herb	*Sipilit*	Supranatural ailment, fever	Oral	Ruderal	Leaves	1.30	0.59	30
Strobilanthes crispa Bl.	Shrub	*Tepuringring*	Abdominal pain	Oral	Wild	Leaves	0.54	0.24	3
Stobilanthes sp.	Shurb	*Pijor holing*	Abdominal pain, injury, fever	Oral	Wild	Leaves	1.91	0.29	75
Amaranthaceae									
Celosia cristata L.	Herb	*Banda ulu*	Fever	Oral	Ruderal	Leaves	0.77	0.61	12
Amaryllidaceae									
Crinum asiaticum L.	Herb	*Ompu-ompu*	Fractures		Ruderal	Bulbs	1.00	0.68	30
Curculigo latifolia Dryand. Ex W.T.Aiton	Herb	*Sukkit*	Eye infection, headache	Oral	Wild	Roots	0.53	0.22	6
Anacardiaceae									
Gluta renghas L.	Tree	*Sipajal/sitorgom*	Diabetes mellitus	Oral	Wild	Leaves	0.30	0.20	3
Mangifera odorata Griff		*Ambasang*	Diabetes mellitus, itch, diarrhea	Oral	Cultivated	Barks	1.37	0.15	21
Annonaceae									
Annona muricata L.	Tree	*Tarutung bulanda*	Abdominal pain	Oral	Cultivated	Barks, leaves	0.54	0.20	3
Apiaceae									
Centella asiatica (L.) Urb.	Herb	*Ampapaga*	Fever, injury, abdominal pain	Oral	Wild	Leaves	1.60	0.71	21
Eryngium foetidum L.	Herb	*Inggu*	Partum, headache, supranatural disease	Inhalation	Wild	Leaves	1.06	0.46	15
Apocynaceae									
Alstonia pneumatophora Baker ex Den Berger	Tree	*Goti*	Ulcer, abdominal pain	Oral	Wild	Fruits	1.07	0.22	36
Aquifoliaceae									
Ilex odorata Buch.Ham. ex D.Don.	Shurb	*Pandappol siburuk*	Fractures	Massage	Wild	Leaves	0.84	0.17	30
Araceae									
Acorus calamus L.	Herb	*Jarango*	Malnutrition, fever, headache, supranatural disease	Inhalation, massage	Ruderal	Stem	1.77	0.76	75
Alocasia macrorrhizos (L.) G.don	Herb	*Lambuk*	Itch	Massage	Wild	Stem	0.30	0.15	4,5
Colocasia esculenta (L.) Schott.	Herb	*Suhat*	Itch	Massage	Cultivated	Stem	0.38	0.17	3
Homalomena rubescens (Roxb.) Kunth	Liana	*Langge*	Fever, abdominal pain	Massage, oral	Wild	Stem	0.53	0.17	4,5
Rhaphidophora nicolsonii P.C.Boyce	Liana	*Gaol-gaol*	Ulcer, fever	Massage, oral	Wild	Leaves	1.30	0.41	48
Araliaceae									
Aralidium pinnatifidum (Jungh. & De Vriese) Miq.	Tree	*Hau obang*	Kidney disease	Oral	Wild	Leaves	0.38	0.51	24
Arthrophyllum diversifolium Blume	Tree	*Sipiturut*	Abdominal pain	Oral	Wild	Stem	0.38	0.20	3
Arecaceae									
Areca catechu L.	Tree	*Pining*	Diabetes mellitus, abdominal pain, headache, fractures	Oral, massage	Cultivated	Roots, fruits	1.53	0.61	48
Arenga pinnata (Wurmb) Merr.	Tree	*Pola*	Cough, fractures, diarrhea	Oral, massage	Ruderal	Roots, sap	1.21	0.39	9
Calamus caesius Blume	Liana	*Mallo*	Fractures	Massage	Wild	Roots	0.38	0.27	4,5
Daemonorops crinita Blume	Liana	*Hotang*	Fractures	Massage	Wild	Roots	0.38	0.15	12

