



Ethnobotanical Study of Zingiberaceae Rhizomes as Traditional Medicine Ingredients by Medicinal Plant Traders in the Pancur Batu Traditional Market, North Sumatera, Indonesia

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ABSTRACT

Traditional market is a place for buying and selling medicinal plants and it can be a source of ethnobotany research data. This study aimed to determine the uses and characteristics of Zingiberaceae rhizomes that used as traditional medicine and traded in the traditional market of Pancur Batu, North Sumatera. The study was conducted with an ethnobotany approach through surveys, interviews and observation participatory. The respondents were all medicinal plants traders in the Pancur Batu traditional market. The things that were asked of the traders included local names, special characters, benefits, and how to recognize the rhizome. The medicinal plant traders in the Pancur Batu traditional market have been utilized and traded as many as 10 species of Zingiberaceae rhizome, most of them belonging to *Curcuma* and *Zingiber* genera. The characteristics of rhizomes were recognized by traders through their size, color, and aroma. The cross-section of the rhizomes of each species was different in structure and color which is used as the main marker for each species. Rhizoma Zingiberaceae was used as the main ingredient for *tawar* (semi-solid medicinal herbs consumed by brewing), *parem* (solid medicinal ingredients), and *oukup* (traditional Karo sauna). The rhizome aroma of each species belonging Zingiberaceae is very distinctive which is related to the content of essential oils. The use of Zingiberaceae rhizomes as *tawar* and *parem* ingredients needs to be studied further so that they are developed into standardized herbs.

Keywords: Ethnobotany, *parem*, *tawar*, traditional market, Zingiberaceae

INTRODUCTION

Zingiberaceae, by local communities of Indonesia have been used as spices and traditional medicinal ingredients. Some species belonging Zingiberaceae have been cultivated in Indonesia, the main genus is *Zingiber* and *Curcuma*. Generally in Indonesia, the utilization

of *Zingiberaceae* as traditional medicine related to Javanese ethnic, whereas Batak ethnic groups in North Sumatera (Silalahi, 2014) and Minangkabau in West Sumatera (Khairiah, 2017) have used *Zingiberaceae* rhizomes as traditional medicine or ingredient of herbal concoction for a long time. Sundanese in Bogor used *Curcuma longa* rhizomes to increase stamina, ingredient of *jamu gadongan*, and baby care. *Jamu gadongan* is a concoction as a tonic for postpartum, it has made by 11 medicinal plants, one of them is *C. longa* (Rahayu et al., 2019). The local people in Yogyakarta drink fresh extract rhizome of *C. longa* to cure liver diseases, rheumatic disorders, typhoid, and diarrhea (Nahdi et al., 2016). Kasrina et al. (2019) reported Lembak ethnic in Bengkulu Province, uses *C. longa* rhizomes as antidote.

Batak ethnic in North Sumatera has been long used *Zingiberaceae* rhizomes to treat some diseases. For example, rhizome of *Boesenbergia pandurata* used to treat fever, gastrointestinal disorder, and stamina concoction, whereas *C. xanthorrhiza* used to treat asthma, stomachache, diabetes mellitus, fever and injury (Silalahi et al., 2015a). Batak ethnic community in North Sumatera use *Kaempferia galanga* rhizomes as an ingredient of traditional steam bathing (*oukup*), to treat diarrhea, malnutrition, rheumatism, and stomachache (Silalahi and Nisyawati, 2019). Rhizomes of *K. galanga* mixed with grapes by Balinese ethnic that is used to treat skin diseases, and relieve rheumatic pain (Oktavia et al., 2017).

Zingiberaceae has more than 52 genera and more than 1200 species (Kress et al., 2002), which Sumatera Island is a center of distribution. Silalahi et al. (2015b) reported 20 species of *Zingiberaceae* traded as traditional medicine in the Kabanjahe traditional market. Some species in *Zingiberaceae* have similar rhizomes shape, therefore it is difficult to distinguish them. Besides, *Zingiberaceae* rhizome is also widely used as spice, so it has long been traded in traditional markets of North Sumatera. Aini (2017) reported that Karo ethnic in Semangat Gunung Village, North Sumatera have been used six species as spices.

The market is a source of information on biodiversity and local culture (Franco et al., 2020; Silalahi et al., 2015b; Iskandar et al., 2018; Sujarwo et al., 2018), therefore, the location is suitable for research on the use of plants. Franco et al. (2020) reported as many as 138 species of vegetables and fruits that are traded in the open air Kianggeh market, Brunai Darussalam. Silalahi et al. (2015b) a total 245 species of medicinal plants are traded in the traditional markets of Kabanjahe, North Sumatera, Indonesia. Iskandar et al. (2018) reported as many as 120 species as food stuffs traded in Ujung Berung traditional markets, West Java. Sujarwo et al. (2018) reported 52 plant species from three traditional markets in Tabanan Regency, Bali.

The Pancur Batu traditional market is located close to the community forest (*Tahura*) Sibolangit which is rich in medicinal plants. The Pancur Batu traditional market is one of the trading centers for traditional medicinal plants in North Sumatera, so it is very interesting to study. The aims of this research was to determine (1) *Zingiberaceae* rhizomes which were traded as traditional medicinal ingredients in Pancur Batu traditional market, North Sumatera; (2) local knowledge of medicinal plant traders to recognize *Zingiberaceae* rhizomes.

