



The local knowledge of medicinal plants trader and diversity of medicinal plants in the Kabanjahe traditional market, North Sumatra, Indonesia



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ABSTRACT

Ethnopharmacological relevance: Market is the main place for transactions of medicinal plants and traditional ingredients by local community in the Karo regency, North Sumatra, Indonesia. This is the first study to document the local knowledge of traders on and the diversity of the medicinal plants. The investigation was carried out in the Kabanjahe traditional market, in the Karo regency. The research goal was to reveal the local knowledge, diversity and utilization of medicinal plants, which have been traded in the Kabanjahe traditional market, as a basis for conservation efforts.

Materials and methods: The study was conducted through ethnobotanical approach using market surveys. All traders of medicinal plants were surveyed applying in-depth interviews and participative observations. Data were analyzed qualitatively using descriptive statistics. The diversity of medicinal plants was expressed in term of the Shannon–Wiener diversity index (H'), whereas the similarity among traders was indicated by Jaccard index (J_i).

Results: Traders of medicinal plants stored the simplicia of medicinal plants in chest of drawers, plastic baskets, plastic bags, and in the air by suspending them from the stall ceilings. We recorded 344 species, 217 genera and 90 families of medicinal plants. Those that were sold mostly belong to *Zingiberaceae* (20 species), *Poaceae* (19 species), and *Asclepiadaceae* (17 species), and the species received high consumers demand, mostly belong to *Zingiberaceae*, *Rutaceae*, and *Asclepiadiaceae*. *Asclepidiaceae* was used to treat diseases like cancer and heart problems. The Shannon–Wiener diversity index of medicinal plants at the Kabanjahe traditional market was high ($H' = 5.637$). The high Jaccard similarity index ($J_i > 0.56$) suggested that the traders were trading similar species of medicinal plants.

Conclusion: Kabanjahe traditional market is the center for the sale of medicinal plants as traditional ingredients. Several species are well known for their pharmacological properties but others, [such as: *Dischidia imbricata* (Blume) Steud., *Dischidia nummularia* R.Br., *Hoya macrophylla* Blume, and *Hoya coriacea* Blume] have been used for cancer treatment by local communities, but pharmacologically unknown, hence they are promising candidates for further investigation.

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1. Introduction

World Health Organization (WHO) estimated that about 60–80% of the world population still derive their medical treatments which are of plant origin (Joy et al., 1998; Fabricant and Farnsworth, 2001). Utilizing data obtained from studies on treatments using traditional medicinal plants by local communities are an effective way in terms of time and cost to find new chemical

compounds that might be useful as a medicine (Purwanto, 2002). To secure data on the usage of medicinal plants by local communities could be done in various ways, such as a market survey (Martin, 1995; Hoang et al., 2008).

A market survey method has various advantages compared to other methods, such as the ability of revealing a wide range of knowledge of local communities (Lee et al., 2008), recognizing the benefits and values, (Martin, 1995; Betti, 2002), revealing species conservation status (Betti, 2002; Van Andel et al., 2012), and formulating a plan for further development of medicinal plants

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(Van Andel et al., 2012). These advantages imply various functions of the market for local communities, such as a place for trading, transactions, information exchange on the use of plants (Lee et al., 2008), place to improve the economy (Revene et al., 2008), and site to earn livelihood (Toksoy et al., 2010).

The study of medicinal plants through market surveys has been carried out in other countries as has been reported by: Betti (2002), Macia et al. (2005), Verma and Singh (2008), Lee et al. (2008), Setshogo and Mberreki (2008), Toksoy et al. (2010), Idu et al. (2010), and Van Andel et al. (2012), but in Indonesia little has been done. To date studies in Sumatra has been largely concerned with community survey on the use of plants by local communities or ethnic groups, such as Batak Toba (Simbolon, 1994), Rejang (Darnaedi, 1999), Malay (Setyowati and Siagian, 2004; Setyowati and Wardah, 2007; Sunesi and Wiryo, 2007; Rahayu et al., 2007; Hariyadi and Ticktin, 2011), Batak (Silalahi, 2014), Batak Simalungun (Silalahi et al., 2015). Investigations on the utilization of medicinal plants applying market surveys have been reported by Kriswiyanti et al. (2011) and Nasution (2009). Some markets in Indonesia, especially the traditional markets, including the Kabanjahe traditional market, North Sumatra are the main sources to acquire plants as an ingredient in traditional medicines practiced by local communities. The Kabanjahe traditional market has been the main source of acquisition of plants and traditional medicines for people in North Sumatra. The aims of this study are: (1) to document the local knowledge of medicinal plant traders in Kabanjahe traditional market, (2) to document diversity of medicinal plants which are sold in Kabanjahe traditional market, and

(3) to provide information on the pharmacological properties of the most commonly used plants in the preparation to cure diseases, especially cancer.

2. Materials and methods

2.1. Study area

Our study site is located at the Kabanjahe traditional market in the Kabupaten (District) Karo, North Sumatra Indonesia. Kabanjahe traditional market is the main market in the Karo District, which is located at N 3°11' and E. 98°31', at a distance of 76 km from Medan, the capital North Sumatra Province, with the elevation of 1100 above sea level (Fig. 1). Kabanjahe has a tropical climate with a bimodal seasonality (dry season from April to Agustus and rainy season from Agustus to April). The average annual temperature varies from 19 to 25 °C. Trading activity in the market is done every day from 7:00 until 18:00, but the market day is Monday.

2.2. Interviews and data collection

Information on the use and diversity of medicinal plants traded in Kabanjahe traditional market was obtained through interviews (semi-structured, in-depth, and participative observation). Interviews were conducted with all the traders of traditional medicinal plants (5 people) in Kabanjahe. Guidelines for conducting interviews were modified from Martin (1995), Alexiades (1996), and

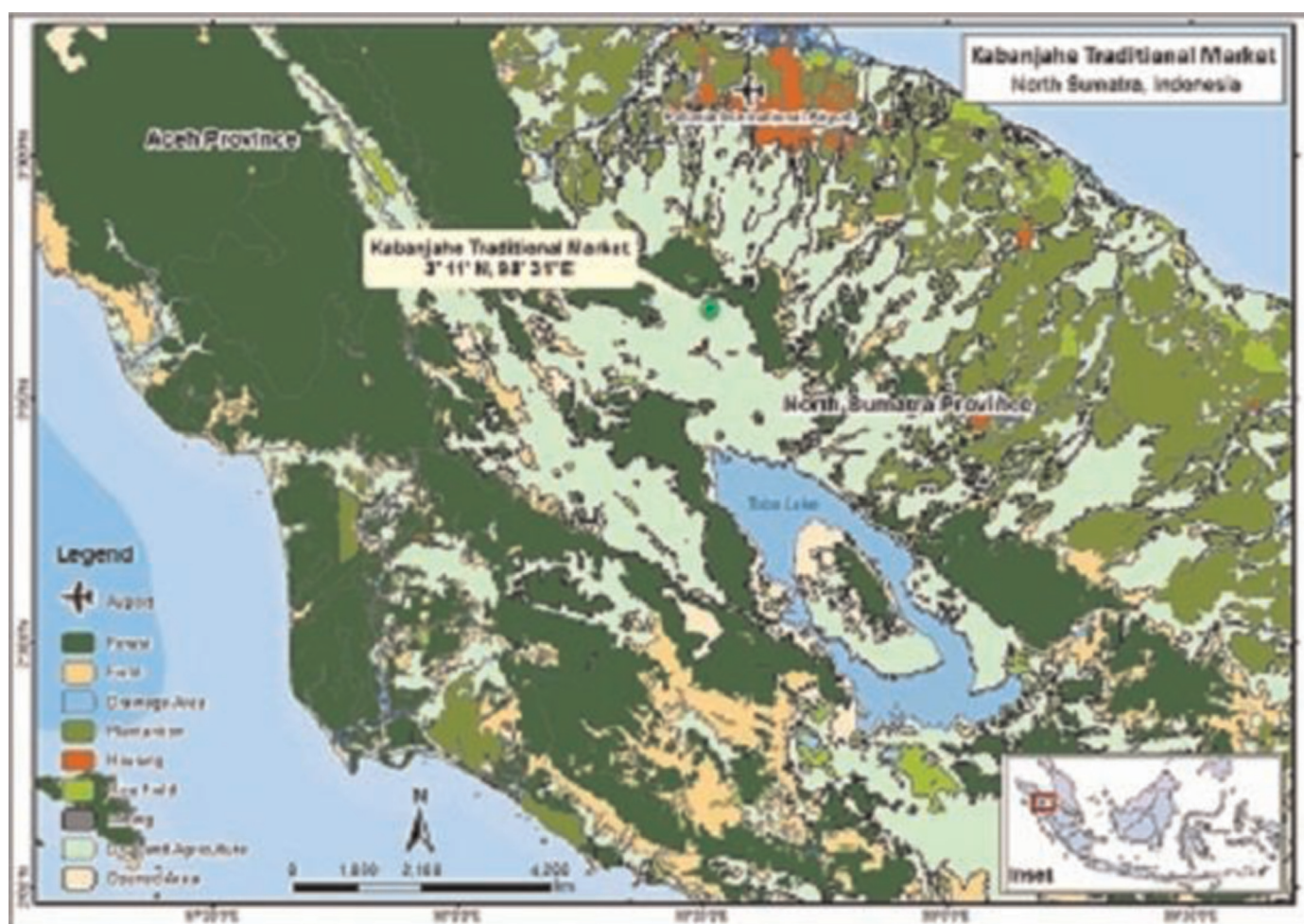


Fig. 1. Study site at Kabanjahe traditional market in North Sumatra, Indonesia.

