

Ethnobotanical study of medicinal plants among the Karo tribe in Kuala Sub-district, Langkat District, North Sumatra, Indonesia

ABDUL RASYID FAKHRUN GANI[✉], UTAMI SRI HASTUTI^{✉✉}, SULISETIJONO SULISETIJONO,
FRIDA KUNTI SETIOWATI

Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Negeri Malang. Jl. Semarang 5, Malang 65145, East Java, Indonesia.
Fax: +62 341-551921, ✉ email: rasyidabdul547@gmail.com, ✉✉ utami.sri.fmipa@um.ac.id

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Abstract. Gani ARF, Hastuti US, Sulisetijono S, Setiowati FK. 2024. *Ethnobotanical study of medicinal plants among the Karo tribe in Kuala Sub-district, Langkat District, Indonesia. Biodiversitas 25: 2960-2968.* Indonesia has a high diversity of plants. One area of Indonesia with a high diversity of plants is Kuala Sub-district, Langkat District, North Sumatra Province, Indonesia. The Karo tribe inhabits Kuala Sub-district, and they still apply the ethnomedicine knowledge in their life; this study aims to: (i) document ethnomedicine knowledge of the use of medicinal plants in Kuala Sub-district, (ii) Analyze the use value and cultural significance index to determine the level of use of medicinal plants by the Karo people in Kuala Sub-district. Ethnomedicine data were collected for eleven months, from October 2022 to April 2024. The data sources in this research were 205 informants (25 key informants and 180 additional informants). Data from 25 key informants was used to determine the cultural significance index, while data from 180 additional informants was used to determine use value (UV). ICS data was collected by conducting focus group discussions with key informants, while UV data collection was carried out using survey techniques. The research was conducted through semi-structured interviews to determine various medicinal plants' quality, intensity, and exclusivity. This research shows 49 plants used in medicinal practice, and the highest significant cultural index and use value is *Kaempferia galanga*. The part of the plant that is most widely used is the leaf. The most common disease experienced by the Karo people in Kuala Sub-district is flatulence and many medicinal plants are used to treat this disease.

Keywords: Ethnobotany, ethnomedicine, Karo, Kuala Sub-district, medicinal plant

INTRODUCTION

Indonesian local community groups are still able to manage plants in various fields such as health, food, clothing, and animal feed. Several local community groups still use plant management services based on their local wisdom (Gani et al. 2022). Patterns of plant use give rise to interactions between humans and the environment; this interaction pattern becomes a characteristic of society's use the plants. The local Indonesian community has used various plants to maintain health since ancient times (Boro et al. 2023; Utamingrum et al. 2022); many still use plants as alternative medicines (Mutheeswaran et al. 2023). The use of plants in the treatment process has been carried out from the old to the new generations and has become a local knowledge (Bhagawan et al. 2022; Lestariningsih et al. 2023).

Indonesian local communities have used many plants for health, often as medicinal ingredients. The local community has developed traditional medicine to produce useful knowledge for developing medical science. Local communities have used plants as medicine for internal and external diseases (Barman et al. 2023; Haque et al. 2023). In addition, plants can also be used to produce therapeutic aromas that are useful medically (Weick et al. 2023). Knowledge of nutritious plants is a cultural heritage that must be maintained to avoid cultural degradation. So, it is very important to document and revitalize local community

ethnomedicine knowledge.

Ethnomedicine knowledge relates to environmental conditions and community culture (Dapar et al. 2020). Ethnomedicinal knowledge of medicinal plants is also prone to change due to socioeconomic changes (Rajapaksha et al. 2023). Ethnomedicinal studies of certain community groups will produce varied patterns of plant utilization. This ethnomedicine study is useful for preserving plants as medicinal ingredients (Nuneza et al. 2021; Ramli et al. 2021). Ethnomedicinal studies will be more abundant in areas with high biodiversity, such as Indonesia. Communities tend to take advantage of the biological resources around them, so the more plants nearby, the more they are used.

Indonesia has a high diversity of plants. One area with a high diversity of plants is Kuala Sub-district, Langkat District, North Sumatra Province. The Karo tribe inhabits communities in Kuala Sub-district, and they still apply ethnomedicine knowledge from their ancestors (Nasution et al. 2018; Silalahi and Nisyawati 2018; Silalahi et al. 2021). The Karo people have used plants to make traditional medicinal ingredients to treat their health and various diseases (Aswandi and Kholibrina 2021; Batubara et al. 2017).

Kuala Sub-district is dominated by people who still use plants to treat illnesses and maintain their body fitness. The community uses plants due to the plant's availability in their environment. Kuala Sub-district still has a high

diversity of plants with medicinal properties. Research in Garunggang village in Kuala Sub-district revealed 268 individual plants with medicinal properties from 37 plant species (Rahmawaty et al. 2019). The availability of plant resources and high knowledge of plant management lead people to have the behavior to utilize these plants in their daily lives.

The Karo people are spread across Karo District, Langkat District, Medan City, and various areas in North Sumatra, Indonesia. Many studies have been conducted to find out the ethnomedicine knowledge of the Karo tribe in the use of plants, but no one has researched it in Kuala Sub-district. Therefore, this study aims to: (i) document ethnomedicine knowledge of the medicinal plant uses in Kuala Sub-district and (ii) Analyze the cultural significance index to determine the medicinal plant use levels by the Karo people in Kuala Sub-district. This research is useful to preserve local culture in plant management, as a basis for developing pharmaceutical science and can be used as learning for the general public.

MATERIALS AND METHODS

Study area

This research location is Kuala Sub-district, Langkat District, North Sumatra Province, Indonesia (Figure 1). Ethnomedicine data were collected for 11 months, from October 2022 to April 2024. Respondents were selected as informants purposively (Hankiso et al. 2023). The data sources in this research were 205 informants (25 key informants and 180 additional informants). Informants were determined using the snowball sampling technique by asking for directions from the first key informant. Informants were determined using the criteria of understanding the local wisdom of the Karo tribe in Kuala

Sub-district in managing plants as medicine. Data from 25 key informants was used to determine the cultural significance index, while data from 180 additional informants was used to determine use value (UV). ICS data was collected by conducting focus group discussions with key informants, while UV data collection was carried out using survey techniques. The research was conducted through semi-structured interviews to determine various medicinal plants' quality, intensity, and exclusivity.