METHODS

Study Area

This research was conducted at Pancur Batu traditional market in August 2017 and August 2018. The market is located in Deli Serdang Regency, North Sumatera, and 98° 35' 50" E longitude lies and 3° 26' 40" U latitudes (Figure 1). The market is adjacent to the

Sibolangit Tahura (people's forest park) which is used by the local community as a source of obtaining medicinal plants. The population mostly Karo ethnic group who still maintains the local wisdom of the Karo ethnic in medicine and the rest are Batak Toba, Batak Simalungun, Malay and Javanese. The occupation of the population are mainly farmers, traders and government employees.

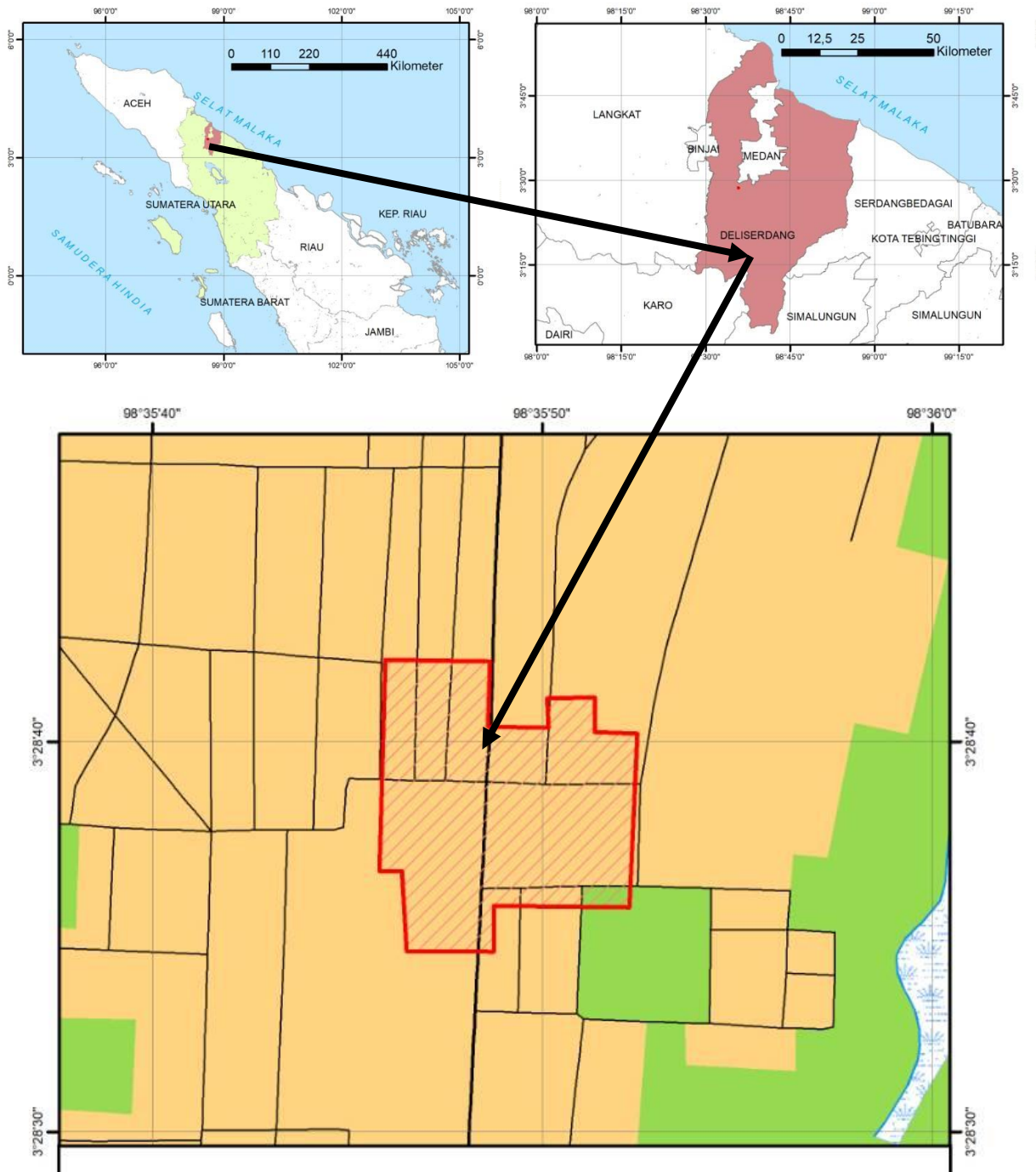


Figure 1. Map of Pancur Batu traditional market, Deli Serdang District, North Sumatera, Indonesia

Data Collection

The study was conducted with ethnobotany approach with surveys, interviews and participatory observations. Respondents were all traders of medicinal plants in the Pancur Batu traditional market. Some of the questions asked of traders are local names, benefits and how to process rhizome as traditional medicine. The all rhizomes species belonging Zingiberaceae that are traded are collected through buying from traders. The collected rhizoma is put in a plastic bag and then labeled, and then rhizoma's morphological characters and cross sections were photographed. The cross section rhizomes was performed on the center of the rhizome 0.2-0.4 mm thick.

Data Analysis

Data were analyzed descriptively by explaining the benefits and characteristics of the species rhizomes belonging Zingiberaceae.

RESULTS AND DISCUSSION

Characteristics of Medicinal Plant Traders

Traders of medicinal plants in the Pancur Batu traditional market are mainly women of the Karo ethnic. Their stall is a semi-permanent building about 2-3 m x 2 m in size, which services 1-2 traders (generally a family such as mother/mother in law and child/daughter in law). Male family members are tasked with collecting medicinal plants from collectors or harvesting them from fields, gardens and forests. Various types of medicinal plants (even estimated to be up to hundreds of species) were traded in each trader (Figure 2A), but in this article only focused on Zingiberaceae rhizomes. All types of Zingiberaceae which are traded are the result of cultivation by both traders themselves and their suppliers and are usually placed in plastic baskets and arranged in layers above the floor (Figure 2B).