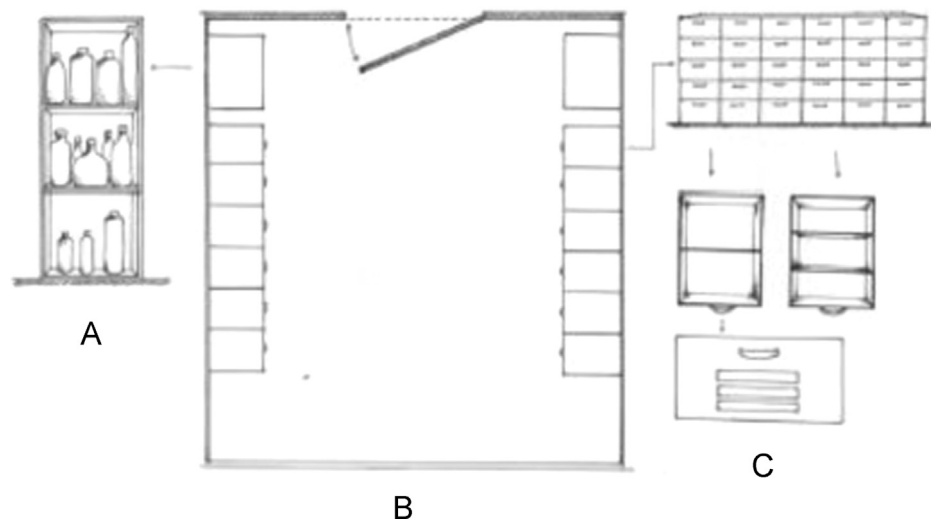


Fig. 2. The schematic drawing of a wood cabinet and storage drawers made for medicinal herbs developed by the medicinal plant traders in Kabanjahe traditional market. (A) lockers for storage of concoctions; (B) front view and the amount of insulation in the drawer. (C) lockers for simplices of medicinal plants.

Idu et al. (2010). We registered the medicinal plants that were sold as traditional medicine recorded their local names, uses and parts used and made voucher specimens. The plants were collected with the informants and then identified by the first author and professional experts of the University Indonesia and the voucher specimens were identified at the Herbarium Bogoriense of the Indonesian Institute of Sciences (LIPI), Cibinong, Bogor, Indonesia. Scientific names of the plant species were verified using on line sources (e.g., The Plantlist, 2015). Voucher specimens were deposited at the Herbarium of University Indonesia, Depok, Indonesia.

The data were analyzed qualitatively. Qualitative data included species of medicinal plants, benefits, organs harvested, supply, and resource acquisition. The data were analyzed using qualitative descriptive statistical methods. To determine the diversity of medicinal plant species, Shannon–Wiener (H'), diversity index was calculated based and the similarity and dissimilarity indices were calculated using Jaccard similarity formula (Krebs, 1978). To complete the analysis secondary data were used. The data were obtained from the publications of other researchers.

3. Results

3.1. Background and characteristics of trader of medicinal plants in traditional market Kabanjahe

Trade the medicinal plants in Kabanjahe traditional market has been existing since 40 years ago. The traders of medicinal plants were dominated by women of Batak Karo sub-ethnic, one of five Batak sub-ethnicities in North Sumatra. The Batak Karo Sub-ethnic has been living in the highlands, called the *Karo Gugung* (Singarimbun, 1975). They were the descendants of the Proto Malay, and have been living there since about 500–600 years ago.

In the past, the transactions were carried out under the tents erected in an open field. At the time of the present study was conducted, the traders had moved into semi-permanent stalls with the size of 9–12 m². Apart from being a place for the sale and purchase transactions, a stall was also used as a warehouse to store herbs, both in dried and fresh forms. The interviews revealed that, the traders of medicinal plants attained their ability to trade and mix the herbs from the knowledge inherited by their parents, experiences, and learning process. The process of inheriting the knowledge was done in a simple way that is by inviting the

children to help in the transactions as well as in gathering activities.

At the beginning, the medicinal plants trading in Kabanjahe market was only done once a week, but now it is done every day from 7:00 to 18:00 local time. At the beginning, the species and volume of medicinal plants that were traded were limited. However, as the time went by, there was an increasing demand for a variety of new species that had not been traded before in the Kabanjahe market. To improve the service and increase the revenues, the traders sought medicinal plant species that the customers needed.

Growing number of medicinal plant species that were traded, had inspired the traders to develop the storage systems. The traders used four storage systems for botanical herbs, namely: (1) wood drawers in a cabinet and each was labelled with local name; (2) a plastic basket with a local name; (3) a plastic bag with a local name; and (4) a pocket in the ceiling of the shop without a name. Storage of crude medicines using wood cabinets looked neater, cleaner, and more systematic compared to other storage means. The wood cabinet was made with a width of 50 cm, height of 150 cm, and a length of 70–80 cm. Every cabinet had 3–5 drawers vertically, and each drawer had 2–4 horizontal spaces (Fig. 2). The amount of insulation that was made was inversely proportional to the size of the space formed. Drawer sizes were adjusted according to the type and volume of organ simplices of medicinal plants to be saved.

The difference in the storage system of simplices of medicinal plants used by the merchant was associated with the size of the stall, capital, and experience. Merchants who had larger stalls and bigger capitals and longer trading experiences had better storage systems and more systematic than other traders. Aside from having knowledge in botanical storage systems, traders also had a setup or preparation system of medicinal plants in the stall. The pattern of the arrangement and compilation of medicinal plants used by the traders were adjusted to demand, supply, volume, size, and type of organ. The medicinal plants that were highly demanded by the customers, or the ones with higher supplies and larger volumes were arranged on the front side of the stall, especially the ones that were in the fresh form (e.g., *Zingiberaceae* and *Rutaceae*) (Fig. 3). Simplices of medicinal plants with larger masses such as roots and barks were placed at the bottom of the stall. The front side of the top of the stall was used to hang the herbs that were still fresh.

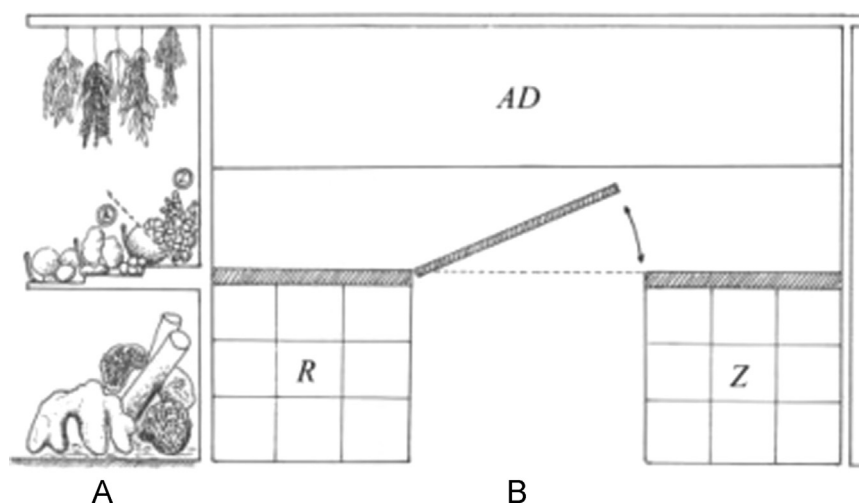


Fig. 3. Schematic arrangement of medicinal plants in Kabanjahe market stall. (A) store view vertically; (B) side of the store front/main room; AD (variety of leaves); R (*Rutaceae*); Z (*Zingiberaceae*).

3.2. The diversity of medicinal plants

Each trader of medicinal plants in the Kabanjahe traditional market sold as many as 214–251 medicinal plant species. The difference of the number of species owned by trader had implications on species diversity index and similarity index of medicinal plants. Based on the presence and absence of species owned by the merchants and traded in the Kabanjahe traditional market had, calculation of the Shannon–Wiener diversity index resulted in a high value (i.e., $H' = 5.637$) and high Jaccard similarity index (i.e., $J_i = 0.56–0.69$). High Jaccard similarity index indicated that the kinds of medicinal plants sold by the traders were relatively the same.

Total medicinal plants traded were 344 species, 217 genera and 90 families. Of the 344 species traded in the Kabanjahe market, 332 species were Spermatophyta, 11 Pteridophyta, and one Lichens. Among the Pteridophyta used as medicines include asarasar (*Selaginella* sp.), sendep-sendep (*Equisetum debile*), sendok-sendok tunggal (*Ophioglossum pedunculatum*), and peldang raja (*Platyterium coronarium*). *Tai angin* (*Usnea barbata*) was the only Lichens that was used as medicine (Table 1).