Data analysis

Data were analyzed using two techniques, namely ICS and UVs. Plant quality, intensity, and exclusivity data were analyzed using ICS with the following formula:

$$ICS = \sum_{i=1}^n (q1 \times i1 \times e1)_{n1} + (q2 \times i2 \times e2)_{n2} + \dots + (qn \times in \times en)_{ni}$$

Where:

ICS: cultural significance index, namely the number of calculations for the use of a plant species from 1 to n (according to the number of benefits of the plant)

q: quality value, namely the quality in the use of a plant, with a value of 5 = staple material; 4 = additives and primary materials; 3 = additives and secondary materials; 2 = mythology, ritual, and recreation; 1 = mere recognition

i: intensity value, which is a description of the intensity of utilization of a plant with a value of 5 = very high intensity; 4 = very moderate-high intensity of use; 3 = moderate intensity of use; 2 = low intensity of use; 1 = very low use intensity.

e: exclusivity value with a value of 2 = the most preferred and the main choice/no second; 1 = several types of plants can replace; 0.5 = secondary source or secondary material.

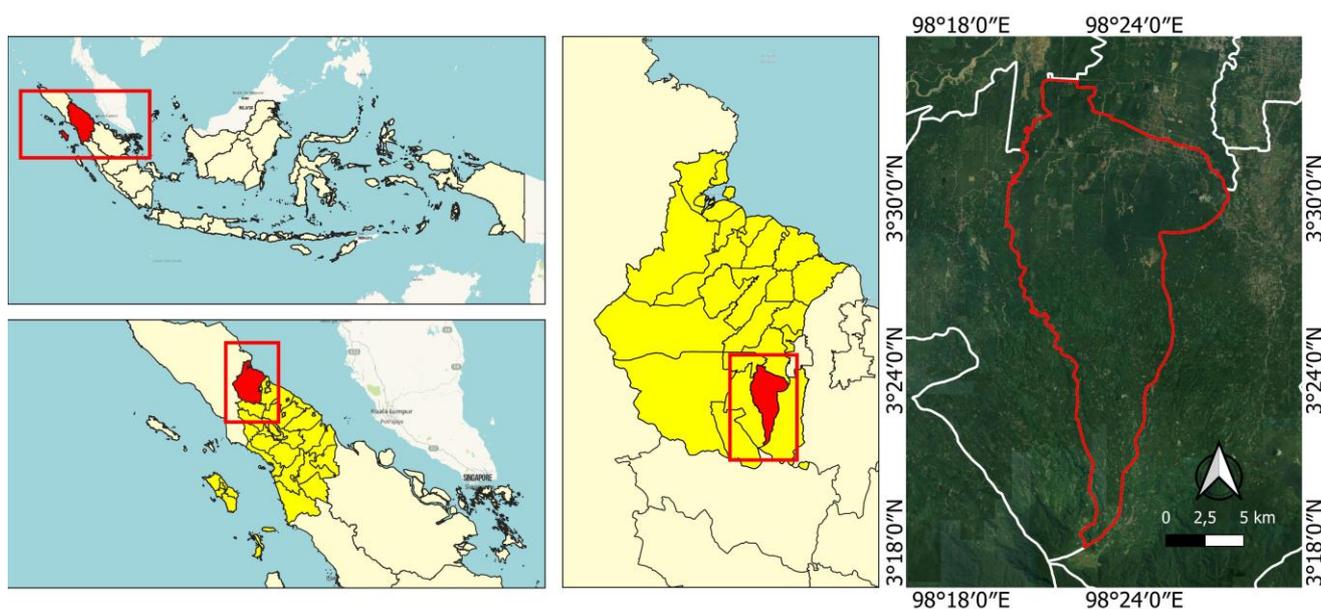


Figure 1. Map of research locations in Kuala Sub-district, Langkat District, North Sumatra Province, Indonesia

The q, i, and e scores were adapted from Turner (1988) and adjusted to the value of a disease often experienced by people in Kuala Sub-district, Langkat District (Batoro 2015; Iskandar 2018). Data on plant benefits from 180 informants were analyzed using UVs with the following formula:

$$UV_s = \frac{\sum UV_{is}}{i_s}$$

Where:

UVs: total use value of plant species

UV_i: the value of plant types determined by informant i

i_s: Number of informants interviewed for each type of plant

RESULTS AND DISCUSSION

Inventory of ethnomedicine knowledge of the Karo tribe in Kuala Sub-district

Moreover, plant inventory was carried out using the snowball technique through observations with key and other informants. The cultural significance index analyzed the investment results explained in Table 1.

The ICS value is used to evaluate the use of plants, which is influenced by cultural values and community beliefs; the use values (UVs) determines the level of community ethnobotanical knowledge. The plant with the highest value based on ICS and UVs is Kaciwer (*Kaempferia galanga*); this means that kencur has high cultural value and is very widely used by the community. Therefore, plants that are most used by the Karo people in Kuala Sub-district are *kaciwer* (*K. galanga*), *kuning las* (*Curcuma xanthorrhiza*), *tualah* (*Cocos nucifera*), *ketumbar* (*Coriandrum sativum*), and *kapulaga* (*Amomum cardamomum*). Those plants were widely used as medicine and believed to cure various diseases. People believe that these plants have medicinal properties due to the experiences taught to them by their ancestors. They argue that using these plants has proven effective in treating many diseases.

The Karo people use medicinal plants by combining traditional medicinal ingredients, such as *minak pengalun*, *sembur*, and *param*. *Minak pengalun* is the extraction of plants into oil (external medicine) which comprise: *Zingiber officinale*, *K. galanga*, *C. xanthorrhiza*, *Kaempferia pandurata*, *Curcuma domestica*, *Myristica fragrans*, *Zingiber cassumunar*, *Cinnamomum burmanni*, *Piper nigrum*, *Citrus hystrix*, *Citrus aurantifolia*, *Eugenia grandis*, *C. sativum*, and *C. nucifera*. *Sembur* is a traditional Karo medicinal ingredient used by spraying it on the affected part of the body, instead of eating or drinking it. There are several sprays, such as cold sprays and *mbeltek* gunshots. *Sembur mesui mbeltek* consists of *Curcuma heyneana*, *C. xanthorrhiza*, *Z. cassumunar*, *K. galanga*, and *Areca catechu*. *Param* is a medicinal herb

that is efficacious in treating various diseases. One type of *param* is used to treat bruised body parts. *Param* herb for treating bruises consists of *Z. cassumunar*, *C. xanthorrhiza*, *Aleurites moluccanus*, *M. fragrans*, *Nicotiana tabacum*, and *C. nucifera*.

Some Karo people in Kuala Sub-district tend to choose modern medicine for certain diseases. Some people are starting to alternate from traditional medicine because of their high level of education and acculturation with other ethnicities, such as the Javanese, who dominate several villages. People who still consume traditional medicines prefer buying medicinal ingredients from Karo District. Karo District still has many *Guru simbelin* (healers) capable of concocting medicine; people assume that eating medicinal plants is an ancient behavior (Shakya et al. 2023). The declining use of plants causes these species to be neglected (Yaipharembi et al. 2023), so the Karo people in Kuala Sub-district cannot utilize many plant species.