Cocos nucifera L.	Tree	*Harambir*	Injury, headache, chiken pox	Massage, oral	Cultivated	Fruits, roots	1.60	0.41	63
Salacca zalacca (Gaertn.) Voss	Tree	*Salak*	Diarrhea, fractures	Oral, massage	Cultivated	Sap	1.67	0.15	30
Asteraceae									
Ageratum conyzoides (L.) L.	Herb	*Sibau-bau*	Ulcer, fever, injury, diarrhea	l, massage	Wild	Leaves	1.99	0.78	52
Blumea balsamifera (L.) DC	Herb	*Langgumgum*	Diarrhea, headache	Oral	Wild	Leaves	1.53	0.78	49
umea chinensis (L.) DC.	Herb	*Sirungkas*	Fever, supranatural disease	Oral	Wild	Leaves	0.60	0.44	9
Chromolaena odorata (l.) R.M.King & H.Rob.	Shrub	*Hau toba nalamis*	Injury, abdominal pain, diarrhea	Oral, massage	Wild	Leaves	1.61	0.90	60
Clibadium surinamense L.	Shrub	*Hau toba marrogon*	Injury, abdominal pain, fever	Oral, massage	Wild	Leaves	1.77	0.97	48
Emilia sonchifolia (l.) Dc. Ex dc.	Herb	*Alum-alum*	Itch, abdominal pain	Oral, massage	Wild	Leaves	0.92	0.73	9
ura crepidioides Benth.	Herb	*Nande rumah*	Injury, headache, abdominal pain	Oral, massage	Wild	Leaves	1.83	0.66	72
ania cordata (Burm.f.) B.L.Rob.	Herb	*Anddor gila*	Injury, abdominal pain, fever	Oral, massage	Wild	Leaves	1.53	0.46	45
Vernonia arborea Welw. ex. O.Hoff.	Tree	*Drasi*	Fever	Oral	Wild	Leaves	0.61	0.51	4,5
Vernonia sp.	Tree	*Saur marnaik*	Malnutrition	Steam-bath	Wild	Leaves	0.38	0.29	4,5
Balsaminaceae									
Impatiens walleriana Hook.F.	Herb	*Bunga pancur*	Chiken pox, fever	Steam-bath	Wild	Leaves	1.30	0.71	18
Blechnaceae									
Blechnum orientale L.	Herb	*Padung-padung*	Ulcer, fever, malnutrition	Oral, steam-bath	Wild	Leaves	0.75	0.51	9
Bombacaceae									
Ceiba pentandra (L.) Gaertn.	Tree	*Ponji*	Fever, abdominal pain, malnutrition	Oral, steam-bath	Ruderal	Leaves	1.38	0.39	39
urio zibethinus L.	Tree	*Tarutung*	Fever, abdominal pain, malaria	Oral	Cultivated	Barks, leaves	1.53	0.88	33
Bromeliaceae									
Ananas comosus (L.) Merr.	Herb	*Honas*	Cough	Oral	Cultivated	Fruits	0.69	0.12	15
Burseraceae									
Canarium pilosum A.W.Benn.	Herb	*Damar-damar*	Itch	Massage	Wild	Leaves	0.69	0.15	9
Caricaceae									
Carica papaya L.	Herb	*Botik*	Injury, abdominal pain, fever, malaria	Oral, massage	Cultivated	Leaves, fruits	2.12	0.90	60
C phillaceae									
rymaria cordata (L.) Willd. Ex. Schult.	Herb	*Hatiddi*	Fever, headache	Oral	Wild	Leaves	1.07	0.83	39
Convolvulaceae									
Ipomoea batatas (L.) Lam.	Herb	*Gadong julur*	Ulcer, fever	Oral, massage	Cultivated	Leaves	1.38	0.32	36
Costaceae									
ostus spicatus (Jacq.) Sw.	Herb	*Tabar-tabar*	Cough	Oral	Ruderal	Rhizome	0.38	0.15	3
Crassulaceae									
Kalanchoe pinnata (Lam.) Pers.	Herb	*Hapal-hapal*	Chiken pox, fever	Massage	Ruderal	Leaves	0.83	0.51	36
C rbitaceae									
Benincasa hispida (Thunb.) Cogn.	Herb	*Gundur*	Cough	Oral	Cultivated	Fruits	0.46	0.30	18
Cucumis sativus L.	Herb	*Ancimun*	Chiken pox, fever	Massage	Cultivated	Fruits	0.77	0.54	4,5
urbita moschata Duchesne	Herb	*Jelok*	Abdominal pain	Oral	Cultivated	Fruits	0.45	0.20	4,5
Momordica charantia L.	Herb	*Pare*	Hipertensi	Oral	Cultivated	Fruits	0.62	0.29	4,5
Sechium edule (Jacq.) Sw.	Herb	*Jipang*	Hipertensi	Oral	Cultivated	Fruits	0.46	0.54	4,5
Cyatheaceae									
Cyathea contaminans (Wall. Ex Hook.) Copel.	Tree	*Tandiang*	Ulcer, fever	Massage	Wild	Leaves	1.06	0.88	30
Cyperaceae									
Cyperus rotundus L.	Herb	*Sitomu dalan*	Fractures	Massage	Wild	Leaves	0.46	0.20	3