Of the 344 species traded, 74.7% were collected exclusively from the wild, and 25.3% were cultivated. The cultivated ones were species of *Rutaceae* (*Citrus aurantium*, *Citrus hystrix*, *Citrus nobilis*, *Citrus medica*), *Zingiberaceae* (*Boesenbergia pandurata*, *Curcuma domestica*, *Kaempferia galanga*, *Zingiber officinale*), and spices (*Piper nigrum*, *Piper longum*, *Myristica fragrans*) (Table 1).

Most of medicinal plants that were traded in the market were species of *Zingiberaceae*, *Asclepiadaceae*, and *Poaceae*, representing more than 16.2% of the total medicinal plants traded. Although some of medicinal plants families that were sold had a lot of species, most of 40 families were only represented by a single (1) species, including *Bromeliaceae*, *Caesalpinaceae*, *Ericaceae*, *Fagaceae*, *Loranthaceae*, and *Meliaceae*.

3.3. The kinds of disease by trader in Kabanjahe traditional market

The medicinal plants sold in Kabanjahe Traditional market have been used for various purposes, including to cure cancer, heart problem, cough, diarrhea, diabetes mellitus, eye infection, fever, bone fractures, hypertension, injury, itchy, kidney disease, lever, rheumatism, stomach ache, tooth ache, cholesterol, and ulcer, as well as to be used as an aphrodisiac and tonicum to maintain stamina (Fig. 4).

Many of the traditional medicinal plants are also used in customary rituals, such as *Oukup* and *erpangir ku lau* which is the rituals practiced by the Batak Karo sub-ethnic in North Sumatra. *Oukup* is a traditional sauna exercised by Batak Karo sub-ethnic, which was originally used to restore the health of mothers postpartum. Sauna has been done by covering the whole body with a blanket heated with hot steam from a container filled with hot water and herbs. Steam heat will warm the body to stimulate intense perspiration, which is believed to clean the body by disposing toxic compounds, giving the effect of relaxation and good blood circulation. Currently the use of *oukup* is also believed to be good for treating rheumatism, high cholesterol, hypertension, headache, stroke, invigorating, and maintaining smooth skin.

Erpangir ku lau is literally means (*erpangir*=shampooing; *ku*=to; *lau*=river). *Erpangir ku lau* is a ritual performed by the local community by way of bathing in spring water treated with ingredient *macan kera* (made from more than 30 plants of *Zingiberaceae*, *Rutaceae* and spices as listed in Table 1). The ingredient *macan kera* is soaked in a bucket containing 5–10 liter of water for 12–24 h and splashed over the whole body, especially the head. This activity is performed supposedly to drive bad things out and bring in good things in.

Cancer is a disease that appeared about 10 years ago. Medicinal plants that have been used to cure cancer by traders of medicinal plants are *kapal-kapalan* (*kapal* = thickness) of *Asclepiadaceae* (*Hoya* and *Dischidia*). Medicinal plants used by local communities to cure of cancer is parasitic plants or epiphytes.

3.4. Part of uses of medicinal plants trader in Kabanjahe traditional market

Aside from whole plants, parts of medicinal plants used and traded in Kabanjahe were leaves, bark, roots, flowers, fruits, seeds, tubers, and rhizomes. Fig. 5 shows parts of medicinal plants used in the Kabanjahe traditional market. Use of leaves was recorded in 227 species, fruits in 27 species, and rhizomes in 20 species. The bark and bulb were the least utilized, that was 3 species, respectively.

A total of 227 species or more than 65% of the medicinal plants traded were leaves, which were used fresh or in the form of *simplicia*. Leaves have been used to cure injury (*Ageratum conyzoides*, *Centella asiatica*, and *Strobilanthes crispus*) and diarrhea (*Blumea balsamifera*, *Coleus ambonicus*, *Eugenia polyantha*).

The whole parts have been used in 18 species. The use of whole

Table 1
Medicinal plants recorded in the Kabanjahe traditional market, North Sumatra, Indonesia.

Plant families and species	Local name	Part used	Medicinal use
Acanthaceae			
<i>Andrographis paniculata</i> (Burm.f.) Nees	Sambiroto	Leaves	Diabetes mellitus, Malnutrition
<i>Hemigraphis alternata</i> (Blume) Hallier f.	Silembur pinggang	Leaves	Heart problem, Kidney disease
<i>Justicia gendarussa</i> Burm.f.	Sangke sempilit	Leaves	Cancer, Fever
<i>Justicia</i> sp.1	Racun biang	Leaves	Fever
<i>Justicia</i> sp.2	Besi-besi	Leaves	Kidney disease
<i>Parastrobilanthes parabolica</i> (Ness) Bremek.	Sigerbeng	Leaves	Kidney disease
<i>Parastrobilanthes</i> sp.1	Siberani	Leaves	Fever, Malnutrition
<i>Parastrobilanthes</i> sp.2	Gambal odang	Leaves	Malnutrition
<i>Peristrophe bivalvis</i> L. (Merr.)	Bulung dayang	Leaves	Fever, Malnutrition
<i>Strobilanthes cernua</i> Blume	Paris	Leaves	Bone fractures, <i>Oukup</i>
<i>Strobilanthes crispera</i> Blume	Kecibeling	Leaves	Injury, Kidney disease
<i>Strobilanthes</i> sp.1	Tepu ringring	Leaves	Kidney disease, Stomach ache
<i>Strobilanthes</i> sp.2	Pijer keling	Leaves	Diarrhea, Fever
Acrostichaceae			
<i>Drymoglossum piloselloides</i> (L.) C. Persl.	Sigelem urat	Leaves	Heart problem
Adiantaceae			
<i>Antrophyum califolium</i>	Dilah hantu hara	Leaves	Cancer, Cholesterol
<i>Adiantum</i> sp.	Regi-regi	Leaves	Kidney disease, <i>Oukup</i>
Amaranthaceae			
<i>Achyranthes aspera</i> L.	Sibera mata	Leaves	Diarrhea, Fever
<i>Celosia cristata</i> L.	Rudang gara	Leaves; flower	Fever, Maintance stamina
<i>Celosia</i> sp.	Rudang	Leaves; flower	Fever
Annonaceae			
<i>Canarium odoratum</i> (Lam.) Baill. ex King	Kenanga	Flower	<i>Oukup</i>
Apiaceae			
<i>Centella asiatica</i> (L.) Urb.	Pegaga	Leaves	Cholesterol, Injury
<i>Coriandrum sativum</i> L.	Ketumbar	Fruit	<i>Oukup</i> , Rheumatism
<i>Coriandrum</i> sp.1	Jera	Seed	Syphilis
<i>Foeniculum vulgare</i> Mill.	Adas	Fruit	<i>Oukup</i> , Rheumatism
<i>Petroselinum sativum</i> Hoffm.	Rumbane	Whole	Cholesterol, Syphilis, Malnutrition
Apocynaceae			
<i>Parameria laevigata</i> (Juss.) Molddenke	Kayu rapet	Stem	Aphrodisiac
Aquifoliaceae			
<i>Ilex odorata</i> Buch.-Ham. Ex D.Don.	Tinggeren keruk bengal	Leaves	Bone fractures
Araceae			
<i>Acorus calamus</i> L.	Jerango	Rhizome	Fever, Malnutrition
<i>Pothos junghuhnii</i> de Vriese	Leka-leka	Leaves	Malnutrition
<i>Philodendron peoppigii</i> Schott	Bewan-bewan	Leaves	Cancer, Bone fractures
<i>Pothos</i> sp.1	Pahpahleto	Leaves	Bone fractures, Malnutrition
<i>Rhaphidophora sylvestris</i> (Blume) Engl.	Tawar tubi perik	Leaves	Maintance stamina
Araliaceae			
<i>Aralia</i> sp.1	Sitelu bulung	Leaves	Bone fractures
<i>Schefflera elliptica</i> (Blume) Harms.	Tawar terumba	Leaves	Bone fractures
<i>Schefflera</i> sp.1	Sidua ngawang	Leaves	Bone fractures
<i>Schefflera</i> sp.2	Kayu idup	Leaves	Bone fractures
Arecaceae			
<i>Arenga pinnata</i> (Wurmb) Merr.	Mayang	Fruit, root	Bone fractures
<i>Calamus</i> sp.1	Ketang	Root	Bone fractures
<i>Caryota cf. mitis</i> Lour.	Andudur	Root	Bone fractures
<i>Cocos nucifera</i> L.	Tuala	Fruit, root	Bone fractures
<i>Nipa fruticans</i> (Wurmb). Thunb.	Ipah	Leaves, root	Bone fractures
Asclepiadiaceae			
<i>Dischidia imbricate</i> (Blume) Steud.	Gelem urat	Leaves	Cancer, Heart problem
<i>Dischidia nummularia</i> R.Br.	Paburnis	Leaves	Cancer, Heart problem
<i>Dischidia</i> sp.1	Siburnis	Leaves	Cancer, Heart problem
<i>Dischidia</i> sp.3	Biruru manuk	Leaves	Cancer, Heart problem
<i>Dischidia</i> sp.4	Bilalang manuk	Leaves	Cancer, Heart problem
<i>Hoya coriacea</i> Blume	Tawar ipuh	Leaves	Cancer, Heart problem
<i>Hoya diversifolia</i> Blume	Cuping-cuping kera	Leaves	Cancer, Heart problem
<i>Hoya cf. lacunose</i> Blume	Tawar ipuh simerata	Leaves	Cancer, Heart problem
<i>Hoya macrophylla</i> Blume.	Tapak gajah	Leaves	Cancer, Heart problem
<i>Hoya parasitica</i> Wall. ex Traill	Kapal-kapal kukur	Leaves	Cancer, Heart problem
<i>Hoya revolute</i> Wight ex Decne	Tawar aji	Leaves	Cancer, Heart problem
<i>Hoya</i> sp.1	Belin urat	Leaves	Cancer, Heart problem
<i>Hoya</i> sp.2	Sumanasiwa	Leaves	Cancer, Heart problem
<i>Hoya</i> sp.3	Kapal-kapal susu	Leaves	Cancer, Heart problem
<i>Hoya</i> sp.4	Tapak raja sulaiman	Leaves	Cancer, Heart problem
<i>Hoya</i> sp.5	Kapal-kapal buluh	Leaves	Cancer, Heart problem
<i>Hoya</i> sp.6	Kapal-kapal jantung	Leaves	Cancer, Heart problem
Asteraceae			
<i>Bidens chinensis</i> (L.) Willd.	Kelesi	Leaves	Diarrhea, Lever, Malnutrition
<i>Blumea balsamifera</i> (L.) DC.	Galunggung	Leaves	Diarrhea
<i>Blumea lacera</i> (Burm.f.) DC.	Sirungkas	Leaves	Fever
<i>Chromolaena odorata</i> (L.) R.M.King & H.Rob.	Spesel	Leaves	Maintance stamina