The Zingiberaceae family plants are the most widely used species by the Karo tribe, Kuala Sub-district (Figure 2). People in traditional markets easily find the Zingiberaceae family. The community also easily cultivates plants from the Zingiberaceae family in their gardens or yards. Apart from being a medicine, plants of the Zingiberaceae family are also preferred because they are used as cooking spices. Plants from the Zingiberaceae family are often used as medicinal ingredients prepared for drinking or the skin.

The Karo people use various types of plants as medicines. The use of these plants is influenced by local culture and existing resources. Garunggang Village, Kuala Sub-district, has 49 types of medicinal plants scattered in the area; the most commonly found medicinal plant is *Alpinia galanga* from the Zingiberaceae family (Rahmawaty et al. 2019). Langkat District has various types of plants, including wild plants in the forest, cultivated plants, and plants based on local perceptions (Samsuri et al. 2019). Besides using cultivated plants, the community also uses wild plants such as *Scruella ferrugia*, wild plants are also often used to meet human needs (Guzo et al. 2023).

The part of the plant that is used

Local people use certain plant parts to make medicines; hence, according to mythological beliefs and their experiences, certain plant parts have medicinal value. The results of the analysis of plant parts used by the Karo tribe in Kuala Sub-district are shown in Figures 3 and 4.

The leaves were the most widely used plant parts (Figures 3 and 4). People prefer to use leaves as a medicinal ingredient because they are believed to treat diseases effectively. Leaves are proven to contain more secondary metabolites than other plant parts, so they are preferred as medicinal ingredients (Aththorick and Berutu 2018).

Table 1. Medicinal plants used by the Karo tribe in Kuala Sub-district, Kuala Sub-district, Langkat District, North Sumatra Province, Indonesia

Vernacular name	Species name	Family	Habit	Part used	Utility	ICS	UVs
Kaciwer	<i>Kaempferia galanga</i>	Zingiberaceae	Herb	Rhizome	Cough, flatulence, fatigue, chills, stimulating breastfeeding, itchy skin, aching rheumatic pain, abdominal pain for children, gout, backache, and fever	470	6.37
Kuning las	<i>Curcuma xanthorrhiza</i>	Zingiberaceae	Herb	Rhizome	Flatulence, facilitating breastfeeding, itchy skin, aching rheumatic pain, abdominal pain for children, gout, back pain, bruises on the body, and fever	380	3.41
Tualah	<i>Cocos nucifera</i>	Araceae	Tree	Fruit (processed into oil)	Flatulence, fatigue, facilitating breastfeeding, achy rheumatic pain, gout, back pain, and fatigue.	300	1.01
Ketumbar	<i>Coriandrum sativum</i>	Apiaceae	Herb	Seeds	Flatulence, fatigue, aching rheumatic pain, gout, back pain, and fatigue.	300	1.02
Kapulaga	<i>Amomum cardamomum</i>	Zingiberaceae	Herb	Seeds	Cough, flatulence, fatigue and chills	270	1.16
Pala	<i>Myristica fragrans</i>	Myrtaceae	Tree	Seeds	Flatulence, stomach ulcers, gout, back pain, fever, and bruises on the body	230	1.81
Temu-temu	<i>Kaempferia pandurata</i>	Zingiberaceae	Herb	Rhizome	Flatulence, itchy skin, aching rheumatic pain, gout, back pain, and fever	221	1.67
Kayu manis	<i>Cinnamomum burmanni</i>	Lauraceae	Tree	Stem	Flatulence, back pain, gout, fever	170	0.98
Padi	<i>Oryza sativa</i>	Gramineae	Herb	Seeds	<i>Mulajadi</i> , stimulating mothers to breastfeed, and aches and pains	150	0.14
Bahing	<i>Zingiber officinale</i>	Zingiberaceae	Herb	Leaves and rhizomes	<i>Mulajadi</i>	140	2.84
Kuning gajah	<i>Curcuma heyneana</i>	Zingiberaceae	Herb	Rhizome	Stomach bloating, stimulating breastfeeding mothers and children with stomach aches	130	1.26
Rimau mukur	<i>Citrus hystrix</i>	Rutaceae	Tree	Fruit	Tired, <i>mulajadi</i> , gout, ulcers, back pain, and fever	124	0.56
Kemiri	<i>Aleurites moluccanus</i>	Euphorbiaceae	Tree	Fruit	Tired, itchy skin and bruises on the body	120	1.18
Terbangun	<i>Coleus amboinicus</i>	Lamiaceae	Herb	Leaf	Flatulence, <i>mulajadi</i> , and gastric pain	120	0.83
Sereh	<i>Eugenia grandis</i>	Myrtaceae	Herb	Leaf	Gout, back pain, and fever	112	1.15
Rimau manis	<i>Citrus sinensis</i>	Rutaceae	Tree	Fruit	Tired, <i>mulajadi</i> , gout, back pain, fever	104	0.14
Kelawas	<i>Alpinia galanga</i>	Zingiberaceae	Herb	Leaf	Flatulence and ulcers	90	0.26
Rimau gawang	<i>Citrus medica</i>	Rutaceae	Tree	Fruit	Gout, back pain, and fever	84	0.24
Rimau nipis	<i>Citrus aurantifolia</i>	Rutaceae	Tree	Fruit	Tired, <i>mulajadi</i> , gout, back pain, fever	84	0.52
Poula	<i>Arenga pinnata</i>	Arecaceae	Palm	Fruit (processed into sugar)	Cough, flatulence, fatigue, and chills	72	0.62
Besi-besi	<i>Justicia</i> sp.	Achantaceae	Shrubs	Leaf	Flatulence and <i>mulajadi</i>	70	0.21
Jera pege	<i>Trachyspermum roxburghianum</i>	Apiaceae	Herb	Seeds	Flatulence and <i>mulajadi</i>	70	0.27
Kuning tahu (kuning gersing)	<i>Curcuma domestica</i>	Zingiberaceae	Herb	Rhizome	Flatulence and <i>mulajadi</i>	70	1.11
Lasuna	<i>Allium sativum</i>	Liliaceae	Herb	Bulb	Flatulence and <i>mulajadi</i>	70	0.60
Lada biring	<i>Piper nigrum</i>	Piperaceae	shrubs	Seeds	Flatulence and <i>mulajadi</i>	60	0.65
Burle	<i>Zingiber cassumunar</i>	Zingiberaceae	Herb	Rhizome	Flatulence	50	0.18
Cep-cepan	<i>Castanopsis costata</i>	Fagaceae	Tree	Leaf	Gastric pain	50	0.54
Gagatan	<i>Vitis gracilis</i>	Vitaceae	Herb	Leaf	Flatulence	50	0.09
Bahing gara	<i>Zingiber officinale</i> var. <i>rubrum</i>	Zingiberaceae	Herb	Rhizome	Flatulence	50	0.72
Jengkol	<i>Archidendron pauciflorum</i>	Fabaceae	Tree	Leaf	Flatulence	50	0.01
Jeringo	<i>Acorus calamus</i>	Araceae	Herb	Rhizome	Flatulence	50	0.14
Meniran	<i>Phyllanthus urinaria</i>	Euphorbiaceae	Stem	Leaf	Flatulence	50	0.24
Rih	<i>Imperata cylindrica</i>	Gramineae	Herb	Root	<i>Mulajadi</i>	50	0.19
Surindan	<i>Scruulla ferrugia</i>	Loranthaceae	Shrubs	Leaf	Flatulence	50	0.01
Temu pahit	<i>Curcuma aeruginosa</i>	Zingiberaceae	Herb	Rhizome	Flatulence	50	0.06
Acem belimbing gulen	<i>Averrhoa Bilimbi</i>	Oxalidaceae	Tree	Leaf	Hypertension	50	0.81
Kalingjuhang	<i>Cordyline fruticosa</i>	Asparagaceae	Shrubs	Leaf	Hypertension	50	0.31
Kumis kucing	<i>Orthosiphon stamineus</i>	Lamiaceae	Herb	Leaf	Flatulence	40	0.04