Dennstaedtiaceae									
Pteridium aquilinum (L.) Kuhn	Herb	*Arsam*	Fever, malnutrition	Massage, steam-bath	Wild	Leaves	1.15	0.39	18
Dilleniaceae									
Tetracera scandens (L.) Merr.	Liana	*Andilo*	Malnutrition, eye infection	Steam-bath, drop	Wild	Leaves	0.38	0.78	12
Dipterocarpaceae									
Dryobalanops aromatica C.F.Gaertn.	Tree	*Hau hapur*	Injury, malaria, abdominal pain	Massage, oral	Wild	Sap, leaves	1.38	0.17	21
Vatica pauciflora Blume	Tree	*Raru*	Abdominal pain	Oral	Wild	Barks	0.53	0.37	3
Euphorbiaceae									
Aglaia argentea Blume	Tree	*Sibalik angin*	Abdominal pain, supranatural disease	Oral, massage	Wild	Leaves	0.22	0.22	9
Aleurites moluccanus (L.) Willd.	Tree	*Gambiri*	Diarrhea, ulcer, abdominal pain, fever, itch	Oral, massage	Cultivated	Sap	2.52	1.00	90
Manihot utilissima Pohl	Shrub	*Gadong hau*	Injury	Massage	Cultivated	Leaves	0.53	0.17	12
Ricinus communis L.	Shrub	*Dulang bajora*	Fever, abdominal pain	Massage, oral	Ruderal	Leaves	0.68	0.78	27
Sauropus androgynus (L.) Merr.	Herb	*Nasi-nasi*	Partum, headache	Oral	Rderal	Leaves	0.92	0.29	30
Fabaceae									
Cassia alata L.	Shrub	*Galinggang*	Itch	Oral	Wild	Leaves	1.00	0.43	30
Mimosa pudica L.	Herb	*Podom-podom*	Eye infection, kidney disease	Oral, drop	Wild	Roots	1.30	0.17	12
Pachyrhizus erosus (L.) Urb.	Herb	*Bangkuang*	Hipertensi	Oral	Cultivated	Tuber	0.61	0.20	12
Parkia speciosa Hassk.	Tree	*Parira*	Chiken pox dan itch	Massage	Cultivated	Fruits, leaves	0.99	0.27	15
Archidendron pauciflorum (Benth.) I.C.Nielsen	Tree	*Joring*	Injury, abdominal pain	Massage, oral	Cultivated	Leaves, fruits	1.30	0.46	46.5
Sp1.	Liana	*Soit*	Malnutrition		Wild	Fruits	0.53	0.41	9
Vigna sinensis (L.) Savi ex Hausskn.	Herb	*Dali tanduk*	Cough, injury	Oral, massage	Cultivated	Leaves	0.92	0.17	12
Gleicheniaceae									
Gleichenia linearis (Burm. F.) C.B. Clarke	Herb	*Sampilpil*	Fever, injury	Massage	Wild	Leaves	1.38	0.56	33
Lamiaceae									
Clerodendrum chinense (Osbeck) Mabb	Shrub	*Sarang banua*	Injury, diarrhea, abdominal pain	Massage, oral	Wild	Leaves	1.83	0.56	21
Coleus amboinicus Lour.	Herb	*Bangun-bangun*	Fever, injury	Oral, massage	Cultivated	Leaves	1.06	0.20	24
Ocimum americanum L.	Herb	*Bane-bane*	Fever, abdominal pain, supranatural disease	Oral, massage, inhalation	Ruderal	Leaves	1.54	0.41	39
Pogostemon cablin Blanco (Benth)	Herb	*Nilam*	Injury, abdominal pain	Massage, oral	Ruderal	Leaves	1.30	0.27	36
Lauraceae									
Cinnamomum cassia (L.) J.Presl	Tree	*Sitolu garis*	Diarrhea, abdominal pain	Oral	Wild	Leaves	0.68	0.21	6
Persea gratissima C.F.Gaertn.	Tree	*Pokkat*	Kidney disease	Oral	Cultivated	Leaves	0.54	0.15	6
Liliaceae									
Allium cepa L.	Herb	*Bawang merah*	Fever, injury, abdominal pain	Oral, massage	Cultivated	Bulbs	2.14	1.00	57
Allium sativum L.	Herb	*Bawang putih*	Hipertensi, injury, abdominal pain	Oral, massage	Cultivated	Bulbs	1.91	0.76	24
Cordyline fruticosa (L.) A.Chev.	Herb	*Silinjuang*	Supranatural disease, fever	Oral, massage	Ruderal	Leaves	1.06	0.37	39
Malvaceae									
Abelmoschus moschatus Medik.	Shrub	*Purbajolma*	Fractures, fever	Massage	Wild	Leaves	1.07	0.46	45
Hibiscus rosa-sinensis L.	Shrub	*Barbarsoma*	Fever, chiken pox, malaria	Oral, massage		Leaves	2.30	0.90	57
Hibiscus sp.	Shrub	*Ancilmong*	Abdominal pain		Wild	Leaves	0.54	0.22	9
Sida rhombifolia L.	Shrub	*Sibagure*	Injury, fractures	Massage	Wild	Roots	1.45	0.44	42
Urena lobata L.	Shrub	*Sampelulut*	Fever, fractures	Massage	Wild	Roots, flower	1.38	0.41	36