Table 1 (continued)

Plant families and species	Local name	Part used	Medicinal use
<i>Elephantopus scaber</i> L.	Dolok liman	Leaves	Injury
<i>Emilia sonchifolia</i> (L.) DC. ex DC.	Sundur langit	Leaves	Malnutrition
<i>Emilia</i> sp.	Cileket kambing	Leaves	Kidney disease
<i>Erigeron sumatrensis</i> Retz.	Ciak-ciak	Leaves	Oukup
<i>Nephrolepis imbricate</i> Presl.	Sampinur	Stem	Lever
<i>Gynura procumbens</i> (Lour.) Merr.	Sambung nyawa	Leaves	Diarrhea
<i>Leontopodium alpinum</i> Colm. ex Cass.	Binara rembang	Whole section	Oukup
<i>Spilanthes iabadicensis</i> A.H. Moore	Sibancir	Leaves; flower	Tooth ache
<i>Sonchus arvensis</i> L.	Kalin cahyo juma	Leaves	Stomach ache
<i>Vernonia arborea</i> Welw. ex. O.Hoff.	Nderasi	Leaves	Fever
<i>Vernonia cinerea</i> (L.) Less.	Alum-alum	Leaves	Fever, Lever
<i>Vernonia</i> sp.	Sarimarnaek	Leaves	Erpangir ku lau
Balsaminaceae			
<i>Balsamina latifolia</i> (L.) DC.)	Bunga sapa	Flower	Cancer, Fever
<i>Impatiens alboflava</i> Miq.	Saringginging	Flower	Cancer, Fever
<i>Impatiens balsamina</i> L.	Pacar air	Flower	Cancer, Fever
<i>Impatiens walleriana</i> Hook.f.	Bunga pancur	Flower	Cancer, Fever
<i>Impatiens</i> sp.	Bunga kiung	Flower	Cancer, Fever
Berberidaceae			
<i>Berberis</i> sp.	Daun mutiara	Leaves	Kidney disease
Bignoniaceae			
<i>Oroxylum indicum</i> (L.) Kurz	Abang-abang	Leaves	Kidney disease
Blechnaceae			
<i>Stenochlaena palustris</i> (Burm.f.) Bedd.	Ndurabi	Leaves	Malnutrition
Boraginaceae			
<i>Heliotropium indicum</i> L.	Sangketan	Leaves	Diarrhea, Fever
Bromeliaceae			
<i>Ananas comosus</i> (L.) Merr.	Kenas	Fruit	Hypertension, Kidney disease
Burseraceae			
<i>Canarium pilosum</i> A.W.Benn.	Damar	Damar	Erpangir ku lau
Caryophyllaceae			
<i>Cerastium cf. papuanum</i> Schult. ex. Mattf.	Garang-garang	Leaves	Cholesterol, Lever
<i>Drymaria cordata</i> (L.) Willd. ex. Schult.	Sirampas bide	Leaves	Fever, Hypertension
Caesalpiniaceae			
<i>Koompassia excels</i> (Becc.) Taub.	Tualang	Stem	Maintance stamina
<i>Caesalpinia sappan</i> L.	Sepang	Stem	Maintance stamina
Crassulaceae			
<i>Kalanchoe pinnata</i> (Lam.) Pers.	Dingin-dingin	Leaves	Fever, Ulcer
Cucurbitaceae			
<i>Benincasa hispida</i> (Thunb.) Cogn.	Gundur	Seed	Cancer, Lever, Malnutrition
<i>Cucumis sativus</i> L.	Cimen	Seed	Cancer, Malnutrition
<i>Cucurbita moschata</i> Duchesne	Jambe	Seed	Cancer, Lever, Malnutrition
<i>Lagenaria siceraria</i> (Molina) Standl.	Tabu	Seed	Cancer, Lever, Malnutrition
<i>Lagenaria</i> sp.	Tabu pagit	Seed	Cancer, Malnutrition
Dioscoreaceae			
<i>Dioscorea alata</i> L.	Gadung belin	Tuber	Diabetes mellitus, Stomach ache
<i>Dioscorea</i> sp.	Gadung raru	Tuber	Diabetes mellitus
Elaeagnaceae			
<i>Elaeagnus latifolia</i> L.	Durung-durung	Leaves	Lever
Ericaceae			
<i>Gaultheria leucocarpa</i> Blume	Kalin cahyo	Seeds	Oukup
Euphorbiaceae			
<i>Acalypha indica</i> L.	Anting-anting	Seeds	Cholesterol, Rheumatism
<i>Aleurites moluccanus</i> (L.) Willd.	Kembiri	Seed	Diarrhea, Ulcer
<i>Allamanda cathartica</i> L.	Alamanda	Flower	Erpangir ku lau
<i>Antidesma</i> sp.	Simaragung-agung	Leaves	Cholesterol
<i>Bischofia javanica</i> Blume	Cinkam	Bark, Root	Cholesterol, Diabetes mellitus
<i>Euphorbia hirta</i> L.	Patikan kebo	Leaves	Gas, Hypertension
<i>Euphorbia</i> sp.	Aji katimukmuk	Leaves	Injury, Ulcer
<i>Hancea penangensis</i> (Mull.Arg.) S.E.C.Sierra, Kulju and Welzen	Ariung	Leaves	Maintance stamina
<i>Homalanthus giganteus</i> Zoll. and Moritz.	Dulpak	Seeds	Fever
<i>Mallotus subpeltatus</i> (Blume) Mull. Arg.	Puspup	Seeds	Diarrhea, Fever
<i>Phyllanthus niruri</i> L.	Siraprap	Whole	Kidney disease, Syphilis
<i>Phyllanthus</i> sp.	Tanduk erbuah	Whole	Kidney disease
<i>Triadica</i> sp.	Waren gegeh	Stem	Cancer, Cholesterol, Fever, Lever
Equisetaceae			
<i>Equisetum debile</i> Roxb. ex Vaucher	Sendep-sendep	Whole	Kidney disease, Hypertension
Fabaceae			
<i>Abrus precatorius</i> L.	Saga	Seed	Malnutrition
<i>Alyxia reinwardtii</i> Blume	Pulosari	Stem	Cancer, Cholesterol
<i>Bauhinia purpurea</i> L.	Sirang-sirang	Leaves	Oukup
<i>Cassia siamea</i> Lam.	Juhar	Leaves	Diarrhea
<i>Cassia alata</i> L.	Galinggang	Leaves	Itchy
<i>Cassia tora</i> L.	Kick-kicik	Leaves	Diarrhea
<i>Callerya nieuwenhuisii</i> (J.J.Sm.) Scholt	Ndupar	Leaves	Bone fractures
<i>Crotalaria juncea</i> L.	Korok-korok	Leaves	Diarrhea, Fever

Table 1 (continued)