Buying and selling transactions are carried out every day from 07.00 to 17.00, but on market days (on Saturdays), some traders conduct transactions outside their stall (near the highway). On market days, the number of medicinal plants is higher than other days, because Pancur Batu traditional market is a sources of medicinal plants for traders in Kabanjahe and Berastagi markets. The supply of medicinal plants at the Pancur Batu market is generally carried out on Friday and part of Saturday by collectors, therefore a fresh form of medicinal plants are easy to find.

Zingiberaceae Traders in Pancur Batu Traditional Market

Ten species of Zingiberaceae family were found in the Pancur Batu traditional market. Each type of rhizome is packed in different basket and labeled on the side, it can make it easier for traders and consumers to recognize it. The trader recognizes Zingiberaceae rhizome through its texture, size, color and aroma. When structure of rhizomes is similar in texture, to ensure the species, traders will injure the rhizomes and recognize from their aroma. Traders claim that each type of rhizome has a distinctive aroma and is related to its utilization and quality. The rhizomes have strong aroma, it can be a marker for better quality.



Figure 2. A. The stall and traders of medicinal plants at Pancur Batu traditional market; B. Rhizoma of Zingiberaceae is placed in a hollow plastic basket.

Zingiberaceae rhizomes have been traded by medicinal plants trader in the Pancur Batu traditional market are *kelawas* (*Alpinia galanga*), *temu kunci* (*Boesenbergia pandurata*), *temu hitam* (*Curcuma aeruginosa*), *kuning gersing* (*Curcuma longa*), *temu putih* (*Curcuma mangga*), *temulawak* (*Curcuma xanthorrhiza*), *kunyit putih* (*Curcuma zedoria*), *keciwer* (*Kaemferia galanga*), *lempuyang* (*Zingiber casumunar*), *bangle* (*Zingiber purpureum*), and *bahing* (*Zingiber officinale*). The Zingiberaceae rhizomes in this study is mostly uses as *parem* and *tawar* ingredients (Table 1).

Table 1. The rhizome belonging Zingiberaceae are traded and used as traditional medicine in Pancur Batu traditional market, North Sumatera, Indonesia

Scientific name	Local name	Uses	Secondary metabolites	Bioactivity
<i>Alpinia galanga</i>	<i>Kelawas</i>	Itchy	1,8-cineole, camphor, β -pinene, (<i>E</i>)-methyl cinnamate, bornyl acetate, guaiol, (<i>E</i>)-methyl cinnamate, α -terpineol, α -fenchyl acetate, borneol (Jirovetz et al., 2003)	Antioxidant (Mahae and Chaiseri, 2009); antimicrobial (Jantan et al., 2004; Wannissorn et al., 2005)
<i>Boesenbergia pandurata</i>	<i>Temu kunci</i>	<i>Parem</i> , head ache, <i>oukup</i> , <i>tawar</i>	1,8-cineole (Cahyadi et al., 2014; Arniputri et al., 2007; Pancharoen et al., 1987), methyl cinnamate, camphor, (Arniputri et al., 2007; Cahyadi et al. 2014) α -terpinene, geraniol, α -ocimene, myrcene, borneol, camphene, terpineol, geranial, neral (Cahyadi et al., 2013), trans- α -ocyneme, trans-geraniol (Arniputri et al., 2007)	Antimicrobial (Taweichaisupapong et al., 2010; Limsuwan et al., 2013); antiobesity (Kim et al., 2013)

<i>Curcuma aeruginosa</i>	<i>Temu hitam</i>	<i>Tawar</i>	α -Pinene, Camphene, β -Pinene, 1,8-Cineol, Terpene-4-ol, α -Terpene-4-ol, 2-Undecanone, β -Elemene, β -Caryophyllene γ -Cadiene, Germacrene D, β -Selinene, α -Selinene, Zingiberene, Germacrene A, β -Bisabolene, α -Cadiene, δ -Cadiene, Germacrene B, Caryophyllene oxide, Guaiol, Furanodiene, Isocurcumenol, Furanoelemene, Germacrone, Curcumenol, Elemenoic acid, Dehydrocurdione, Curcumenone, Gajutsulactone A, Gajutsulactone B Zederone (Srivilai et al., 2018)	Antiandrogen, stimulates hair growth (Srivilai et al., 2018)
<i>Curcuma longa</i>	<i>Kuning gersing</i>	Stomach ache, diarrhea, gastrointestinal disorder, <i>parem</i>	curcumin, demethoxycurcumin, bisdemethoxycurcumin, tumerone, atlantone, zingiberone (Jurenka 2009)	Antioxidant (Nurcholis et al., 2012; Itokawa et al., 2008); antibacterial (Lawhavinit et al., 2010); antiinflamantory (Itokawa et al., 2008)
<i>Curcuma mangga</i>	<i>Temu putih</i>	Stomach ache	L-beta-pinene (Baharudin et al 2015); (<i>E</i>)-labda-8,12-dien-15,16-dial), (<i>E</i>)-15,16-bisnor-labda-8; 11-dien-13-on, zerumin A, β -sitosterol, curcumin, demethoxycurcumin and bis- demethoxycurcumin (Malek et al., 2011)	Antimicrobial (Baharudin et al., 2015); Philip et al., 2009: anticancer (Karsono et al., 2014; Malek et al., 2011)
<i>Curcuma xanthorrhiza</i>	<i>Temulawak</i>	Stomach ache, increase appetite, <i>parem</i>	Curcuminoids (Duke 2003; Aggarwal et al., 2006) xanthorrhizol, bisacumulol, bisacurool, bisacurone, zingiberene,	Antimicrobial (Lee et al., 2008; Mangunwardoyo et al., 2012); antidiabetic (Kim et

