

Applications of the Zingiberaceae in traditional medicine among the Dayak Tamambaloh Tribe in Labian Ira'ang and Temau Villages, Kapuas Hulu District, Indonesia

MARKUS IYUS SUPIANDI^{1,*}, HENDRIKUS JULUNG¹, YUDITA SUSANTI¹, DIDIN SYAFRUDDIN¹,
ADRIANA GANDASARI¹, SUSRIYATI MAHANAL², SITI ZUBAIDAH²

¹STKIP Persada Khatulistiwa Sintang. Jl. Pertamina Km 4, Sengkuang, Sintang 78614, West Kalimantan, Indonesia.

Tel.: +62-821-5596-4080, *email: msupiandi@gmail.com

²Program of Biology Education, Faculty of Mathematics and Science, Universitas Negeri Malang. Jl. Semarang No. 5, Malang 65145, East Java, Indonesia

Manuscript received: 24 November 2023. Revision accepted: 15 January 2024.

Abstract. Supiandi MI, Julung H, Susanti Y, Syafruddin D, Gandasari A, Mahanal S, Zubaidah S. 2024. Applications of the Zingiberaceae in traditional medicine among the Dayak Tamambaloh Tribe in Labian Ira'ang and Temau Villages, Kapuas Hulu District, Indonesia. *Biodiversitas* 25: 71-78. This indigenous knowledge remains largely undocumented, primarily in oral form and only possessed by specific individuals. Therefore, this study aimed to record the Zingiberaceae species systematically applied for traditional medicine by the Dayak Tamambaloh Tribe, Kapuas Hulu District, Indonesia through a qualitative descriptive method. Data were collected from informants and recommendation sources through different stages including a literature study, semi-structured interviews, field observations, and documentation, for subsequent analysis using descriptive methods. The results showed that Labian Ira'ang Village inhabitants utilize eight Zingiberaceae species, namely *lengkuas* (*Alpinia galanga*), *lalamas* (*A. nieuwenhuizii*), *kunus baute* (*Curcuma zedoaria*), *kunus kuning* (*C. longa*), *tantamu kuning* (*C. xanthorrhiza*), *sakur* (*Kaempferia galanga*), *japa* (*Zingiber montanum*), and *laia* (*Z. officinale*). Meanwhile, the tribe in Temau reported nine species, including *lengkuas* (*A. galanga*), *kunus baute* (*C. zedoaria*), *kunus* (*C. longa*), *tantamu kuning* (*C. xanthorrhiza*), *katimbang* (*Etilingera coccinea*), *randar* (*Hornstedtia havilandii*), *sakur* (*K. galanga*), *japa* (*Z. montanum*), and *laiya* (*Z. officinale*). The results show the same types of plants used by people in Labian Ira'ang and Temau Villages, although the processing methods and uses differ. The difference is due to different experiences in gaining knowledge about using plants as traditional medicine.

Keywords: Dayak, medicinal, rhizome, traditional, Zingiberaceae

INTRODUCTION

West Kalimantan, the fourth-largest province in Indonesia (Soetarto et al. 2001), is predominantly populated by the Dayak people (Supiandi et al. 2019), including the Dayak Tamambaloh Tribe located in Labian Ira'ang Village, Batang Lupar Sub-district and Temau Village, Embaloh Hulu Sub-district, Kapuas Hulu District. The Dayak Tamambaloh Tribe, with a long history of using forest products such as plants for traditional medicine has preserved this knowledge in oral form over the years (Qamariah et al. 2020; Az-Zahra et al. 2021; Syafruddin et al. 2022; Supiandi et al. 2023; Susanti et al. 2023).