Kunyit putih	<i>Curcuma zedoria</i>	Zingiberaceae	Herb	Rhizome	Flatulence	40	0.10
Senduduk	<i>Melastoma malabatricum</i>	Melastomaceae	Shrubs	Leaf	Flatulence	40	0.18
Tebu	<i>Saccharum officinarum</i>	Gramineae	Herb	Stems (processed into sugar)	Gastric pain	40	0.05
Jera rumbane	<i>Cuminum sp.</i>	Apiaceae	seed	Leaf	<i>Mulajadi</i> and sengget	40	0.67
Sanggar	<i>Themeda gigantea</i>	Graminae	Herbs	Leaf	<i>Mulajadi</i> and sengget	40	0.61
Rimo puraga	<i>Citrus nobilis</i>	Rutaceae	Tree	Leaf	<i>Mulajadi</i> and sengget	40	0.44
Tembakau	<i>Nicotiana tabacum</i>	Solanaceae	Herb	Leaf	Bruises on the body	32	0.32
Cengkeh	<i>Syzygium aromaticum</i>	Myrtaceae	Tree	Seeds	<i>Mulajadi</i>	20	0.28
Mayang	<i>Areca catechu</i>	Arecaceae	Palm	Fruit	<i>Mulajadi</i>	20	0.00
Tawan gegeh	<i>Spatholobus littoralis</i>	Leguminosae	Tree	Leaf	<i>Mulajadi</i>	20	0.10
Asar-asar	<i>Selaginella sp.</i>	Selaginellaceae	Herb	Leaf	Herpes	9	0.69

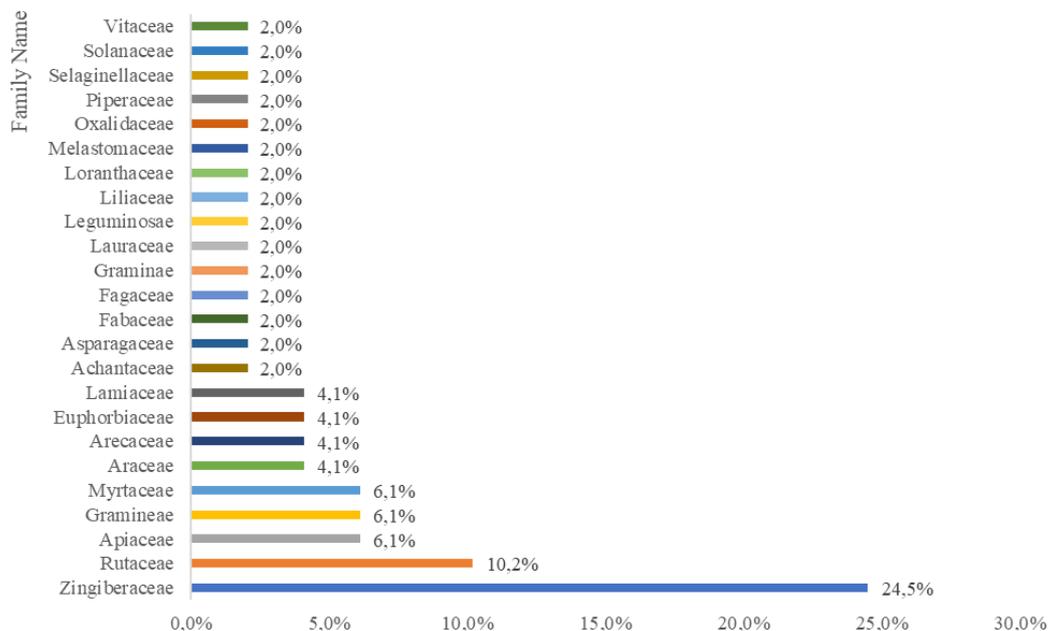


Figure 2. Percentage of plants utilization based on family

The next plant used is rhizome which is also widely used as medicinal. Karo people in Kuala Sub-district most often use rhizomes from the Zingiberaceae family; they are believed to have medicinal properties and positively affect the body. The rhizome of the Zingiberaceae family is believed to be able to maintain fitness so that the body remains healthy. Additionally, plant rhizomes have also been shown to have secondary metabolites beneficial to humans. Secondary metabolites in plants act as bioactive compounds and contribute directly to healing various diseases (Arman et al. 2022; Saraswathy 2023; Brahmi et al. 2022). The people choose the parts of the plants they use because they are considered capable and proven to cure diseases based on their experiences. Those selections were also due to mythological value, such as curing diseases due to interference by supernatural spirits, such as the *erpangir* ritual, which uses various kinds of leaves with mythological and aromatic value (Mandal et al. 2023).

The seeds used as medicine are nutmeg (*M. fragrans*) to cure colds and gout, cumin (*Trachyspermum*