Marattiaceae									
Angiopteris evecta (G. Forst.) Hoffm.	Tree	*Ingel-ingel*	Ulcer, fever	Massage	Wild	Leaves, fruits	0.46	0.49	12
Melastomataceae									
Clidemia hirta (L.) D. Don	Shrub	*Sanduduk*	Injury, partum	Oral, massage, steam-bath	Wild	Leaves	1.53	0.95	48
Melastoma malabathricum L.	Shrub	*Harimonting*	Injury, abdominal pain	Oral, massage	Wild	Leaves	1.53	0.37	45
Phyllagathis rotundifolia (Jack) Blume	Herb	*Timba laut*	Supranatural disease	Massage	Wild	Leaves	0.69	0.32	9
Meliaceae									
Lansium domesticum Corrêa	Tree	*Latsat*	Abdominal pain, diarrhea	Oral	Cultivated	Barks	1.30	0.80	60
Moraceae									
Artocarpus elasticus Reinw. Ex Blume	Tree	*Torop*	Abdominal pain, malaria, diarrhea	Oral	Wild	Barks	0.76	0.17	15
Artocarpus heterophyllus Lam.	Tree	*Pinasa*	Cough, abdominal pain	Oral	Cultivated	Fruits, leaves	0.84	0.20	30
Ficus sp.	Tree	*Simarlayang-layang*	Injury, diarrhea	Oral	Wild	Leaves	0.45	0.15	6
Musaceae									
Musa × *paradisiaca* L.	Herb	*Pisang sitabar*	Injury, fractures	Massage	Cultivated	Roots, buds, sap	1.38	0.66	36
Myrtaceae									
Eugenia polyantha Barb. Rord.	Tree	*Lomas*	Diarrhea, abdominal pain, fever	Oral	Ruderal	Leaves	1.30	0.95	52
Melaleuca leucadendra (L.) L.	Tree	*Eucaliptus*	Injury, abdominal pain	Oral, massage	Cultivated	Leaves	0.68	0.34	12
Psidium guajava L.	Tree	*Attaboang*	Abdominal pain	Oral	Cultivated	Leaves	1.00	1.00	15
Rhodamnia sp.	Tree	*Baja*	Injury, toothaache abdominal pain	Oral, massage	Wild	Leaves, sap	1.83	0.98	45
Syzygium sp.	Tree	*Anggolam*	Malnutrition	Steam-bath	Wild	Barks	0.92	0.73	15
Syzygium aromaticum (L.) Merril & L.M. Perry	Tree	*Cengkeh*	Cough	Oral	Cultivated	flower, leaves	1.14	0.93	24
Nepentheceae									
Nepenthes ampullaria Jack	Herb	*Tahur-tahur tapongan*	Injury	Massage	Wild	Leaves	1.00	0.29	12
Nepenthes gracilis Korth.	Herb	*Tahur-tahur manuk*	Injury, eye infection, abdominal pain	Massage, drop, oral	Wild	Leaves	1.60	0.34	36
Oxalidaceae									
Averrhoa carambola L.	Tree	*Balimbing*	Thrush	Massage	Cultivated	Flower	0.77	0.17	15
Pandanaceae									
Pandanus amaryllifolius Roxb.	Herb	*Pandan*	Partum	Oral	Cultivated	Leaves	0.61	0.37	12
Piperaceae									
Piper betle L.	Herb	*Napuran*	Injury, partum, eye infection	Massage, drop, oral	Ruderal	Leaves	1.91	1.00	75
Piper crocatum Ruiz. & Pav. (Herb)	Herb	*Napuran harangan*	Fever, itch, malnutrition	Massage, drop, oral	Wild	Leaves	0.52	0.20	45
Piper nigrum L.	Herb	*Lada*	Headache, fractures		Cultivated	Seeds	1.38	0.63	42
Poaceae									
Cymbopogon nardus L.	Herb	*Sangge-sangge holing*	Malnutrition	Steam-bath	Cultivated	Whole	0.99	0.46	18
Bambusa vulgaris Schrad.	Tree	*Bulu*	Malnutrition	Steam-bath	Wild	Roots, leaves	1.15	0.41	3
Cymbopogon citratus (DC.) Staft.	Herb	*Sangge-sangge*	Malnutrition	Steam-bath	Cultivated	Whole	1.44	0.51	33
Eleusine indica	Herb	*Padang-padang*	Chiken pox	Steam-bath	Wild	Roots	0.53	0.20	12
Imperata cylindrica (L.) Raeusch.	Herb	*Rih*	Cough, abdominal pain	Oral	Wild	Roots	0.53	0.12	3
Paspalum conjugatum P.J.Bergius	Herb	*Duhut jau*	Injury	Massage	Wild	Leaves	0.77	0,12	12
Paspalum scrobiculatum L.	Herb	*Sanggar*	Fractures	Massage	Wild	Roots	0.46	0.12	3
Saccharum officinarum L.	Herb	*Tobu tawar*	Injury, fractures	Massage	Cultivated	Stem	0.76	0.12	21
Saccharum spontaneum L.	Herb	*Tolong*	Fractures	Massage	Wild	Roots	0.38	0.17	3
Vetiveria zizanioides (L.) Nash	Herb	*Hapias*	Abdominal pain	Oral	Wild	Leaves	0.54	0.20	4,5