Plant families and species	Local name	Part used	Medicinal use
<i>Desmodium gargenticum</i> DC.	Nakan angin	Leaves	Rheumatism
<i>Desmodium strangulatum</i> Wight & Arn.	Iket-iket manuk	Leaves	Bone fractures
<i>Desmodium</i> sp.	Tawar keruk bengah	Leaves	Bone fractures
<i>Hyloidesmum repandum</i> (Vahl.) H.Ohashi & R.R.Mill.	Siderne	Leaves	Cholesterol, Fever
<i>Mimosa pudica</i> L.	Pedem-pedem	Root	Kidney disease
<i>Parkia roxburghii</i> G. Don	Kedawung	Seed	Cancer, Cholesterol, Lever
<i>Psophocarpus tetragonolobus</i> (L.) DC.	Bereng	Fruit	Malnutrition, Maintance stamina
Fagaceae			
<i>Quercus lusitanica</i> Lam.	Manjakani	Seed	Aphrodisiac
Gesneriaceae			
<i>Aeschynanthus sumatranus</i> Ohwi.	Sigara tundal	Leaves	Cancer, Heart problem
<i>Aeschynanthus</i> sp.1	Raja Bulung-bulung	Leaves	Cancer, Heart problem
<i>Aeschynanthus</i> sp.2	Biring tundal	Leaves	Cancer, Heart problem
<i>Cyrtandra</i> sp.	Gumbar api	Leaves	Cancer, Heart problem
<i>Episcia</i> sp.	Baruk-baruk	Leaves	Kidney disease
<i>Monophyllaea leuserensis</i> B.L.Burt	Gagatan ulok	Leaves	Heart problem
Gleicheniaceae			
<i>Gleichenia linearis</i> (Burm.f.) C.B.Clarke	Sampilpil	Leaves	Fever, Bone fractures
<i>Gleichenia</i> sp.	Paku culiki	Leaves	Bone fractures, Cancer
Hamamelidaceae			
<i>Altingia excels</i> Noronha	Tulasan	Stem	Maintance stamina
Hypericaceae			
<i>Cratoxylum formosum</i> (Jacq.) Benth. & Hook.f. ex Dyer,	Garunggang	Leaves	Diarrhea
Lamiaceae			
<i>Callicarpa longifolia</i> Lam.	Bedi-bedi	Leaves	Kidney disease, Syphilis
<i>Coleus scutellarioides</i> (L.) Benth.	Terbangun gara	Leaves	Diarrhea
<i>Coleus amboinicus</i> Lour.	Terbangun rata	Leaves	Diarrhea
<i>Coleus</i> sp.	Sibo	Leaves	Injury
<i>Leucas decemdentata</i> (Willd.) Sm.	Silembur kumpa	Leaves	Kidney disease
<i>Ocimum americanum</i> L.	Ruku-ruku begu	Whole	Oukup
<i>Ocimum basilicum</i> L.	Kumangi	Whole	Oukup
<i>Ocimum</i> sp.	Selasih	Seed	Oukup
<i>Ocimum sanctum</i> L.	Ruku-ruku	Whole	Oukup
<i>Orthosiphon stamineus</i> Benth.	Kumis kucing	Leaves	Kidney disease
<i>Paraphlomis cf. javanica</i> (Blume) Prain	Babi dalu	Leaves	Aphrodisiac, Maintance stamina
<i>Pogostemon cablin</i> (Blanco) Benth.	Nilam	Leaves	Oukup, Diarrhea
<i>Pogostemon auricularius</i> (L.) Hassk.	Ikur-ikur asu	Leaves	Aphrodisiac, Syphilis, Maintance stamina
Lauraceae			
<i>Cinnamomum burmanni</i> (Nees & T.Nees) Blume	Kulit manis	Bark, leaves	Oukup, Rheumatism
<i>Cinnamomum porrectum</i> (Roxb.) Kosterm.	Pirawas	Leaves	Oukup
<i>Cinnamomum cassia</i> (L.) J.Presl	Bunga lawang	Flower	Oukup, Rheumatism
<i>Cinnamomum</i> sp.1	Sitelu uruk	Leaves	Bone fractures, Oukup
<i>Cinnamomum</i> sp.2	Gajah menta	Leaves	Oukup
<i>Cinnamomum</i> sp.3	Gajah menikam	Leaves	Bone fractures
<i>Litsea</i> sp.	Junjung buhit	Leaves	Erpangir ku lau
Liliaceae			
<i>Allium cepa</i> L.	Pia	Bulb	Diarrhea, Fever, Malnutrition, Rheumatism, Ulcer
<i>Allium sativum</i> L.	Lasuna	Bulb	Cholesterol, Diarrhea, Hypertension, Rheumatism
<i>Allium tuberosum</i> Rotler ex Spreng.	Kuca	Bulb	Cholesterol, Maintance stamina
<i>Belamcanda chinensis</i> (L.) DC.	Piso-piso	Leaves	Fever, Bone fractures
<i>Cordyline fructicosa</i> (L.) A.Chev.	Kalinjuang	Leaves	Erpangir ku lau, Fever, Malnutrition
Loganiaceae			
<i>Strychnos ligustrina</i> Blume	Bidara laut	Leaves	Bone fractures, Maintance stamina
Lomariopsidaceae			
<i>Bolbitis heteroclita</i> (C. Presl) Ching	Lompat pitu	Leaves	Cancer, Maintance stamina
Loranthaceae			
<i>Loranthus</i> sp.	Sarindan kopi	Leaves	Cancer, Maintance stamina
Lycopodiaceae			
<i>Lycopodium carinatum</i> Desv. ex Poir.	Tamtam jumalo	Leaves	Cancer, Bone fractures
<i>Lycopodium nummularifolium</i> Blume	Taratuit	Leaves	Cancer, Bone fractures
<i>Lycopodium proliferum</i> Blume	Sijergal	Whole	Aphrodisiac, Bone fractures
<i>Lycopodium phlegmaria</i> L.	Tara tinggi	Leaves	Cancer, Kidney disease
Magnoliaceae			
<i>Michelia champaca</i> L.	Kantil	Flower	Erpangir ku lau, Oukup
Malvaceae			
<i>Urena lobata</i> L.	Sampelulut	Root, flower	Fever, Bone fractures
<i>Grewia laevigata</i> Vahl.	Simpaling	Leaves	Erpangir ku lau, Oukup
<i>Hibiscus similis</i> Blume	Baru	Root	Fever, Bone fractures
<i>Sida rhombifolia</i> L.	Bunga beras-beras	Flower; root	Fever, Bone fractures, Maintance stamina
<i>Sida</i> sp.1	Salah ernipi	Leaves	Erpangir ku lau
<i>Sida</i> sp.2	Bunga ubung-ubung	Flower	Erpangir ku lau
<i>Sida</i> sp.3	Sibalik ernipi	Leaves	Erpangir ku lau
<i>Wissadula periplocifolia</i> C. Presl.	Sibalik sumpah	Leaves	Erpangir ku lau
Maranthaceae			
<i>Donax cannaeformis</i> (G.Forst.) K.Schum.	Bomban	Leaves	Fever, Bone fractures

Table 1 (continued)