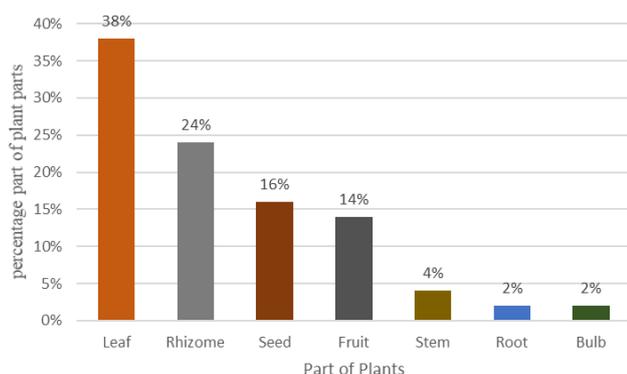
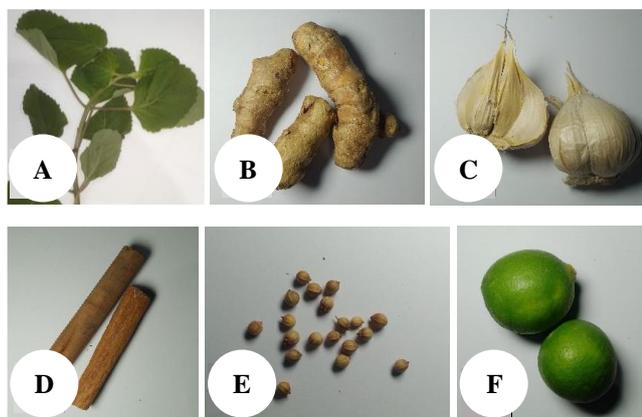
roxburghianum) to cure colds, and cloves (*Syzygium aromaticum*); these three seeds have mythological value for curing mucosal diseases. The tuber part which is used in medicinal was the garlic plant to treat mucus disease. The roots are used from cogon grass (*Imperata cylindrica*), which is believed to be able to treat stomach ulcers. Many of the fruits used come from the Rutaceae family, such as *Citrus medica*, *Citrus sinensis*, *C. hystrix*, and *C. aurantifolia*, which are used to cure colds and have mythological value. Plant parts such as seeds, tubers, bark, and fruit are also beneficial because they contain various active compounds (Shakya et al. 2023).

Variation of disease

The variation of diseases often experienced by the Karo people in Kuala Sub-district, Langkat District, is the basis for the community's grouping of medicinal plants. Variations in disease form the basis for variations in medicinal herbs developed by the community, presented in Table 2.

Table 2. Curable disease variation

Disease category	Percentage (%)
Flatulence	20.6
Uric acid	11.0
Back pain	11.0
Fever	11.0
<i>Mulajadi</i>	9.6
Muscle soreness	5.9
Tired	4.4
Gastric pain	4.4
Stimulating breastfeeding mother	3.7
Itchy skin	3.7
Freezing	2.9
Body bruises	2.9
Stomach ache (for child)	2.2
Cough	2.2
<i>Sengget</i>	2.2
Hypertension	1.5
Herpes	0.8

**Figure 3.** The part of the plant that is used as a medicinal ingredient**Figure 4.** The part of plant that used as medicine: A. leaf of terbangun (*Coleus amboinicus*), B. rhizome of kuning las (*Curcuma xanthorrhiza*), C. bulb of lasuna (*Allium sativum*), D. bark of kayu manis (*Cinnamomum burmanni*), E. seed of ketumbar (*Coriandrum sativum*), and F. fruit of rimo nipis (*Citrus aurantifolia*)

Flatulence is the most common disease experienced by the Karo people in Kuala Sub-district, resulting in stomach rumbling, cramps, pain, and diarrhea. Flatulence is due to intestinal microbes that release gases such as H₂, CO₂, and residual CH₄, which causes flatulence symptoms (Bepary and Wadikar 2019). The community believes that flatulence originates from within the human body, so it is necessary to drink hot medicinal concoctions to heal this disease. Flatulence can also be cured using Pengalun oil applied to the affected part of the stomach. Furthermore, colds, fever, and aching rheumatic pains are common ailments for the Karo people. Those diseases become symptoms of various diseases caused by stress, fatigue, and irregular eating. Therefore, the community uses medicinal plants such as *K. galanga*, *C. xanthorrhiza*, *C. burmanni*, and many more to release those symptoms. Those plants have also been scientifically proven to treat various diseases (Hayward et al. 2019; Nonglang et al. 2022; Nurcholis et al. 2018).

Mulajadi pain is a phenomenon that often occurs in the Karo tribe based on their local knowledge. *Mulajadi* is considered a disease from birth that cannot be treated medically. For example, some people experience ear swelling due to the hot climate or fever during climate change. The community believes several medicinal plants, such as *Z. officinale*, *S. aromaticum*, *C. domestica*, *P. nigrum*, and several others, can overcome this disease. These plants are usually processed into herbal teas.

The Karo people are also familiar with *sengget* disease caused by spirits. *Sengget* means to be surprised; this happens because of an energy collision between humans and spirits. They believe *Sengget* is caused by violating regulations in an area, for example, behaving impolitely and violating forest ethics. The people believe that impolite behavior in the forest caused anger to the spirits, which then humans to become feverish. *Sengget* is usually treated with the *erpangir* ritual, boiling various plant ingredients for bathing. The *erpangir* ritual usually uses 7 plants in the surrounding environment, including *C. domestica* leaves, *T. roxburghianum* leaves, *C. hystrix* leaves, and various other types.

The plants that the Karo people use have been widely researched scientifically. For example, *K. galanga* is often used as a medicine for boils, coughs, headaches, sore throats, diabetes, flatulence, and indigestion and to treat tumors (Majee et al. 2023). *K. galanga* is also often used as a modern medicine (Gunasekaran et al. 2019). This plant has antibacterial and anticancer properties; besides that, this plant has been shown to have cytotoxic activity against tumor cells (Amuamuta et al. 2017). *C. xanthorrhiza* has also become an ingredient in traditional and modern medicine because it has many pharmacological effects (Kang et al. 2022); it has been shown to have anti-inflammatory, anticancer, anti-hypertensive, and antioxidant activities (Oon et al. 2015), and has potential as an antibacterial and antifungal (Kim et al. 2019).

Plants used by the community as medicinal ingredients have been proven to contain phytochemical compounds. Examples of phytochemical compounds are flavonoids, saponins, tannins, alkaloids, and polyphenols contained in

rhizomes of *keciwer* (*K. galanga*) (Afnan 2018). Another example is the rhizome of *kuning las* (*C. xanthorrhiza*), which contains tannins, flavonoids, terpenes, triterpenes, and steroids (Arofik 2022); plants and endophytic fungi can produce these active compounds in plant tissues (Hastuti et al. 2019, 2023); those active plant compound contents can maintain body fitness.

Alkaloids, flavonoids, terpenoids, and tannins can be used as antioxidants and antibiotics (Hastuti et al. 2018, 2022). This active compound can also have antibacterial characteristics. Phytochemical compounds can influence active compounds and provide antimicrobial substances that can damage microbial cells, such as damaging cell walls, changing cell permeability, changing protein molecules, inhibiting the work of enzymes in cells, and inhibiting nucleic acid synthesis (Pelczar et al. 2014).

Prayers or spells for healing rituals

The Karo people's medical rituals are inseparable from chanting mantras and prayers. Prayers said during treatment are believed to be able to add healing value to people who are sick. Anyone can perform prayers, but healing rituals are usually performed by people considered capable, such as shamans or healers. The way people pray for medicinal rituals also shifts according to their religion; an example of prayer is explained as follows.