Polypodiaceae									
Platycerium coronarium (Mull.) Desv.	Herb	*Pollang raja*	Abdominal pain, itch	Oral, massage	Wild	Whole	0.38	0.12	9
Rosaceae									
Rubus moluccanus Auct.	Shrub	*Sihupi*	Injury, diarrhea	Oral, massage	Wild	Leaves	1.45	0.88	42
Rubiaceae									
Coffea arabica L.	Tree	*Kopi*	Itch	Massage	Cultivated	Seeds	0.46	0.12	6
Myrmecodia tuberosa Jack	Herb	*Pollang asar porgis*	Itch, diabetes mellitus	Oral, massage	Wild	Stem	0.15	0.07	3
Timonius sericeus (Desf.) K.Schum.	Tree	*Simarbosi-bosi*	Kidney disease, diarrhea	Oral	Wild	Leaves	1.91	0.88	48
Uncaria gambir (Hunter) Roxb.	Shrub	*Gambir*	Abdominal pain	Oral	Ruderal	Sap	1.00	1.00	30
Rutaceae									
Citrus aurantiifolia (Christm.) Swingle	Tree	*Utte bunga*	Cough, itch	Oral, massage	Cultivated	Fruits, leaves	0.99	0.88	27
Citrus hystrix DC.	Tree	*Utte pangir*	Fever, supranatural disease, malnutrition	Oral, inhalation, steam-bath	Cultivated	Fruits, leaves	1.99	1.00	60
Melicope glabra (Blume) T.G. Hartley	Tree	*Situkkol*	Injury, abdominal pain, malaria, fever	Massage, oral	Wild	Leaves	1.91	0.59	69
Sapindaceae									
Nephelium lappaceum L.	Tree	*Rambutan*	Abdominal pain, chiken pox, fever	Oral, steam-bath	Cultivated	Leaves, barks	1.82	0.83	72
Solanaceae									
Capsicum frutescens L.	Herb	*Lasina*	Eye infection, ulcer	Massage	Cultivated	Leaves	1.06	0.41	27
Physalis angulata L.	Herb	*Pultak-pultak*	Chiken pox, fever, hypertention	Steam-bath, oral	Wild	Whole	1.53	0.17	57
Solanum melongena L.	Shrub	*Torung*	Hypertention	Oral	Cultivated	Fruits	0.62	0.24	4,5
Nicotiana tabacum L.	Shrub	*Timbaho*	Abdominal pain, injury	Oral, massage	Cultivated	Leaves	0.93	0.27	15
Solanum nigrum L.	Shrub	*Inggir-ingir*	Hipertensi, headache	Oral	Wild	Fruits	0.77	0.22	15
Solanum schiffnerianum Witasek	Herb	*Inddot*	Fractures	Massage	Wild	Leaves	0.53	0.10	12
Solanum torvum Sw.	Shrub	*Rimbang*	Eye infection, fever, ulcer	Oral, massage	Ruderal	Leaves, fruits	1.45	0.17	36
Sterculiaceae									
Commersonia bartramia (L.) Merr.	Liana	*Andor laut*	Malaria, abdominal pain	Oral	Wild	Leaves	0.54	0.22	12
Simaroubaceae									
Eurycoma longifolia Jack	Tree	*Tengku ali*	Fever, malaria, diarrhea, abdominal pain, approdisiac	Oral	Wild	Roots, stem, leaves, seeds	3.44	1.00	126
Styracaceae									
Styrax benzoin Dryand.	Tree	*Haminjon*	Supranatural disease, injury, fractures, fever	Oral, massage	Cultivated	Sap, leaves	1.69	0.80	57
Thymeleaceae									
Aquilaria malaccensis Lam.	Tree	*Alim*	Abdominal pain	Oral	Wild	Sap	0.77	0.10	4,5
Urticaceae									
Leucosyke sp.	Herb	*Hambing-hambing*	Abdominal pain, eye infection	Oral, drop	Wild	Leaves	0.92	0.15	12
Laportea decumana (roxb.) Wedd.	Shrub	*Latong*	Itch	Massage	Wild	Roots	0.21	0.05	4,5
Leucosyke capitellata Wedd.	Herb	*Simarihan-ihan*	Malnutrition, eye infection	Steam-bath	Wild	Leaves	0.93	0.37	30
Verbenaceae									
Callicarpa sp.	Tree	*Rittua*	Fever, abdominal pain	Oral	Wild	Leaves	0.91	0,20	6
Zingiberaceae									
Alpinia galanga L. Willd.	Herb	*Halaos*	Itch, malnutrition, diabetes mellitus	Oral, steam-bath, massage	Cultivated	Rhizome, leaves	1.29	0.71	27
Curcuma longa L.	Herb	*Hunik*	Cough, injury, itch, diarrhea,	Oral, steam-bath,	Cultivated	Rhizome	2.67	1.00	112

			abdominal pain	massage					
Etlingera elatior (Jack.) R.M.Sm	Herb	*Sihala dairi*	Ulcer, fever, malnutrition, injury	Oral, steam-bath, massage	Ruderal	Stem, leaves	1.99	0.39	93
Hornstedtia leonurus (J.Koenig) Retz.	Herb	*Sihala sisik*	Malnutrition	Steam-bath	Wild	Stem, leaves	1.00	0.39	30
Kaempferia galanga L.	Herb	*Hasihor*	Injury, malaria, supranatural disease, partum	Oral, steam-bath, massage	Cultivated	Rhizome	2.21	0.93	67
Zingiber purpureum Rosc.	Herb	*Hunik burley*	Diarrhea, abdominal pain, headache	Oral	Cultivated	Rhizome	1.0	0.76	63
Zingiber officinale Rosc.	Herb	*Pege*	Cough, diabetes mellitus, injury, gastrointestinal disoldel	Oral, steam-bath, massage	Cultivated	Rhizome	2.60	0.90	105

Table 2. List of top 20 important medicinal plant species for the Batak Toba community, based on each of the three studied quantitative measures of relative importance (UV, RFC and CSI)

Use Value (UV)	Relative Frequency of Citation (RFC)	Cultural Significance Index (CSI)
Eurycoma longifolia Jack (3.44)	*Eurycoma longifolia* Jack (1.00)	*Eurycoma longifolia* Jack (126)
Curcuma longa L. (2.67)	*Curcuma longa L. (1.00)*	*Curcuma longa* L. (112)
Zingiber officinale Rosc. (2.60)	*Piper betle* L. (1.00)	*Zingiber officinale* Rosc. (105)
Aleurites moluccanus (L.) Willd. (2.52)	*Allium cepa* L. (1.00)	*Aleurites moluccanus* (L.) Willd. (90)
Hibiscus rosa-sinensis L. (2.30)	*Aleurites moluccanus* (L.) Willd. (1.00)	*Piper betle* L. (75)
Kaempferia galanga L. (2.21)	*Citrus hystrix* DC. (1.00)	*Gynura crepidioides* Benth. (72)
Allium cepa L. (2.14)	*Uncaria gambir* (Hunter) Roxb. (1.00)	*Nephelium lappaceum* L. (72)
Carica papaya L. (2.12)	*Rhodamnia* sp. (0.98)	*Melicope glabra* (Blume) T.G. Hartley (69)
Citrus hystrix DC. (1.99)	*Clibadium surinamense* L. (0.97)	*Kaempferia galanga* L. (67)
Etlingera elatior (Jack.) R.M.Sm (1.99)	*Eugenia polyantha* Barb. Rord (0.95)	*Zingiber purpureum* Rosc. (63)
Ageratum conyzoides (L.) L. (1.99)	*Clidemia hirta* (L.) D. Don (0.95)	*Carica papaya* L. (60)
Piper betle L. (1.91)	*mpferia galanga* L. (0.93)	*Citrus hystrix* DC. (60)
Allium sativum L. (1.91)	*Syzygium aromaticum* (L.) Merril & L.M. (0.93)	*Lansium domesticum* Corrêa (60)
Strobilanthes sp. (1.91)	*Zingiber officinale* Rosc. (0.90)	*Chromolaena odorata* (L.) R.M.King & H.Rob. (60)
onius sericeus (Desf.) K.Schum. (1.91)	*Carica papaya* L. (0.90)	*Allium cepa* L. (57)
Melicope glabra (Blume) T.G. Hartley (1.91)	*Hibiscus rosa-sinensis* L. (0.90)	*Physalis angulata* L. (57)
Gynura crepidioides Benth. (1.83)	*Chromolaena odorata* (L.) R.M. King & H. Rob. (0.90)	*Hibiscus rosa-sinensis* L. (57)
Clerodendrum chinense (Osbeck) Mabb (1.83)	*Durio zibethinus* L. (0.88)	*Styrax benzoin* Dryand. (57)
Rhodamnia sp. (1.83)	*Cyathea contaminans* (Wall. Ex Hook.) Copel. (0.88)	*Eugenia polyantha* Barb. Rord. (52)
Nephelium lappaceum L. (1.82)	*Nephelium lappaceum* L. (0.83)	*Clibadium surinamense* L. (48)