			curcuminoids (Duke 2003); α -thujene, α -pinene, camphene, β -pinene, cis-pinane, myrcene Jantan <i>et al.</i> (2012).	<i>al.</i> , 2015); antioxidant (Jantan <i>et al.</i> , 2012)
<i>Curcuma zedoria</i>	<i>Kunyit putih</i>	<i>Tawar</i>	Curcumenol, isoprocurcumenol, dan procurcumenol, curcumenone, zederone (Tariq <i>et al.</i> , 2016) furanodiena, furanodiene, germacrone, curdione, neocurdione, curcumenol, isocurcumenol, aerugidiol, zedoarondiol, curcumenone, curcumin (Matsuda <i>et al.</i> , 1998)	Anticholesterol (Srividya <i>et al.</i> , 2012); anticancer (Lobo <i>et al.</i> , 2009; Hamdi <i>et al.</i> , 2017); antibacterial (Das and Rahman, 2012)
<i>Kaemferia galanga</i>	<i>Keciwer</i>	<i>Oukup, parem, tawar</i>	Asam 2-Propenoic, asam phthalic, asam palmitic, sandaracopima-radiene, asam oleic, asam octadecanoic, 2-[2-(4-nonylphenoxy) ethoxy] ethanol dan glycidyl stearate (Ali <i>et al.</i> , 2018)	Anticancer (Ali <i>et al.</i> , 2018); antimicrobial (Lakshmanan <i>et al.</i> , 2011); anti hypertension (Othman <i>et al.</i> , 2006)
<i>Zingiber cassumunar</i>	<i>Lempuyang</i>	<i>Oukup, parem</i>	Sabinene, β -pinene, caryophyllene oxide, caryophyllene, triquinacene 1,4-bis (methoxy), (Z)-ocimene, terpinen-4-ol (Bhuyian <i>et al.</i> 2018)	Antimicrobial (Isrul <i>et al.</i> , 2017); antiobesity (Iswantini <i>et al.</i> , 2011); analgesic (Chaiwongsa <i>et al.</i> , 2012)
<i>Zingiber purpureum</i>	<i>Bangle</i>	<i>Oukup, parem,</i>	α -Thujene, Bicyclo, α -Pipene, Camphene, Sabinene, β -Pinene, α -Terpinene, 4-Isopropyl Toluene, Limonene, β -Phellandrene cyclohexane, γ -Terpinene, Trans-Sabinene Hydrate, Terpinolene, Cis-Sabinene Hydrate, 2-cyclohexane, 2-	Antidepression (Matsui <i>et al.</i> , 2012)

<i>Zingiber officinale</i>	<i>Bahing seratis dan bahing gara</i>	<i>Oukup, parem, tawar</i>	cyclohexane-1-ol, Terpeneol-4, α – Terpeneol, Cis-piperitol, Piperitol-isomer, α -Terpinenyl acetate, Phenol, α -Zingiberene, 2-Propenal, β -sesquiphellandrene, Quinoline, 11-dimethylbicyclo, 3-dimethylindole, Benzoic acid, Phthalic acid (Mahfud <i>et al.</i> , 2017) 2-heptanol, tricyclene, α -pinene, camphene, sabinene, β -pinene, 6-methyl-5-hepten-2-one, myrcene, α -Phellandrene, δ -3-Carene, p-cymene, limonene, 1,8-cineole (Sivasothy <i>et al.</i> , 2015)	Antibacterial (Sivasothy <i>et al.</i> , 2011; Padalia <i>et al.</i> , 2011); antifungi (Barman and Jha, 2013)
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Tawar is a semi-solid herb made from extracts of various types of medicinal plants (Zingeraceae rhizome as the main component). It can be brewed with hot water and drunk. *Tawar* is used as medicine by Karo ethnic. Whereas, *parem* is a solid concoction made from various extracts (fresh extract of medicinal plants especially Zingiberaceae rhizomes) and added some rice flour as compactor (Figure 4). *Parem* is used at surface of body's skin, especially the part to be treated.



Figure 4. *Parem* in traditional market Pancur Batu, North Sumatera, Indonesia

Several benefits of Zingiberaceae rhizomes are mainly used to treat diseases of digestive system such as diarrhea, gastrointestinal disorders and stomachache (Figure 3). *Parem* is made with seven species, five species are used to make *oukup*, *tawar* (five species)

and three species were used to treat stomach ache. Most of the medicinal plants utilized by the community were processed by boiling water or fresh rhizome extract, but *parem* is used as external medicine to treat itchy.