"*Dibata sinisembah kami, arah tambar enda pepalem ndu pinakit enda*", which mean: "God, through this medicine to cure this disease"

Some Karo people still believe in the power of their ancestors. This belief causes differences in the wording of sentences in prayers and spells, so people usually say prayers addressed to their ancestors. The community believes that mantras are a group of sentences that can provide healing if read correctly. The person who understands the mantra is usually a shaman or *Guru simbelin*. Shamans can make medicines from various plants that are given spells. Belief in shamans began to wane; people chose to read prayers according to their beliefs. The example of the prayer is as follows.

"*Nini tudung ras nini bulang arak-arakendu kamu gelas sehat kerina*", which mean: "Our ancestors, support us to be healthy"

Prayer reading is an important component for the community in carrying out treatment. Prayers are performed by the healer and patient being treated. Prayer is important because people believe in God who always gives healing to His servants. Prayer continues to grow according to people's beliefs. The Karo people are dominated by Christianity, Islam, and ancestral religion (*Pemena*). *Pemena* (which comes from the word *bena*) means original, initial, or first. So, *Pemena* is interpreted as the original religion of the Karo tribe before the arrival of Islam and Christianity. The healing tradition in *Pemena* is based on the relationship between this world and the spirit world. *Pemena* believe that the spirit world contains their ancestors who can help in healing rituals, so they pray to ask for help from their ancestors. This belief is closely attached to the Karo people, but now many people are Muslim and Christian, so prayers for healing are carried out

based on their respective beliefs in their gods. The shift in the beliefs of the Karo people affects the important value of a plant and the medicinal process. Some people still believe in traditional medicine, but others prefer modern medicine; they also continue to do prayers considered not contrary to religious belief (Perangin-angin and Zuska 2021).

Communities also have certain management patterns to produce traditional medicines, such as the use of special tools or belief in spirits (Murphy 2017). The Karo people in Kuala Sub-district make medicinal ingredients using traditional tools, such as a wooden mill, knives, and cauldrons made of clay. Some medicines only use plants processed by chewing and then applying them to the affected body area. All medicine stage productions have a mythological value, so prayer accompanies medicine. The community also believes in the mythological value of the plants used; for example, *rimo mungkur* is able to treat medical and non-medical diseases. *Rimo mungkur* is believed to provide a cool feeling to the body. *Rimo mungkur* juice is considered a symbol of balance in the universe, so it can be used in various rituals to heal the body from non-medical illnesses such as disturbances from supernatural spirits or *sengget*.

Ethnomedicine behavioral changes of the Karo tribe in Kuala Sub-district

The Karo people are no longer the dominant group in Kuala Sub-district. The community group in Kuala Sub-district is the Javanese Ethnic Group. The multi-group nature of society in Kuala Sub-district creates an acculturation process. Acculturation can occur if there is long interaction between people of different ethnic groups, and this assimilation can be passed on from generation to generation (Bagus and Alam 2023). Acculturation has changed the ethnomedicine knowledge among the Karo people in Kuala Sub-district so that it differs from the other areas. Many informants stated that it was difficult to find authentic Karo treatment in Kuala Sub-district, so many of them sought treatment in other areas such as Karo District, which the Karo tribe still dominates.

Kuala Sub-district has medical and pharmaceutical facilities that are easily accessible to the public. Many people use chemical medicines because they are considered more practical than traditional herbal medicines. People use chemical medicines because they cure diseases more quickly than traditional medicines. However, there are still many people who believe that supernatural spirits cause non-medical diseases, so they still need traditional treatment. The Karo tribe in Kuala Sub-district has tried to maintain traditional healing culture and knowledge of medicinal plants by introducing this knowledge to their descendants. Apart from that, people in Kuala Sub-district are still close to resources in the form of plants used as traditional medicine. Kuala Sub-district has a market that provides various plants; apart from that, residents own various plantations, and there is a culture of maintaining garden plants. Several people in Kuala Sub-district keep plants from the Zingiberaceae family because they have properties for treating their illnesses.

This research shows 49 plants used in medicinal practice, and the highest significance cultural index and use value is *K. galanga*. The part of the plant that is most widely used is the leaf. The most common disease experienced by the Karo people in Kuala Sub-district is flatulence, and many medicinal plants are used to treat this disease. The Karo tribe in Kuala Sub-district still has the knowledge and trust and applies plant management practices as ingredients for traditional medicine. This research documents the knowledge, beliefs, and practices of managing medicinal plants by the Karo tribe community in Kuala Sub-district, Langkat District, North Sumatra. Hopefully, this research can become a basis for ethnobotanical research on traditional medicine and become an additional reference.