Use Value (UV)

The range of UV was between 0.15 - 3.44 with the mean value of 1.08 (±0.59). A higher UV indicated species that were considered most important by the Batak Toba, as shown by their number of use-reports in Table 1. Three of the plants with the highest UV were *Eurycoma longifolia* Jack. (UV=3.44) having 5 use reports, *Curcuma longa* L. (UV=2.67) also having 5 use reports and *Zingiber officinale* Rosc. (UV=2.60) used in 4 disease categories. Eurycoma longifolia has been used to cure fever, malaria, diarrhea, abdominal pain, approdisiac, where some respondents only mention 3-4 benefits of them, that the UV value is lower than 5. The respondent's knowledge about the use of medicinal plants is strongly influenced by age and ease of access to medicinal plants. However, 65.77% of all the recorded plants had more than one use report. For instance, *Curcuma longa* L. has been used to cure five of ailments (diarrhea, abdominal pain, cough, itch, injury). Such multiple uses demonstrated the importance of these plants as a part of the local cultural heritage.

Cultural Significance Index (CSI)

Based on the CSI value, medicinal plant species may be classified into five groups, as follows: species of very high significance (CSI> 200), species of high significance (CSI= 100-199), species of moderate significance (CSI= 20-99), species of low significance (CSI= 5-19), and species of very low significance (CSI < 5) (Pieroni 2001). In the present study, the highest, the highest CSI value obtained was 126 and the lowest was 3. Accordingly, there were no species of very high cultural significance in the present study. 3 species were of high significance, 75 species were of moderate significance, 46 species were of low significance and 26 species were of very low significance (Figure 3). *Eurycoma longifolia* Jack., *Curcuma longa* L. and *Zingiber officinale* Rosc. were the top three species with high significance, whereas *Cyperus rotundus* L. (3), *Imperata cylindrica* (L.) Raeusch (3), *Cucumis sativus* L. (4,5), and *Laportea decumana* (4,5) (Roxb.) Wedd. were examples for low significance species.

Relative frequency of citation (RFC)

The RFC based grouping of medicinal plants used by the Batak Toba is shown in Figure 4. The following eight species found to be having highest RCF (1.00 or 100%): *Allium cepa* L., *Aleurites moluccanus* (L.) Willd., *Citrus hystrix* DC., *Curcuma longa L.* , *Eurycoma longifolia* Jack, *Piper betle* L., *Psidium guajava* L. and *Uncaria gambir* (Hunter) Roxb. Most of these plants were used in the treatment of abdominal pain (*Aleurites moluccanus* (L.) Willd., *Allium cepa* L., *Curcuma longa* L., *Eurycoma longifolia* Jack, *Psidium guajava* L. and *Uncaria gambir* (Hunter) Roxb.), for curing fever and supranatural purposes (*Citrus hystrix* DC. and *Piper betle* L.), and as aphrodisiacs (*Eurycoma longifolia* Jack).

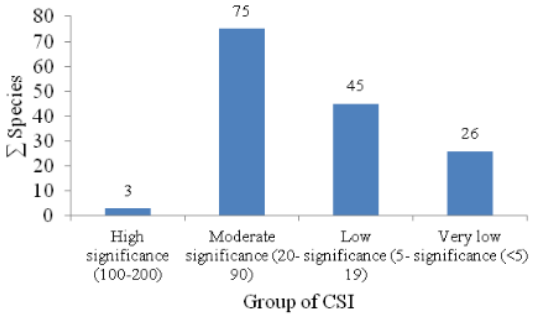

Figure 3. Categorisation of medicinal plant species used by Batak Toba, North Sumatra Indonesia, according to their CSI values.