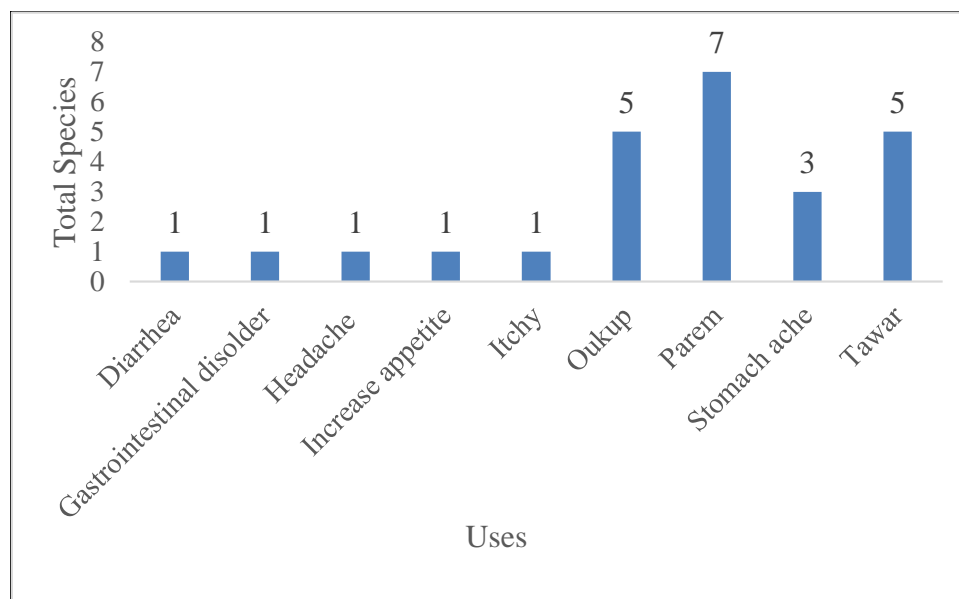


Figure 3. Utilization of Zingiberaceae rhizomes by medicinal plant traders in the traditional market of Pancur Batu, North Sumatera, Indonesia

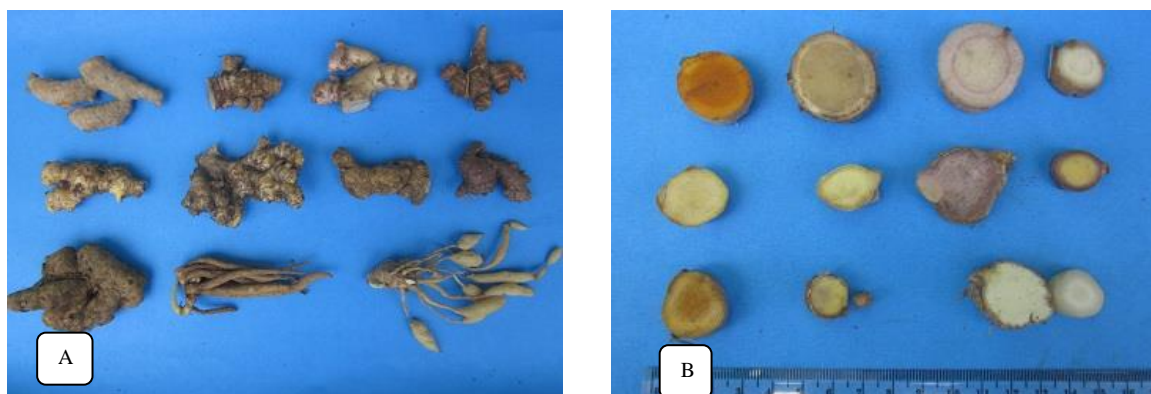


Figure 5. Rhizoma of various types of Zingiberaceae which are traded in the Pancur Batu traditional market, North Sumatera. A. Morphology; B. Transverse section. Top row in order from left to right: *temulawak* (*Curcuma xanthorriza*), *kunyit putih* (*Curcuma mangga*), *temu hitam* (*Curcuma aeruginosa*), *keciwer* (*Kaempferia galanga*). Middle row from left to right: *bahing seratis* (*Zingiber officinale*), *lempuyang* (*Zingiber cassumunar*), *temu hitam* (*Curcuma aeruginosa*), *bahing gara* (*Zingiber officinale*). Bottom row from left to right: *bangle* (*Zingiber purpureum*), *temu kunci* (*Boesenbergia pandurata*), *kunyit putih* (*Curcuma zedoaria*)

Zingiberaceae rhizomes have 12 local names, but it has 11 species and 5 genera, have been traded in Pancur Batu traditional market as traditional medicine. Five species belonging to *Curcuma* and three species belonging *Zingiber*, and other genus were represented by a species. Based on texture of morphological rhizomes, some of them are very easily to distinguish, such as *keciwer* (*Kaempferia galanga*), *temu kunci* (*Boesenbergia pandurata*) and *temu putih* (*Curcuma zedoaria*), while the other rhizomes are similar (Figure 5A). The

transverse incision colour of rhizome is different among species and others (Figure5), it is often used for identification.

Discussion

Pancur Batu traditional market is a place to get variety of medicinal plants and their uses, especially Zingiberaceae rhizomes. Karo ethnicity in North Sumatera still maintains local wisdom such as *oukup* (Silalahi and Nisyawati, 2018) to maintain their health. Silalahi et al. (2015b) stated that Karo ethnicity is an ethnic group that still use of traditional medicines to maintain and improve their health. It will help public to get traditional medicinal materials easily, because of that, it will increase the trading of medicinal plants in traditional markets. At least 10 species of rhizome belonging to Zingiberaceae have been traded in Pancur Batu traditional market, North Sumatera.

Alpinia galanga (Kelawes)

Alpinia galanga or *kelawes* uses especially to treat itchy skin. According to local people, *A. galanga* rhizome is better known as a cooking spice than traditional medicine, therefore it is easier to find in seasoning traders compared to medicinal plant traders. The use of *A. galanga* for the treatment of itching is thought to be related to its bioactivity as an antimicrobial (Male et al., 2014), especially essential oils (Table 1). *Alpinia galanga* contains about 167 types of essential oils, at least 110 types in leaves, 108 types in stems, 107 types in rhizomes and 108 types in roots (Jirofetz et al., 2003). Leaves and rhizomes of *A. galanga* have the highest content of essential oil. It is the main components in Batak traditional sauna, which believed to make skin healthier and smoother.