Plant families and species	Local name	Part used	Medicinal use
Melastomaceae			
<i>Melastoma malabathricum</i> L.	Sanduduk	Leaves	Diarrhea, Bone fractures, <i>Oukup</i>
<i>Melastoma sylvaticum</i> Schltld.	Siduduk tonggal	Leaves	Bone fractures, <i>Oukup</i> , Stomach ache
<i>Melastoma</i> sp.	Sanduduk kerangan	Leaves	Diarrhea
Meliaceae			
<i>Aglaiia odoratissima</i> Blume	Ukat-ukat	Leaves	Diarrhea
<i>Aglaiia argentea</i> Blume	Sibalik angin	Leaves	Stomach ache
Menispermaceae			
<i>Tinospora crispa</i> (L.) Hook.f. & Thomson	Brotowali	Stem	Col, Diabetes mellitus, Malnutrition
<i>Tinospora</i> sp.	Pecah dareh	Leaves	Heart problem
<i>Cyclea barbata</i> Miers	Pupuk muljadi	Leaves	Hypertension, Malnutrition
Molluginaceae			
<i>Mollugo penthaphylla</i> L.	Rangrang gumis	Whole	Kidney disease, Stomach ache
<i>Molugo</i> sp.	Rancang	Leaves	Hypertension
Moraceae			
<i>Ficus cf deltoidea</i> Jack.	Tawar palitan	Leaves	Aphrodisiac, Cancer, Heart problem
<i>Ficus</i> sp.	Kapal-kapal ringgit	Leaves	Cancer
Myrtaceae			
<i>Eugenia polyantha</i> Barb. Rord.	Salam	Leaves	Diarrhea, <i>Oukup</i>
<i>Eugenia aromatic</i> O. Berg	Cengkeh	Leaves, Flower	Bone fractures, <i>Oukup</i> , Rheumatism, Syphilis, Tooth ache
<i>Melaleuca leucadendra</i> (L.) L.	Kayu putih	Leaves	<i>Oukup</i>
<i>Psidium guajava</i> L.	Galiman	Leaves	Diarrhea
Myristicaceae			
<i>Myristica fragrans</i> Houltt.	Pala	Seed	Rheumatism, Syphilis, Tooth ache
Myrsinaceae			
<i>Ardisia laevigata</i> Blume	Antik	Leaves	Cholesterol, Rheumatism
<i>Labisia pumila</i> (Blume) Fern.-Vill	Rumput patimah	Leaves	Aphrodisiac
Nepentaceae			
<i>Nepenthes gracilis</i> Korth.	Takur-takur	Leaves	Heart problem, Aphrodisiac
<i>Nepenthes ampullaria</i> Jack	Takur kebo	Leaves	Heart problem
Nyctaginaceae			
<i>Pisonia umbellata</i> Seem.	Loning	Leaves	Cholesterol, Bone fractures
Oleaceae			
<i>Jasminum sambac</i> (L.) Aiton	Melati	Flower	<i>Oukup</i> , <i>Erpangir ku lau</i>
Ophioglossaceae			
<i>Ophioglossum pedunculatum</i> Desv.	Sendok-sendok tonggal	Whole	Aphrodisiac, Cancer, Maintance stamina
<i>Ophioglossum pendulum</i> L.	Tete nipe	Leaves	Cancer, Heart problem
Orchidaceae			
<i>Anoectochilus reinwardtii</i> L.	Surat dibata	Whole	Aphrodisiac, Cancer, Maintance stamina
<i>Dendrobium salaccense</i> (Blume) Lindl.	Kapias	Leaves	Fever, Maintance stamina
<i>Macodes petola</i> (Blume) Lindl.	Surat dibata	Whole	Cancer, Maintance stamina
<i>Nervilia aragoana</i> Gaudich.	Selemban sebulan	Whole	Aphrodisiac, Maintance stamina
<i>Nervilia plicata</i> (Andrews) Schltz.	Selemban setahun	Whole	Aphrodisiac, Maintance stamina
Oxalidaceae			
<i>Biophytum adiantoides</i> Wight ex Edgew. and Hook.f.	Sigurjil	Leaves	Aphrodisiac, Bone fractures
<i>Oxalis corniculata</i> L.	Asam-asam	Leaves	Cholesterol, Hypertension
Pandanaceae			
<i>Pandanus amaryllifolius</i> Roxb.	Pandan	Leaves	<i>Oukup</i>
Pedaliaceae			
<i>Sesamum orientale</i> L.	Lenga	Fruits	<i>Oukup</i> , Rheumatism, Lever
Piperaceae			
<i>Piper aduncum</i> L.	Belo-belo	Leaves	Eye infection, Injury, <i>Oukup</i>
<i>Piper attenuatum</i> Buch.-Ham. Ex Miq.	Belo karangan	Leaves	Injury, Mal, <i>Oukup</i>
<i>Piper betle</i> L.	Belo situhu	Leaves	Eye infection, Fever, Malnutrition
<i>Piper cubeba</i> Vahl.	Kemukus	Fruit	Rheumatism
<i>Piper longum</i> L.	Lada tunggal	Fruit	Heart problem, Maintance stamina, Rheumatism
<i>Piper nigrum</i> L.	Lada	Seed	Cor, Maintance stamina, Rheumatism
<i>Piper umbellatum</i> L.	Bulung gumba	Leaves	Fever, Maintance stamina
<i>Piper</i> sp.1	Gumbalayo	Leaves	Diarrhea, Maintance stamina
<i>Piper</i> sp.2	Dilah kerbo	Leaves	Aphrodisiac, Maintance stamina
Passifloraceae			
<i>Adenia cordifolia</i> (Blume) Engl.	Cimen riris	Leaves	Hypertension, Kidney disease
<i>Passiflora suberosa</i> L.	Tawar rancang	Leaves	Cancer, Cholesterol
Polygonaceae			
<i>Persicaria chinensis</i> (L.) H. Gross	Siang-siang	Leaves	Cholesterol
Polygalaceae			
<i>Polygala venenosa</i> Juss. ex Poir.	Parimbalang rih	Leaves	Cholesterol, Diarrhea, Fever
<i>Polygala</i> sp.	Tonggap terulang	Leaves	Cholesterol
Polypodiaceae			
<i>Lepisorus longifolius</i> (Blume) Holttum.	Peldang tubi perik	Leaves	Cancer
<i>Macrosporium</i> sp.	Peldang kuliki	Leaves	Cancer
<i>Microsorium buergerianum</i> (Miq) Ching.	Paduka aji	Leaves	Cancer, Heart problem
<i>Platyterium coronarium</i> (Mull.) Desv.	Peldang raja	Leaves	Bone fractures, Cancer
Poaceae			
<i>Andropogon nardus</i> L.	Sereh wangi	Stem	<i>Oukup</i> , Rheumatism
<i>Andropogon zizanioides</i> (L.) Urb.	Akar wangi	Root	<i>Oukup</i>

Table 1 (continued)

Plant families and species	Local name	Part used	Medicinal use
<i>Cymbopogon citratus</i> (DC.) Staft	Sereh	Stem	Oukup, Rheumatism
<i>Imperata cylindrical</i> (L.) Raeusch.	Rih	Rhizome	Kidney disease, Hypertension
<i>Leptapsis</i> sp.1	Sibalik putar	Leaves	Erpangir ku lau, Kidney disease
<i>Leptapsis</i> sp.2	Putar balik	Leaves	Erpangir ku lau
<i>Leptapsis</i> sp.3	Putar leman	Leaves	Erpangir ku lau
<i>Lophatherum gracile</i> Brongn.	Kambing bajar	Leaves; tuber	Aphrodisiac, Maintance stamina
<i>Lophatherum</i> sp.	Kisik	Flower	Kidney disease
<i>Panicum barbatum</i> Lam.	Kisik	Leaves	Kidney disease, Hypertension
<i>Pogonatherum crinitus</i> Thunb.	Padang lalis	Whole	Bone fractures, Aphrodisiac
<i>Scleria laevis</i> Willd.	Bulung sae-sae	Leaves	Kidney disease
<i>Scleria pergracilis</i> (Nees) Kunth	Sayat-sayat	Leaves	Kidney disease, Hypertension
<i>Sorghum saccharatum</i> (L.) Moench	Dawa bendil	Fruit	Malnutrition
<i>Sorghum</i> sp.	Dawacur	Fruit	Malnutrition
<i>Schizostachium</i> sp.1	Buluh regan	Root	Bone fractures, Kidney disease
<i>Schizostachium</i> sp.2	Buluh laga	Root	Bone fractures, Kidney disease
<i>Vaniculum viride</i>	Jaba ikur	Fruit	Malnutrition
<i>Vetiveria zizanioides</i> (L.) Nash	Kepias	Leaves	Fever
Podocarpaceae			
<i>Dacrycarpus imbricatus</i> (Blume) de Laub.	Jamuju /cemba-cemba	Leaves	Bone fractures
Polypodiaceae			
<i>Pyrosia sphaerosticha</i> (Mett.) Ching	Gagatan harimo jantan	Leaves	Diarrhea
Pteridaceae			
<i>Pteris ensiformis</i> Burm.f.	Paku loncat	Leaves	Cancer
Ranunculaceae			
<i>Nigella sativa</i> L.	Jintan	Fruit	Oukup, Rheumatism
Rosaceae			
<i>Prunus acutissima</i> Urb.	Kacihe	Leaves	Diarrhea
<i>Rubus alceaefolius</i> S. Vidal	Kupi-kupi	Leaves	Diarrhea
<i>Rubus pyrifolius</i> Hook.f. & Thomson ex Hook.f.	Siraprap igung	Leaves	Diarrhea
<i>Rubus</i> sp.	Cancang dori	Leaves	Diarrhea
Rubiaceae			
<i>Hedyotis auricularia</i> L.	Bibi ketandu	Leaves	Hypertension
<i>Hedyotis</i> sp.	Aji ketandu	Leaves	Ulcer, Fever
<i>Hemidiodia ocyimifolia</i> (Willd. ex Roem. and Schult.) K. Schum.	Bibi katimukmuk	Leaves	Ulcer, Kidney disease
<i>Mussaenda philippinensis</i> Merr.	Gagatan beruang	Leaves	Diarrhea, Maintenance stamina
<i>Myrmecodia</i> sp.	Sarang semut	Tuber	Cancer, Heart problem
<i>Oldenlandia corymbosa</i> L.	Lidah ular	Leaves	Heart problem
<i>Oldenlandia</i> sp.1	Waren karang	Leaves	Kidney disease
<i>Oldenlandia</i> sp.2	Sinonggali teba	Leaves	Kidney disease
<i>Oldenlandia</i> sp.3	Teraka perkas	Leaves	Kidney disease
<i>Oldenlandia</i> sp.4	Kebal pusuh	Leaves	Kidney disease, Ulcer
<i>Oldenlandia</i> sp.5	Kebal pusuh	Leaves	Diarrhea
<i>Paederia verticillata</i> L.	Selaun bulung	Leaves	Bone fractures, Maintance stamina
<i>Pavetta subvelutina</i> Miq.	Jarum-jarum	Leaves	Bone fractures
<i>Psychotria</i> sp.	Nahang-nahang	Leaves	Bone fractures
<i>Uncaria gambir</i> (Hunter) Roxb.	Gambir	Sap	Cholesterol, Diarrhea
Rutaceae			
<i>Evodia speciosa</i> Rchb.f. & Zoll ex Teijsm. and Binn.	Telu bulung	Leaves	Oukup
<i>Citrus x aurantium</i> L.	Rimo bunga	Leaves; fruit	Cough
<i>Citrus hystrix</i> DC.	Rimo mungkur	Leaves; fruit	Aphrodisiac, Erpangir ku lau, Fever, Oukup, Rheumatism
<i>Citrus nobilis</i> Lour.	Rimo puraga	Leaves; fruit	Erpangir ku lau, Oukup
<i>Citrus medica</i> L.	Rimo gawang	Leaves; fruit	Erpangir ku lau, Oukup
<i>Citrus</i> sp.1	Rimo hantu	Leaves; fruit	Erpangir ku lau, Oukup
<i>Citrus</i> sp.2	Rimo kayu	Leaves; fruit	Erpangir ku lau, Oukup
<i>Citrus</i> sp.3	Rimo kejaren	Leaves; fruit	Erpangir ku lau, Oukup
<i>Citrofortunella x microcarpa</i> Bunge	Rimo kesturi	Leaves; fruit	Erpangir ku lau, Oukup
<i>Citrus</i> sp.4	Rimo kersik	Leaves; fruit	Erpangir ku lau, Oukup
<i>Citrus</i> sp.5	Rimo kuku harimau	Leaves; fruit	Erpangir ku lau, Oukup
<i>Citrus</i> sp.6	Rimo lemon	Leaves; fruit	Cough
<i>Citrus</i> sp.7	Rimo malam	Leaves; fruit	Oukup
<i>Murraya paniculata</i> (L.) Jack.	Kemuning	Flower	Cholesterol
<i>Ruta angustifolia</i> Pers.	Inggau	Damar	Erpangir ku lau
Santalaceae			
<i>Santalum album</i> L.	Cendana	Stem	Oukup
Schisandraceae			
<i>Kadsura scandens</i> (Blume) Blume	Sira-sira	Leaves	Aphrodisiac, Diarrhea
Scrophulariaceae			
<i>Curanga fel-terrae</i> (Lour.) Merr.	Sidua kupang	Leaves	Maintance stamina, Malnutrition, Cholesterol
<i>Lindernia viscosa</i> (Hornem.) Merr.	Pegun tanah	Leaves	Diabetes mellitus, Syphilis, Malnutrition, Lever
<i>Lindernia</i> sp.1	Amak-amak	Leaves	Malnutrition, Maintance stamina
<i>Lindernia</i> sp.2	Rakut pertibi	Leaves	Maintance stamina, Bone fractures
<i>Lindernia</i> sp.3	Kukur-kukur	Leaves	Malnutrition, Diarrhea
Selaginellaceae			
<i>Selaginella</i> sp.	Asar-asar	Whole	Bone fractures, Erpangir ku lau
Simaroubaceae			
<i>Eurycoma longifolia</i> Jack	Bulung besan	Leaves; root	Aphrodisiac, Diarrhea, Syphilis