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REFERENCES

- Afnan. 2018. Uji efektivitas ekstrak rimpang kencur (*Kaempferia galanga* L.) sebagai antibakteri *Staphylococcus aureus* secara in vitro. Universitas Brawijaya, Malang. [Indonesian]
- Alam MBS. 2023. Acculturation of Java and Chinese culture in historical perspective. *Sinolingua: J Chinese Stud* 1 (1): 1-14.
- Anumamuta A, Plengsuriyakarn T, Na-Bangchang K. 2017. Anticholangiocarcinoma activity and toxicity of the *Kaempferia galanga* Linn. rhizome ethanolic extract. *BMC Complement Altern Med* 17: 1. DOI: 10.1186/s12906-017-1713-4.
- Arman M, Chowdhury KAA, Bari MS, Khan MF, Huq MMA, Haque MA, Capasso R. 2022. Hepatoprotective potential of selected medicinally important herbs: evidence from ethnomedicinal, toxicological and pharmacological evaluations. In *Phytochem Rev* 21: 1863-1886. DOI: 10.1007/s11101-022-09812-5.
- Arofik HN. 2022. Etnobotani dan profil fitokimia tumbuhan obat oleh masyarakat kawasan Gunung Wilis Kabupaten Tulungagung. Universitas Islam Negeri Maulana Malik Ibrahim, Malang. [Indonesian]
- Aswandi A, Kholibrina CR. 2021. Ethnomedicine of forest's essential oils for respiratory and cardiovascular treatments in Northern Sumatra. *IOP Conf Ser: Earth Environ Sci* 914: 1. DOI: 10.1088/1755-1315/914/1/012073.
- Aththorick TA, Berutu L. 2018. Ethnobotanical study and phytochemical screening of medicinal plants on Karonese people from North Sumatra, Indonesia. *J Phys: Conf Ser* 1116 (5): 052008. DOI: 10.1088/1742-6596/1116/5/052008.
- Barman T, Samant SS, Jyoti, Dey A, Nandy S, Maitra R, Tiwari LM, Anjana. 2023. Sustainable employment of folkloric botanicals and conservation practices adopted by the inhabitants of Parbati Valley of North Western Himalaya, India in healing substantial corporeal disorders. *Adv Tradit Med* 23: 443-482. DOI: 10.1007/s13596-021-00605-3.
- Batoro J. 2015. *Pengelolaan Lingkungan dengan Pendekatan Etnobiologi-Etnobotani*. UB Press, Malang. [Indonesian]
- Batubara RP, AM Zuhud E, Hermawan R, Tumanggor R. 2017. Nilai guna spesies tumbuhan dalam oukup (mandi uap) Masyarakat Batak Karo. *Media Konservasi* 22: 79-86. DOI: 10.29244/medkon.22.1.79-86. [Indonesian]
- Bepary RH, Wadikar DD. 2019. HPLC profiling of flatulence and non-flatulence saccharides in eleven ricebean (*Vigna umbellata*) varieties from North-East India. *J Food Sci Technol* 56 (3): 1655-1662. DOI: 10.1007/s13197-019-03675-z.
- Bhagawan WS, Suproborini A, Prastya PDL, Nurfatma A, Putra RT. 2022. Ethnomedicinal study, phytochemical characterization, and pharmacological confirmation of selected medicinal plant on the northern slope of Mount Wilis, East Java, Indonesia. *Biodiversitas* 23: 4303-4313. DOI: 10.13057/biodiv/d230855.
- Boro M, Das B, Boro KK, Nath M, Buragohain P, Roy S, Sarma PJ, Kalita S, Nath N. 2023. Quantitative ethnobotany of medicinal plants used by the Bodo Community of Baksa District, BTR, Assam, India. *Biodiversitas* 24: 3169-3182. DOI: 10.13057/biodiv/d240610.
- Brahmi F, Iblhoulen Y, Issaadi H, Elsebai MF, Madani K, Boulekbache-Makhlouf L. 2022. Ethnobotanical survey of medicinal plants of bejaia localities from algeria to prevent and treat coronavirus (COVID-19) infection shortened title: Phytomedicine to manage COVID-19 pandemic. *Adv Tradit Med* 23: 819-831. DOI: 10.1007/s13596-022-00649-z.
- Dapar MLG, Meve U, Liede-Schumann S, Alejandro GJD. 2020. Ethnomedicinal appraisal and conservation status of medicinal plants among the manobo tribe of bayugan city, philippines. *Biodiversitas* 21: 3843-3855. DOI: 10.13057/biodiv/d210854.
- Gani ARF, Sueb, Hastuti US. 2022. Ethnoecological studies: Environmental management of the local community in Angkola Sangkunar, North Sumatra, Indonesia. *AIP Conf Proc* 2659 (1): 060008. DOI: 10.1063/5.0113058.
- Gunasekaran S, Venkatachalam K, Namasivayam N. 2019. Anti-inflammatory and anticancer effects of p-methoxycinnamic acid, an active phenylpropanoid, against 1,2-dimethylhydrazine-induced rat colon carcinogenesis. *Mol Cell Biochem* 451: 117-129. DOI: 10.1007/s11010-018-3398-5.
- Guzo S, Lulekal E, Nemomissa S. 2023. Ethnobotanical study of underutilized wild edible plants and threats to their long-term existence in Midakegn District, West Shewa Zone, Central Ethiopia. *J Ethnobiol Ethnomed* 19 (30): 1-19. DOI: 10.1186/s13002-023-00601-8.
- Hankiso M, Warkineh B, Asfaw Z, Debella A. 2023. Ethnobotany of wild edible plants in Soro District of Hadiya Zone, southern Ethiopia. *J Ethnobiol Ethnomed* 19: 21. DOI: 10.1186/s13002-023-00588-2.
- Haque E, Bari MS, Khandokar L, Anjum J, Jantan I, Seidel V, Haque MA. 2023. An updated and comprehensive review on the ethnomedicinal uses, phytochemistry, pharmacological activity and toxicological profile of *Tinospora crispa* (L.) Hook. f. & Thomson. *Phytochem Rev* 22 (1): 211-273. DOI: 10.1007/s11101-022-09843-y.
- Hastuti US, Asna PMA, Rahmawati D. 2018. Histologic observation, identification, and secondary metabolites analysis of endophytic fungi isolated from a medicinal plant, *Hedychium acuminatum* Roscoe. *AIP Conf Proc* 2002 (1): 020070. DOI: 10.1063/1.5050166.
- Hastuti US, Novianti V, Rahmawati D, Sari RY, Zahida NS. 2023. Endophytic fungi isolated from *Jasminum sambac* L.: Identification, histological observation, and content analysis of secondary metabolites. In 12th International Conference on Green Technology (ICGT 2022) (pp. 20-33). Atlantis Press. DOI: 10.2991/978-94-6463-148-7_4.
- Hastuti US, Rahmawati D, Sari RY. 2019. Histologic observation, identification and secondary metabolites analysis of endophytic fungi isolated from *Cananga odorata* (Lam.) Hook. F. & Thomson. *IOP Conf Ser: Mater Sci Eng* 546: 2. DOI: 10.1088/1757-899X/546/2/022005.
- Hastuti US, Sulisetijono S, Thoyibah C, Pratiwi SH, Khotimah K. 2022. Histological observation, identification, and secondary metabolites content in endophytic fungi of mahogany tree (*Swietenia mahagoni* Jacq). In 7th International Conference on Biological Science (ICBS 2021) (pp. 156-164). Atlantis Press. DOI: 10.2991/absr.k.220406.024.
- Hayward NJ, McDougall GJ, Farag S, Allwood JW, Austin C, Campbell F, Horgan G, Ranawana V. 2019. Cinnamon shows antidiabetic properties that are species-specific: Effects on enzyme activity inhibition and starch digestion. *Plant Foods Human Nutr* 74 (4): 544-552. DOI: 10.1007/s11130-019-00760-8.
- Iskandar J. 2018. *Etnobiologi, Etnoekologi dan Pembangunan Berkelanjutan*. Plantaxia, Yogyakarta. [Indonesian]
- Kang J, Won J, Hwang JK, Kang W. 2022. Bioavailability of xanthorrhizol following oral administration of a supercritical extract of Java turmeric. *Food Sci Biotechnol* 31: 1309-1313. DOI: 10.1007/s10068-022-01124-w.