Boesenbergia pandurata (Temu Kunci)

The local name of *Boesenbergia pandurata* is *temu kunci* (*temu* = rhizomes; *kunci* = key) because it has a rhizome that similar with key, and the characteristics of this rhizome are very different from other types of Zingiberaceae rhizomes. The *empu* (main rhizomes) of *B. Pandurata* has many branches, slender and long (Figure 6). *Boesenbergia pandurata* is used as main ingredient for making *tawar* and local people in Indonesia also use *temu kunci* as an ingredient to make vegetable soup, which is believed to make soup is fresher. It has bioactivity as an antimicrobial (Taweechaisupapong et al., 2010; Limsuwan et al., 2013) and antiobesity (Kim et al., 2013), so it is very potential to be developed as a natural food preservative and nutraceutical.



Figure 6. Rhizomes of *Boesenbergia pandurata*

Curcuma aeruginosa (Temu Itam)

Temu itam (*Curcuma aeruginosa*) looks similar to ginger, but its texture is tougher than ginger (Figure 7A). In addition, this rhizome is very easy to recognize from its

transverse incision, which is marked by black (*itam*) fibers and inner circles (Figure 7B). When traced further, the color of the fibers is related to the age of the rhizome, which the old rhizome has darker fibers than young rhizome. As a traditional medicine, traders use it as *tawar* and *parem* ingredients. Srivilai et al. (2018) stated that *C. aeruginosa* has activity to stimulate hair growth.

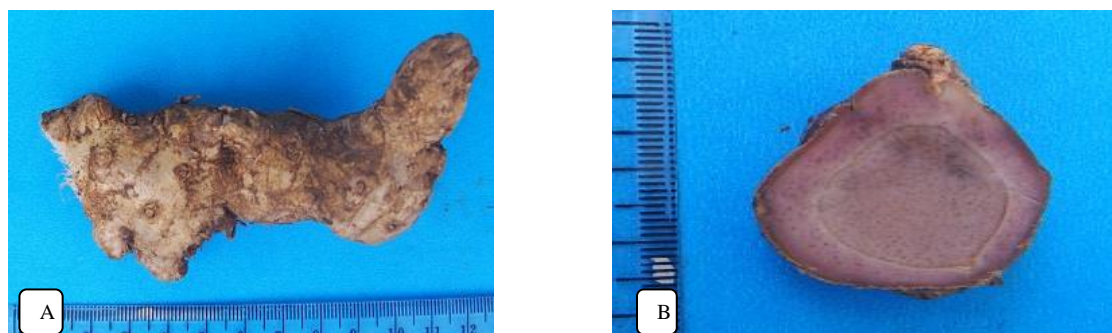


Figure 7. The rhizomes of *temu itam* (*Curcuma aeruginosa*). A. Morphology; B. cross section of rhizome

Curcuma longa (Kuning Gersing)

Turmeric (*Curcuma longa*) is a species of Zingiberaceae that is found in every trader because its dual function as a traditional medicine and spice, moreover it is very attractive for consumers. The *indung* (mother) or hump of turmeric is the most favorite part for customers, because it has the best quality. This type is used to treat digestive tract disorders such as stomach aches, ulcers, and diarrhea. The rhizome morphological characteristics are similar to *C. xanthorrhiza* but smaller in size, lighter color and fresher aroma than ginger (see *C. xanthorrhiza*). *Curcuma longa* extract is also used as an ingredient in traditional Karo ethnic ingredients called *kuning* (another term for *parem*). Habit of people living in Karo highlands has applying *kuning* to their whole body at night or while working in fields. The yellow mask will give a warm effect at night and during the day will protect the skin, especially face from sunburn. The bioactivity and essential oils of *C. longa* see in table 1.

Curcuma mangga (Temu Putih)

The characteristics of *temu putih* (*temu* = rhizome; *putih* = white) are similar to *temu itam*, but inside color of this rhizome is brighter than *temu itam* (Figure 8). *Curcuma mangga* is used as a *param* ingredient. Bioactivities of *C. mangga* are antimicrobial (Baharudin et al., 2015; Philip et al., 2009) and anti-cancer (Karsono et al., 2014; Malek et al., 2011) (Table 1).

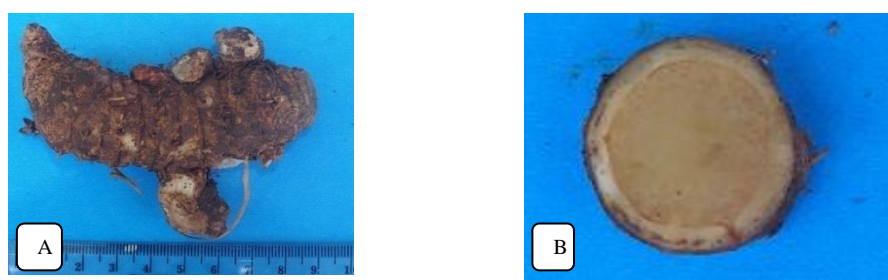


Figure 8. The rhizomes of *Curcuma mangga* A. Morphology; B. Cross section of rhizome

Curcuma xanthorrhiza (Temulawak)

The structure of *temulawak* (*Curcuma xanthorrhiza*) is similar to turmeric (*C. longa*), but curcuma rhizome has larger size and dark yellow color with distinctive aroma (Figure 9).