Table 1 (continued)

Plant families and species	Local name	Part used	Medicinal use
Smilacaceae			
<i>Smilax</i> sp.	Rambut tualan	Stem	Aphrodisiac, Syphilis
Solanaceae			
<i>Physalis angulata</i> L.	Pultak-pultak	Whole	Hypertension, Fever
<i>Nicotiana tabacum</i> L.	Mbako	Leaves	Injury
<i>Solanum verbascifolium</i> L.	Lancing	Leaves	Bone fractures, Injury
Sterculiaceae			
<i>Helicteres isora</i> L.	Lada putar	Fruit	Aphrodisiac, Syphilis, Rheumatism
Styracaceae			
<i>Styrax</i> sp.	Kemeyan	Damar	Erpangir ku lau,
Theaceae			
<i>Eurya</i> sp.	Raru	Bark	Diabetes mellitus, Cholesterol
Thymeliaceae			
<i>Aquilaria</i> sp.	Gaharu	Damar	Erpangir ku lau
<i>Phaleria macrocarpa</i> (Scheff.) Boerl.	Mahkota dewa	Fruit	Cholesterol
Urticaceae			
<i>Boehmeria sanguine</i> Hassk.	Perdit	Leaves	Fever
<i>Elatostema strigosum</i> Hassk.	Sisik naga	Leaves	Cholesterol, Maintance stamina
<i>Elatostema</i> sp.	Sitekep	Leaves	Cholesterol, Fever
<i>Leucosyke capitellata</i> Wedd.	Ikan-ikan	Leaves	Malnutrition, Oukup
<i>Poikilospermum suaveolens</i> (Blume) Merr.	Apuspus	Leaves	Syphilis
Usneaceae			
<i>Usnea barbata</i>	Tai angin	Whole	Aphrodisiac, Oukup, Rheumatism, Syphilis
Verbenaceae			
<i>Clerodendrum calamitosum</i> L.	Rimbo tasik	Leaves	Cough
<i>Callicarpa longifolia</i> Lam.	Bening-bening	Leaves	Syphilis
<i>Premna tomentosa</i> Willd.	Tabar-tabar	Leaves	Aphrodisiac, Bone fractures
<i>Vitex trifolia</i> L.	Salagundi	Leaves	Cough, Fever
Violaceae			
<i>Viola inconspicua</i> Blume	Calung-calung	Leaves	Syphilis
Vitaceae			
<i>Ampelocissus thyrsoiflora</i> (Blume) Planch	Gagatan harimo	Leaves	Aphrodisiac, Diarrhea, Maintance stamina,
<i>Ampelocissus</i> sp.1	Gagatan harimo betina	Leaves	Diarrhea, Aphrodisiac
<i>Ampelocissus</i> sp.2	Tawar sidari	Leaves	Diarrhea
<i>Ampelocissus</i> sp.3	Tawar bisa	Leaves	Diarrhea, Cancer
<i>Cayratia japonica</i> (Thunb.) Gapneb.	Kerpebalu	Leaves	Bone fractures, Fever
Zingiberaceae			
<i>Alpinia galangal</i> L. (Willd.)	Kelawas	Leaves, Rhizome	Oukup, Itc, Rheumatism
<i>Alphinia</i> sp.	Laja	Rhizome	Oukup
<i>Amomum cardamomum</i> L.	Kapulaga	Rhizome	Oukup, Maintance stamina, Rheumatism
<i>Boesenbergia pandurata</i> (Roxb.) Schltr.	Temu kunci	Rhizome	Maintance stamina
<i>Curcuma aeruginosa</i> Roxb.	Temu itam	Rhizome	Cancer, Cholesterol
<i>Curcuma heyneana</i> Valetton & Zijp.	Kuning gajah	Rhizome	Oukup
<i>Curcuma domestica</i> Valetton	Kuning gersing	Leaves, Rhizome	Oukup, Diarrhea, Stomach ache, Injury
<i>Curcuma mangga</i> Valetton & Zijp.	Temu mangga	Rhizome	Oukup
<i>Curcuma zanthorrhiza</i> Roxb.	Temulawak	Rhizome	Stomach ache, Malnutrition
<i>Etilingera eliator</i> (Jack.) R.M.Sm.	Cekala	Leaves, Stem	Cholesterol, Fever, Oukup
<i>Hedychium cylindricum</i> Ridl.	Cekala kabang	Leaves	Erpangir ku lau, Cancer
<i>Kaempferia rotunda</i> L.	Temu putih	Rhizome	Cancer, Cholesterol
<i>Kaempferia galangal</i> L.	Keciwer	Rhizome	Diarrhea, Malnutrition, Rheumatism, Stomach ache
<i>Zingiber amaricans</i> Blume	Lempuyang	Rhizome	Oukup
<i>Zingiber aromaticum</i> Valetton	Lempuyang wangi	Rhizome	Oukup
<i>Zingiber officinale</i> Roscoe	Bahing	Leaves, Rhizome	Cough, Fever, Injury, Oukup, Rheumatism
<i>Zingiber purpureum</i> Roscoe	Bungle	Rhizome	Oukup, Rheumatism
<i>Zingiber zerumbet</i> (L.) Roscoe ex Sm.	Lempuyang gajah	Rhizome	Oukup, Rheumatism
<i>Zingiber</i> sp.1	Cekala rih	Rhizome	Erpangir ku lau
<i>Zingiber</i> sp.2	Alia	Rhizome	Oukup

parts was determined by the small size of plants (*Anoectochillus reinwardtii*, *Macodes petola*, and *Ophioglossum pedunculatum*) or difficulty to separate the parts of plants (*Phyllanthus urinaria*). The utilization of whole parts of plants resulted in destructive harvesting leading to the rapid depletion of population in the field and even to the total disappearance of plants, making it hard to find, hence limited supply. This is the case with regard to *Anoectochillus reinwardtii*, *Macodes petola*, and *Ophioglossum pedunculatum*.

The traders of medicinal plants in the Kabanjahe market sold roots as much as 4.3% whereas and bark of less than 1%. The main roots have been used *Eurycoma longifolia* and *Hibiscus similis*), and adventitious roots in *Areca catechu*, *Caryota cf. mitis* and *Calamus* sp.. The roots of the above species have been used to treat various

diseases, such as: cancer, diabetes mellitus, and syphilis. Bark of *cinkam* (*Bischofia javanica* Blume) has been used as a spice in cooking by the major traditional sub-ethnic Batak of Simalungun, and raru (*Eurya* sp.) have been utilized in the production of *tuak* (traditional wine of the Batak). Barks of the plant which was sold in the direct harvest of forest Except for *Cinnamomun burmanii*, which has been in cultivation, barks are usually sold by harvesting them directly from forests.