- Kim MS, Kim HR, Kim H, Choi SK, Kim CH, Hwang JK, Park SH. 2019. Expansion of antibacterial spectrum of xanthorrhizol against Gram-negatives in combination with PMBN and food-grade antimicrobials. *J Microbiol* 57: 405-412. DOI: 10.1007/s12275-019-8511-2.
- Lestariningsih N, Jalil M, Ayatusa'adah, Nirmalasari R. 2023. Ethnomedicine exploration of medicinal plants in Dayak Bakumpai and Ngaju Tribes, Central Kalimantan, Indonesia. *Biodiversitas* 24: 1163-1174. DOI: 10.13057/biodiv/d240257.
- Majee CK, Ali SY, Padhy PK. 2023. Effects of atmospheric dust particles on common medicinal plants in an industrial area of West Bengal, India. *Environ Monit Assess* 195: 1-29. DOI: 10.1007/s10661-023-11573-3.
- Mandal D, Sarkar T, Chakraborty R. 2023. Critical review on nutritional, bioactive, and medicinal potential of spices and herbs and their application in food fortification and nanotechnology. *Appl Biochem Biotechnol* 195: 1319-1513. DOI: 10.1007/s12010-022-04132-y.
- Murphy KM. 2017. A quiet harvest: Linkage between ritual, seed selection and the historical use of the finger-bladed knife as a traditional plant breeding tool in Ifugao, Philippines. *J Ethnobiol Ethnomed* 13 (1): 3. DOI: 10.1186/s13002-016-0124-9.
- Mutheeswaran S, Mariappan A, Ragavendran K, Porchezhiyan V, Elankani P, Al-Dhabi NA, Arasu MV, Ignacimuthu S. 2023. Quantitative ethnobotany of Paliyar tribe in Sathuragiri hills, Virudhunagar District, Tamil Nadu, India. *Adv Tradit Med* 23: 483-501. DOI: 10.1007/s13596-021-00609-z.
- Nasution B, Aththorick TA, Rahayu S. 2018. Medicinal plants used in the treatment of diabetes in karo ethnic, north sumatra, indonesia. *IOP Conf Ser: Earth Environ Sci* 130: 1. DOI: 10.1088/1755-1315/130/1/012038.
- Nonglang FP, Khale A, Bhan S. 2022. Phytochemical characterization of the ethanolic extract of *Kaempferia galanga* rhizome for anti-oxidant activities by HPTLC and GCMS. *Future J Pharm Sci* 8 (1): 1-12. DOI: 10.1186/s43094-021-00394-1.
- Nuneza OM, Rodriguez BC, Nasiad JGM. 2021. Ethnobotanical survey of medicinal plants used by the Mamanwa tribe of Surigao del Norte and Agusan del Norte, Mindanao, Philippines. *Biodiversitas* 22: 3284-3296. DOI: 10.13057/BIODIV/D220634.
- Nurcholis W, Munshif AA, Ambarsari L. 2018. Xanthorrhizol contents, α -glucosidase inhibition, and cytotoxic activities in ethyl acetate fraction of *Curcuma zanthorrhiza* accessions from Indonesia. *Revista Brasileira de Farmacognosia* 28 (1): 44-49. DOI: 10.1016/j.bjp.2017.11.001.
- Oon SF, Nallappan M, Tee TT, Shohaimi S, Kassim NK, Sa'ariwijaya MSF, Cheah YH. 2015. Xanthorrhizol: A review of its pharmacological activities and anticancer properties. *Cancer Cell Intl* 15: 1-15 DOI: 10.1186/s12935-015-0255-4.
- Pelczar MJ, Chan ECS. 2014. *Dasar-Dasar Mikrobiologi*. UI-Press, Depok. [Indonesian]
- Perangin-angin RF, Fikarwin. 2021. Traditional treatment of tawar penggel in Karo tribe. *Indones J Med Anthropol* 2: 63-68. DOI: 10.32734/ijma.v2i2.6475.
- Rahmawaty, Amalia R, Rauf A, Batubara R. 2019. Medicinal plant inventory using GIS and GPS in Garunggang Village, Kuala Sub-district, Langkat District, North Sumatra. *IOP Conf Ser: Earth Environ Sci* 374: 1. DOI: 10.1088/1755-1315/374/1/012056.
- Rajapaksha R, Pham VT, Ojha R, Islam T, De Silva N, Pushpakumara G, Bussmann RW. 2023. Ethnobotany of *Lasia spinosa* (L.) Thwaites: the spiny edible aroid in Asia. *Genet Resour Crop Evol* 70: 1553-1566. DOI: 10.1007/s10722-023-01574-z.
- Ramli MR, Milow P, Malek S. 2021. Diversity and traditional knowledge of medicinal plants in home gardens of Kampung Masjid Ijok, Perak, Malaysia. *Biodiversitas* 22: 2458-2465. DOI: 10.13057/biodiv/d220502.
- Samsuri, Ahmad AG, Zaitunah A, Tambusai HK. 2019. Evaluation of plant species suitability for lowland forest landscape restoration in Lengan watersheds, Langkat district, north Sumatra, Indonesia. *Biodiversitas* 20: 2903-2909. DOI: 10.13057/biodiv/d201018.
- Saraswathy SD. 2023. An overview on the ethnopharmacological, nutritional, and phytochemical perspectives of *Elaeocarpus floribundus* Blume. *Curr Pharmacol Rep* 9 (5): 377-389. DOI: 10.1007/s40495-023-00329-9.
- Shakya A, Naorem A, Khurajam JS. 2023. *Gnetum* L., An underutilized plant of India: Distribution and ethnobotany. *Genet Resour Crop Evol* 71 (1): 29-38. DOI: 10.1007/s10722-023-01704-7.
- Silalahi M, Nisyawati, Purba EC, Abinawanto DW, Wahyuningtyas RS. 2021. Ethnobotanical study of Zingiberaceae rhizomes as traditional medicine ingredients by medicinal plant traders in the Pancur Batu Traditional Market, North Sumatera, Indonesia. *J Trop Ethnobiol* 4: 78-95. DOI: 10.46359/jte.v4i2.54.
- Silalahi M, Nisyawati. 2018. The ethnobotanical study of edible and medicinal plants in the home garden of Batak Karo sub-ethnic in north Sumatra, Indonesia. *Biodiversitas* 19: 229-238. DOI: 10.13057/biodiv/d190131.
- Turner NJ. 1988. "The importance of a rose": evaluating the cultural significance of plants in Thompson and Lilloet Interior Salish. *Am Anthropol* 90 (2): 272-290. DOI: 10.1525/aa.1988.90.2.02a00020.
- Utaminigrum W, Nofrianti, Hartanti D. 2022. Diversity and use of medicinal plants for traditional women's health care in Northern Banyumas, Indonesia. *Biodiversitas* 23: 1970-1976. DOI: 10.13057/biodiv/d230431.
- Weick CW, Aamir N, Reichart J. 2023. The ethnobotanical evolution of the mediterranean cypress (*Cupressus sempervirens*). *Econ Bot* 77 (2): 203-221. DOI: 10.1007/s12231-023-09570-1.
- Yaipharembi N, Huidrom, elizabeth, NoNgalleima K, birKumar Singh. 2023. An ethnobotanical study on the dietary use of wild trees as traditional vegetables by Three Ethnic Communities in Manipur, North East India. *Econ Bot* 77 (3): 324-339. DOI: 10.1007/s12231-023-09582-x.