It have been used to treat stomach ache, increase appetite and *parem* ingredient (Table 1). Rhizome fresh extract is used to neutralize stomach acid and digestive tract disorders. Some traders also sell rhizome dry powder, so it is easier to process. Bioactivity of *C. xanthorrhiza* is anti-microbes (Lee et al., 2008; Mangunwardoyo et al., 2012), anti-diabetic (Kim et al., 2015) and anti-oxidants (Male et al., 2012).

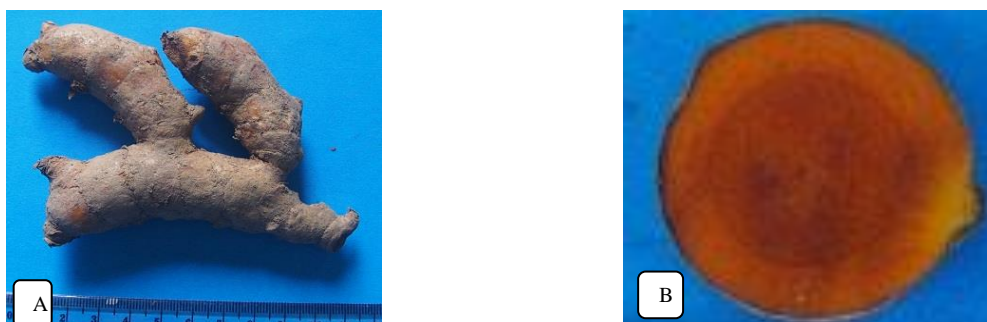


Figure 9. The rhizomes of *temulawak* (*Curcuma xanthorrhiza* Roxb.). A. Morphology; B. Cross section of rhizome

Curcuma zedoaria (Kunyit Putih)

White turmeric or *Curcuma zedoaria* has very distinctive rhizome characteristics compared to other rhizome species, which are characterized by enlarged, fleshy branches at the tip of rhizome (Figure 10). The medicinal plant traders in Pancur Batu traditional markets are using this to make *parem* (table 1). *Curcuma zedoaria* has bioactivity as anti-cholesterol (Srividya et al., 2012), anti-cancer (Lobo et al., (Lobo et al., 2009; Hamdi et al., L 2017), anti-bacterial (Das and Rahman, 2012), because of its essential oil (Table 1).

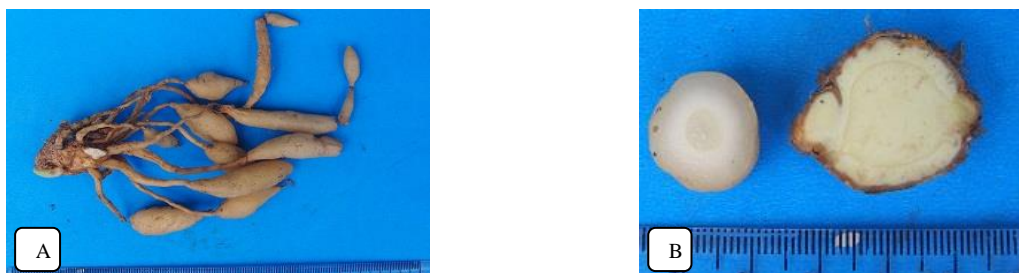


Figure 10. The *kunyit putih* (*Curcuma zedoaria*) rhizomes. A. Morphology; B. Cross section of main and branches rhizomes

Kaempferia galanga (Keciwer)

Keciwer (*Kaempferia galanga*) is a species belonging *Zingiberaceae* which is most intensively utilized by Karo ethnic and traders. The traditional medicine by Karo ethnic is using *kesaya silima-lima* (five important ingredients in medicine), namely *bahing* (*Zingiber officinale*), *pia* (*Allium cepa*), *lasuna* (*Allium sativum*) and pepper (*Piper nigrum*). Empirically, these plants give “hot” effect, so it is believed to warm the “cold” body. A warm body will improve blood circulation which will directly or indirectly nourish the body. *Kencur* is main component of *parem*, increasing stamina and treating headaches. Various traditional Indonesian dishes also use *K. galanga* as additional seasoning such as *pecal*, *urap* (similar to a salad) because it gives a refreshing effect and aroma. *Kaempferia galanga* has bioactivity as anti-cancer (Ali et al., 2018), anti-microbial (Lakshmanan et al., 2011) and anti-hypertensive (Othman et al., 2006) (Table 1). Rind of *K. galanga* rhizome is reddish brown but white or creamy inside (Figure 11).

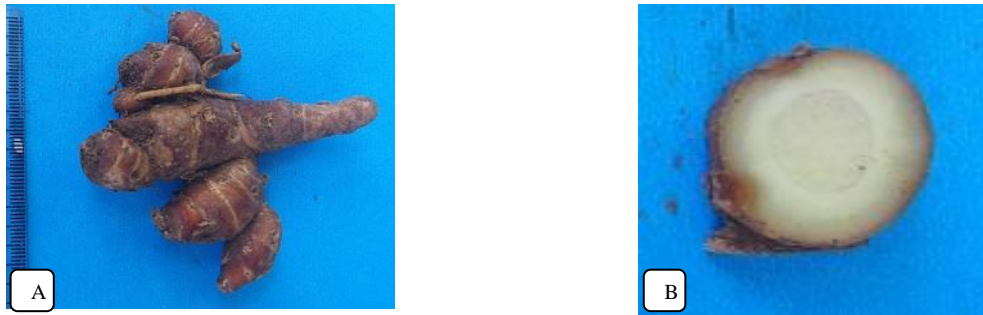


Figure 11. The rhizomes of *keciwer* (*Kaemferia galanga*). A. Morphology; B. Cross section rhizomes

Zingiber cassumunar (Lempuyang)

Lempuyang or *Zingiber cassumunar* is used as a *parem* ingredient and to treat rheumatism. *Lempuyang* rhizome is similar to ginger rhizome. The color is light yellow while ginger is creamy (Figure 12). Bioactivity of *Z. Crassumunar* is anti-microbial (Isrul et al., 2017), anti-obesity (Iswantini et al., 2011), and analgesic (Chaiwongsa et al., 2012).