3.5. Phytochemical profile

Most of the cited medicinal plants above have been documented pharmacologically and their chemical profiles have been well studied. Roots of *Eurycoma longifolia* Jack have been reported

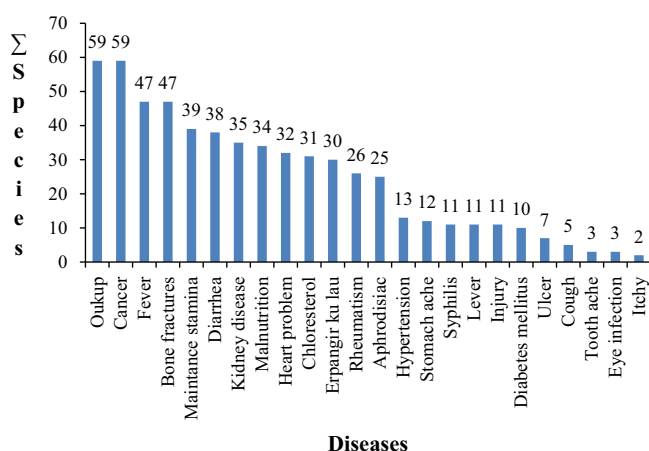


Fig. 4. Number of plants species used for different diseases by traders of medicinal plants in Kabanjahe traditional market.

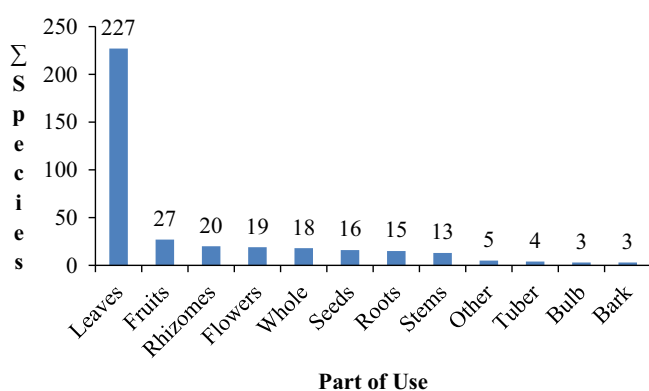


Fig. 5. The parts of medicinal plants used in the Kabanjahe traditional market.

to contain quassinoid-C₂₀ (13^β, 21-dihydroxy eurikomanol), and the leaves contain quassinoid-C₂₀ (13^α, 21-epoxy) (Achmad et al., 2008); *Euphorbia hirta* L. contains flavonoids, terpenoids, phenols, and essential oils (Huang et al., 2012); *Vernonia cinerea* (L.) Less. contains steroids, glycosides, triterpenoids, lupeol, stigmaterol, β-sitosterol (Haque et al. 2012); *Selaginella* contains alkaloids, phenols (flavonoids, tannins, saponins), and terpenoids (triterpene, steroid) (Chikmawati et al., 2008; Setyawan, 2009); and *Piper aduncum* L. contains apiol, β-caryophyllen, piperitone, α-humulene (Rali et al., 2007).

Some plants recorded in the present study are being investigated for their pharmacological activity potentials, but the chemical profiles of many others are still little known, such as Asclepiadiaceae (*Dischidia imbricate* (Blume) Steud, *Dischidia nummularia* R.Br., *Hoya coriacea* Blume, *Hoya diversifolia* Blume, *Hoya cf lacunose* Blume, *Hoya macrophylla* Blume, *Hoya revolute* Wight ex Decne), Orchidaceae (*Anoectochilus reinwardtii* L., *Macodes petola* (Blume) Lindl.) and Euphorbiaceae (*Bischofia javanica*). Therefore, they are further investigation for their phytochemical compounds and bioassay.

4. Discussion

The traders of medicinal plants in Kabanjahe market were mostly from the Batak Karo sub-ethnicity, hence the local names of medicinal plants are highly similar. Ethnical diversity in medicinal plants trading would have implications on the higher number of medicinal plant species that were traded (Betti, 2002)

and variety of local names of medicinal plants (Van Andel et al., 2012). In the traditional culture of the Batak Karo sub-ethnicity, women were responsible for maintaining the health of the family, whereas men were responsible for the fulfillment of basic needs, hence women are more knowledgeable about and able to identify medicinal plants better than men (Voeks, 2006). Eyssartier et al. (2008) said that the difference of knowledge on the usage of medicinal plants between men and women is related to the way inheritance handled in the family, which in this case it is mainly done by the women, the mother or the grandmother. Female domination in the trade of medicinal plants was also found in Ghana (Van Andel et al., 2012) and Bolivia (Macia et al., 2005). This is due to the advantages of trading of medicinal plants that can be carried out by women who not only earn the living but at the same time they do parenting.

To improve the services to customer, the traders developed storage systems and arrangement of medicinal plants in the stalls. The containers made of plastic had been the top choice. Those were related to the advantages possessed by plastic materials, which are lighter, relatively cheap, durable, and easily moved. Keeping the medicinal plants in plastic baskets without cover caused the plants to become dirty, whereas using plastic bags tightly covered led to poor air circulation that caused the growth of fungi on medicinal plants stored therein. Only 60% of the traders have used covered wood cabinets, so as to keep the stored medicinal plants clean. To improve the quality of medicinal plants sold, so it is important to improve the storage system used by the Kabanjahe market traders. The technique of storing medicinal plants in wood drawers and cabinets has long been used by the Javanese in Yogyakarta, but at present such a storage method is rarely used and very hard to find any (Wahyono et al., 2008)

The number of medicinal plant species sold in the Kabanjahe traditional market was higher than in any such markets in Indonesia (Kriswiyanti et al., 2010) and even in other countries (Betti, 2002; Shanley and Luz, 2003; Macia et al., 2007; Lee et al., 2008; Idu et al., 2010; Moeng, 2010; Setshogo and Mberreki, 2010).

The number of species that were sold by each trader was relatively high, with the range of 214–251 species. The above account shows that the traditional markets in Indonesia, especially North Sumatra, are the potential sites for undertaking bioprospecting and potential sources to acquire data on uses of medicinal plants as well as to obtain plant-based medicines. It is higher than those that had been found by Lee et al. (2008) in Yunan Chinese market (216 species), but at family level the number was similar. As indicated above, in the Kabanjahe the medicinal plants sold, 20 species were Zingiberaceae and 17 species were Asclepiadaceae. It should be noted that various ethnic groups in Indonesia show fanaticism to Zingiberaceae as medicinal plants. In Indonesia Zingiberaceae has been dominantly used for traditional medicine since hundreds years ago until today (Heyne, 1987).

Utilization of Asclepiadiaceae as medicine in the Kabanjahe market was a new finding, elsewhere in Indonesia, *Hoya* species have been used as ornamental plants because they have attractive leaves and flowers. Although the number of species of Asclepiadaceae recorded in the present study and traded in Kabanjahe market are relatively large (17 species), but the number of genera are low (2). Out of 17 species of Asclepiadaceae traded 12 species belonged to the genus *Hoya*. Sumatra is believed to be the center of distribution of *Hoya* With approximately 50–60 species (Rahayu 2006).

Leaves were the most used part of plants. It is likely related to the fact that in most plants the secondary metabolites are stored in leaves. For example, asiaticoside (*Centella asiatica*), essential oils, flavonoids (*Ageratum conyzoides*), and andrografoid (*Andrographis paniculata*) are stored in the leaves (Achmad et al., 2009). Our finding in Kabanjahe differed from the facts discovered by Van

Andel et al. (2012), where the barks and roots were the parts of plants in traditional market of Ghana. The difference appear to be related to the selling value of the barks in Ghana which were higher than the leaves. In addition to the price factor, availability of organs of the medicinal plants is also affected by the storage. Utilization of different plant organs is allegedly associated with differences in the content of bioactive compounds in each organ. For example, *Catharanthus roseus* saved ajmalicine in the root while vincristine and vinblastine were stored in the leaves (Joy et al., 1999).

Tubers and rhizomes are the organs that were also used as medicines. Utilization of rhizomes of *Zingiberaceae* in Kabanjahe traditional market was similar to that practiced by other ethnic groups in Indonesia, although the same species of tubers may be used for different treatments. For example, *Dioscorea* tuber was generally used as a contraceptive (Walujo, 2013), but the Kabanjahe trader used it as the main ingredient for diabetes mellitus treatment. Utilization of *Dioscorea* as ingredients to cope with diabetes mellitus should be further investigated, considering the fact that the disease is a common degenerative disease among Indonesian people. Utilization of *Nervilia aragoana* and *Nervilia plicata* bulbs as aphrodisiac ingredients to maintain stamina reported in the present study needed to be tested further, because they are newly recorded medicinal plants in Indonesia.

5. Conclusion

The study recorded as many as 344 species, 217 genera and 90 families of medicinal plants traded in the Kabanjahe traditional market. Species diversity of medicinal plants traded in Kabanjahe market is high but the species that were sold by each trader were relatively the same. The large number of medicinal plants species that were sold by the merchants affected the storage system and arrangements, which were based on the value, type of organ, size, volume, and moisture content.

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