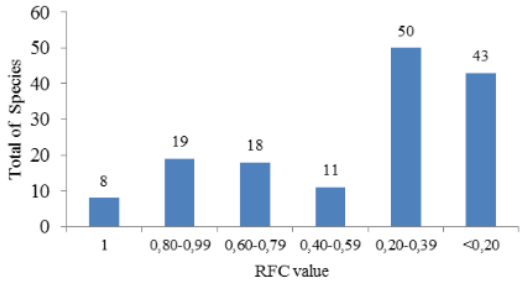

Figure 4. RFC value based grouping of medicinal plants used by Batak Toba of North Sumatra, Indonesia

Table 3. Informant Consensus Factor (ICF) for different medicinal plant use categories

Ailment Category	Nur	Nt*	ICF	Frequently Used Species
Thrush	2	1	1.000	*Averrhoa carambola* L.
Aphrodisiac	5	1	1.000	*Eurycoma longifolia* Jack.
Toothache	5	2	0.750	*Rhodamnia* sp.
Malaria	31	9	0.733	*Eurycoma longifolia* Jack
Diabetes Mellitus	17	6	0.688	*Zingiber officinale* Rosc.
Diarrhea	54	19	0.660	*Uncaria gambir* (Hunter) Roxb.)
Ulcer	30	11	0.655	*Rhaphidophora nicolsonii* P.C.Boyce
Headache	32	12	0.645	*Cocos nucifera* L.
Partus	15	6	0.643	*Acorus calamus* L.
Injury	106	39	0.638	*Melastoma malabathricum* L.
Supranatural Ailment	29	11	0.634	*Styrax benzoin* Dryand.
Fever	119	45	0.627	*Hibiscus rosa-sinensis* L.
Eye Infection	17	7	0.625	*Piper Betle* L.
Abdominal Pain	134	54	0.602	*Uncaria gambir* (Hunter) Roxb.)
Chicken Pox	21	9	0,600	*Physalis angulata* L
Cough	21	11	0.565	*Syzygium aromaticum* (L.) Merril & L.M. Perry
Hypertension	10	5	0.556	*Allium sativum* L.
Itches	32	18	0.528	*Cassia alata* L.
Malnutrition	32	16	0.516	*Acorus calamus* L.
Fractures	33	18	0.469	*Sida rhombifolia* L.
Kidney Disorder	6	4	0.400	*Aralidium pinnatifidum* (Jungh. & De Vriese) Miq.
Total	751	304		

Note: taxon may be reported in more than one use category. Nur: Number of Use-Reports, Nt: Number of Taxa, ICF: Informant Consensus Factor

Informant Consensus Factor (ICF)

The Batak Toba traditional healers generally used two or three plant parts for the preparation of medicines used in the treatment of single or multiple ailments. Use categories namely Thrush and aprodisiac have the highest ICF of 1.00, but these categories ranked the lowest in the number of use reports (2 and 5 respectively) and number of species used (1 species, in each category). The use categories with more than 20 use reports were abdominal pain (134 use reports, 54 species), malaria (31 use reports, 9 species) and betes mellitus (17 use reports, 6 species) (Table. 3). The least agreement between the informants was observed in kidney disorders as indicated by the lowest ICF value of 00, followed by fractures with a ICF of 0.469. Thus, this study indicated that the degree of knowledge sharing by the rs in the study area regarding the use of medicinal plants in the treatment of various ailments is low.

Discussi

The use of medicinal plants by local communities is influenced by various factors, such as pharmacological effectiveness, ecological availability and cultural factors (Menendez-Baceta et al. 2015). The cultural factors can shape the uneven distribution of medicinal knowledge across biogeographically similar regions and some such factors are language, social networks, meaning response (Vandebroek et al. 2004; Cocks and Dold 2006; Menendez-Baceta et al. 2015) and enviromental diversity (Eyssartier et al. 2008). The language is one of the frontiers t hinder the diffusion of local knowledge across linguistically distinct areas (Perales et al. 2005).

This study documented 149 medicinal plant species belonging to 56 families which are used for the treatment of 21 disease/use categories. The higher number of medicinal plant species documented in the current study when compared with an earlier study with another related tribe called Batak Phakpak (Silalahi 2006) shows that the Batak Toba has a richer tradition of medicinal plant use and therapy.But, the medicinal plant knowledge of Batak Toba is poorer in comparison to the Batak Karo tribe which uses 156 species (Silalahi et al. 2013) and Batak Simalungun tribe that uses 239 species (Silalahi et al. 2015). Despite the fact that all the three are named Batak tribes (Karo, Simalungun and Batak Toba) and they inhabit North Sumatra, they language and cultural differences. Some of

the medicinal plants used by Batak Toba tribe are also used by the other Batak tribes residing in other sections of North Sumatra. They include *Acorus calamus* L., *Ageratum conyzoides* (L.) L., *Citrus hystrix* DC., *Etlingera elatior* (Jack.) R.M.Sm., *Eurycoma longifolia* Jack and *Zingiber officinale* Rosc. (Silalahi et al. 2015; Silalahi et al. 2013). However, some of the medicinal plants recorded in this study such as *Melicope glabra* (Blume) T.G. Hartley (*situkkol*), *Timonius sericeus* (Desf.) K.Schum (*Simarbosi-bosi*), *Rhodamnia* sp. (*Baja*) and *Vatica pauciflora* (Raru) are new reports with regard to healing of diarrhea and abdominal pain. The difference of species CSI is influenced by the level of knowledge, the particular cultural settings and the local conditions (Turner 1988; Pei et al. 2009; Helida et al. 2015).

In this research, quantitative ethnobotanical tools such as CSI, UV, RFC and the ICF were used to make the results more comprehensive to prioritize conservation of medicinal plants (Byg and Baslev 2001; Kvist et al. 2001; Dalle et al. 2004) and also to facilitate bioprospecting (Xavier et al. 2014; Silalahi et al. 2015). The values of RFC, UV and ICF are quantitave indicators that measure the cultural significance and importance of traditional medicinal plants (Thomas et al. 2009; Ong and Kim 2014; Menendez-Baceta et al. 2015; Sujarwo and Caneva 2015). The values of RFC, UV, and ICF are based on the respondents knowledge (Silva et al. 2006) whereas CSI is based on the analisys of researchers (Turner 1988; Hoffman and Timothy 2007).