Figure 12. The rhizomes of lempuyang (*Zingiber crassumunar*). A. Morphology; B. Cross section rhizomes

Zingiber purpureum (Bangle)

Bangle or *Zingiber purpureum* has a morphological character of rhizomes similar to *Z. Crassumunar* from their texture and color of inside the rhizome (Figure 13 A, B). According to aroma, *Z. purpureum* is sharper than *Z. crassumunar*. The aroma produced by plants, because of volatile oil. This plant is used as an ingredient of *parem* and *tawar*. Bioactivity of *Z. Purpureum* is anti-depressant (Matsui et al., 2012).



Figure 13. The rhizomes of *bangle* (*Zingiber purpureum*.). A. Morphology; B. Cross section rhizomes

Zingiber officinale (Bahing)

Bahing is a local name of *Z. officinale*, that is grouped in two cultivars are *bahing gara* (red ginger) and *bahing seratis* (ginger) by traders. The rhizome of *Z. officinale*

cultivars has different color, size, texture, and aroma (Figure 14). *Bahing gara* (red ginger) has reddish color, hard texture, sharp aroma, small size, while *bahing seratis* (ginger) has creamy color, soft texture, soft aroma and large size. Red ginger is only used as traditional medicine, while ginger is used for traditional medicine and spices. The price of red ginger is higher than ginger, up to 2-3 times of ginger. The bioactivities of *Z. officinale* are antibacterial (Sivasothy et al., 2011; Padalia et al., 2011) and antifungi (Barman and Jha, 2013). *Z. officinale* has essential oil, it can be seen in Table 1.

As a medicinal ingredient, *Z. officinale* is used to treat rheumatism and fresh extract can treat coughing and scarring. *Oukup* is a traditional Karo ethnic steam or sauna bath by combining various types of plants that produce aromatherapy especially *Zingiberaceae* and *Rutaceae* (Silalahi et al., 2015b; Silalahi and Nisyawati, 2018). *Tawar* is a semi-solid form of medicine, it is made from various types of plants and consumed by brewing in hot water. Traders stated that *tawar* can increase blood circulation and maintain stamina. *Z. officinale* is used as a rheumatic drug in *parem* form or single form.

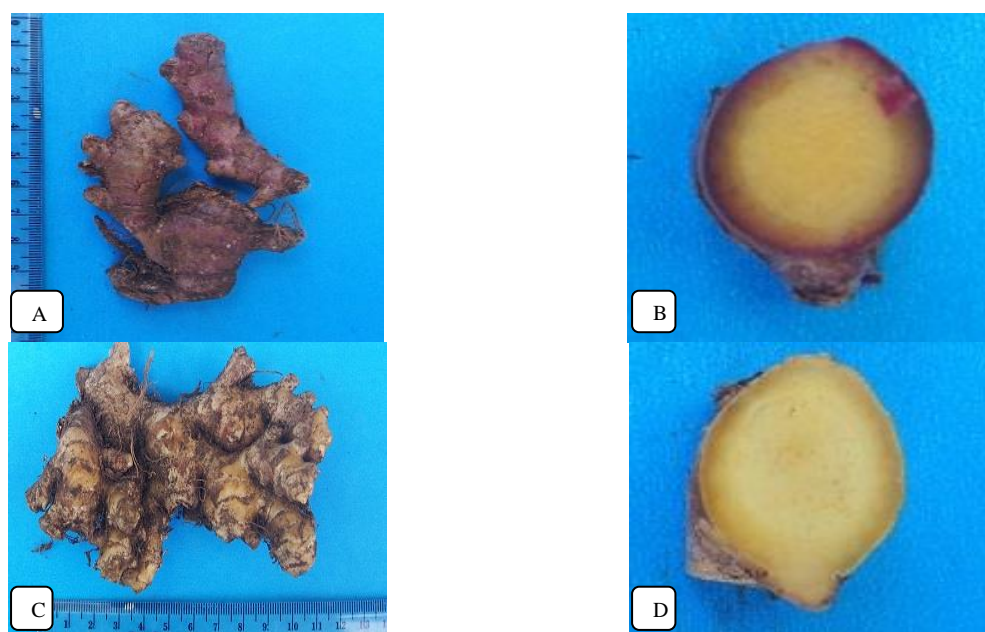


Figure 14. The rhizomes of *bahing* (*Zingiber officinale*). Top: *Bahing gara*; Below: Bahing fiber. A and C. Morphology; B and D. Cross section rhizomes

CONCLUSIONS

The medicinal plants trader have been used 10 species of rhizomes belonging 5 genera of *Zingiberaceae* as traditional medicine ingredients. Traders of medicinal plants recognize each rhizome species of *Zingiberaceae* through size, color, and aroma. *Zingiberaceae* rhizomes are used as *tawar* (a concoction of semi-solid medicine consumed by brewing) and *parem* (solid concoction made from various extracts), and *oukup* (traditional sauna of Karo ethnic). Most of the species in this study have antimicrobial activity, so they have potential to be developed to treat gastrointestinal tract infections and skin infections. *Parem* is very potential to be developed as an ingredient for skin care, therefore further research is needed regarding its composition and toxicity.

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