Phillips and Gentry (1993) have developed quantitative measure to know the species relative importance, which know as UV. UV has also been associated with issues of conservation, based on the idea that the most important species will suffer the greatest harvesting pressure (Albuquerque et al. 2006). *Eurycoma longifolia* Jack. (UV=3.44), *Curcuma longa* L. (UV=2.67, and *Zingiber officinale* Rosc. (UV=2.60) are the plants with the highest of UV in this study which indicates that these plants are considered most important as medicines by the Batak Toba tribe. UVs are high when there are many use-reports for a plant, implying that the plant is important, and low when there are few use-reports (Ong and Kim 2014). There are factors influencing the respondents knowledge of plants, important among others are age (Voeks 2007; Quinlan and Quinlan 2007; Guimbo et al. 2011), gender (Quinlan and Quinlan 2007; Camou-Guerrero et al. 2008; Guimbo et al. 2011), formal education (Voeks 2007; Quinlan and Quinlan 2007; Giovannini et al. 2011), use of biomedicines (Vandebroek et al. 2004), occupation (Quinlan and Quinlan 2007) and village level (Sujarwo et al. 2014). The level of formal education (Quinlan and Quinlan 2007; Giovannini et al. 2011; Sujarwo et al. 2014) and use of biomedicines (Vandebroek et al. 2004; Giovannini et al. 2011) have a negative correlation with the level of local knowledge; but age has a positive correlation with level local knowledge (Silalahi et al. 2015a). Number of medicinal plants known by women is generally higher than men (Camou-Guerrero et al. 2008; Guimbo et al. 2011). The CSI value depends on quality, intensity and exclusivity of species of the medicinal plants (Turner 1988; Silalahi et al. 2015a). This research showed that *Curcuma longa* L., *Eurycoma longifolia* Jack. and *Zingiber officinale* Rosc. has high cultural significance in the Batak Toba tribe, on the basis of their CSI values.

In the present study, plants used as aphrodisiac and in the treatment of thrush had the highest ICF of 1 each. A high value ICF indicates the agreement of selection of taxa between informants, whereas a low value indicates disagreement (Ragupathy et al. 2008; Xavier et al. 2014). ICF can thus be used to pinpoint particularly interesting species for the search of bioactive compounds (Canales et al. 2005). Thrush and aprodisiac have the highest ICF of 1.00 each because the informants agreed of using only a single species for each category. *Eurycoma longifolia* Jack is used as aphrodisiac, whereas *Averrhoa carambola* L. is used against thrush. High ICF values were also observed for use categories related to toothache, fever, malaria, diarrhea, diabetes, abdominal pain gastrointestinal disorder, etc. This finding suggested that there is a well-defined plant selection criterion for these use categories (Srithi et al. 2009; Silva et al. 2005). Cultural importance indices make it possible to quantify the role that a given plant plays within a particular culture, and CSI is used to evaluate and classify these plants according to their respective cultural significance (Pieroni 2001).

This study identified *Eurycoma longifolia* Jack., *Dryobalanops aromatica* C.F.Gaertn, *Vatica pauciflora* Blume and *Melicope glabra* (Blume) T.G. Hartley as having high overall use value, but according to our field data these plant species have a restricted distribution and a low abundance. *Eurycoma longifolia* Jack. has been phytochemically investigated by many researchers (Ang et al. 2000; Kuo et al. 2003; Chan et al. 2004; Farouk et al. 2007; Achmad et al. 2008; Talbott et al. 2013), but such studies are yet to be undertaken with *Dryobalanops aromatica* C.F.Gaertn, *Vatica pauciflora* Blume and *Melicope glabra* (Blume) T.G. Hartley.

Styrax benzoin Dryand is included in the 20 plants with the highest CSI but it is rarely found in the environment around. *Styrax benzoin* Dryand is indigenous in Sumatra island especially in Humbang and Tapanuli District (Kashio and Johnson 2001; Langenheim 2003; Lopez and Shanley 2004; Kusters and Belcher 2008), has been used by local communities in North Sumatra as an export commodity since the 8th century (Backer and Bakhuizen van den Brink 1965; Boer and Ella 2001) is called *Sumatra benzoin* (Boer and Ella 2001; Kashio and Johnson 2001). Resin of *Styrax benzoin* Dryand in North Sumatera (Backer and Bakhuizen van den Brink 1965; Boer and Ella 2001), at the beginning taken by the local community from wild plants in forest (Kusters and Belcher 2008), and has been cultivated by the Batak ethnic since 200 years ago (Lopez and Shanley 2004).

It was summarized that the local communities of Batak Toba in Peadungdung village uses 149 medicinal plants belonging in 131 genera of 55 families to cure 21 type of ailment. A total number of the species having highest CSI, UV, and RCF in top 20 plant species ranking was 33 species, belonging to 31 genera and 20 families. Medicinal plants with the highest recorded UV, CSI, RFC, and IFC

were *Eurycoma longifolia* Jack, *Curcuma longa* L., and *Zingiber officinale* Rosc. *Eurycoma longifolia* Jack. and *Styrax benzoin* Dryand, *Dryobalanops aromatica* C.F.Gaertn, *Vatica pauciflora* Blume, and *Melicope glabra* (Blume) T.G. Hartley as having high overall use value but according to our field data, these plant species have a restricted distribution and a low abundance, so which species needs the protection and the ex situ and in situ conservation.

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