Traditional knowledge is all the ancestral wisdom and collective and comprehensive knowledge of indigenous peoples (Trejo 2021). Traditional knowledge plays a crucial role in local development, enabling the local tribe to access essential resources for survival (Gartaula et al. 2020). Traditional knowledge creates community awareness to manage daily activities. It provides an important foundation for community-based climate change adaptation measures and conservation of natural resources (Mekonnen et al. 2021). It offers scientific methods to achieve long-term sustainability goals (Cao et al. 2020). Additionally, it is rooted in place-based spiritual

knowledge and values passed across generations (Singer et al. 2023), with applications in human health care (Shah et al. 2023).

Traditional knowledge of the Dayak Tamambaloh Tribe pertains to using species from the Zingiberaceae family for medicinal purposes. The dependence on the Zingiberaceae family is attributed to the (i) abundance in nature, (ii) ease of cultivation, (iii) economic affordability, and (iv) proven efficacy in deworming, augmenting sexual desire, eliminating unpleasant body odor, facilitating postpartum recovery, and repelling colds. Additionally, these plants serve as blood purifiers and remedies for rheumatism, infantile fever, skin infection/itching, appendicitis, typhoid, dysentery, vaginal discharge, menstrual irregularities, ulcers, constipation, chickenpox, influenza, headache, diarrhea, stomach inflammation, eye pain, wounds, ringworm, scabies, cancer, tumor, postpartum bleeding, nosebleeds, pinworm infestations, and vomiting (Supiandi et al. 2023). According to Zaki et al. (2019), plants play an important role among rural tribes as a source of medicine for curing common diseases. Sulaiman et al. (2020) stated that residents in remote areas usually rely on traditional knowledge regarding medicinal plants for treating different health conditions.

The Zingiberaceae, commonly known as the ginger family, is the most prominent herbaceous family worldwide, with 50 genera and approximately 1,300 to over 1,600 species, particularly scattered across Africa, Asia, and America (Tamokou et al. 2017; Premram et al. 2018; Donadu et al. 2020). This group of plants is broadly distributed in the tropics and subtropics, with a significant presence of 19 genera and 375 species in Indonesia (Hartati et al. 2014). Based on the medicinal benefits of the Zingiberaceae (Dubost et al. 2019; Zhao et al. 2019; Silalahi et al. 2021), it has been traditionally used to accelerate postpartum recovery and treat various diseases (Hartati et al. 2014), such as stomach ulcers, hepatitis, worm infestations, and scabies (Ege et al. 2022).

The oral transmission of traditional knowledge concerning medicinal plants among the Dayak Tamambaloh Tribe faces challenges due to generational shifts and a decreasing interest among the younger population (Shah et al. 2023) influenced by modernization (Ghanimi et al. 2022), cultural change, and the expansion of modern education (Nguyen et al. 2019).

The threat of losing invaluable knowledge prompts an investigation into the use of the Zingiberaceae family by the local tribe for traditional medicine. Therefore, this study aimed to systematically record the types (botanical name, vernacular name), parts of plants used, processing methods, and medicinal benefits. Documenting relevant information about medicinal plants is essential to preserve indigenous knowledge amidst modern challenges (Hussain et al. 2022). Documentation of indigenous knowledge on medicinal plant utilization is important as it ensures that indigenous cultural heritage is preserved for current and future generations (Mahwasane et al. 2013). Documenting traditional knowledge of medicinal plants and practices is essential for future management strategies and conserving medicinal plant genetic resources (Dapar et al. 2020).

MATERIALS AND METHODS

Study area

This study was conducted at Labian Ira'ang Village, Batang Lupar Sub-district and Temau Village, Embaloh Hulu Sub-district, both in Kapuas Hulu District, West Kalimantan, Indonesia (Figure 1). Labian Ira'ang covers an area of 2,370 hectares with a population of 455 people (242 men and 213 women), amounting to 126 families; it comprises Bakul, Kereng Lunsu, and Sembawang hamlets, containing 219, 195, and 43 people, equivalent to 62, 51, and 13 families, respectively (Supiandi et al. 2023). Temau, located in the northern part of Putussibau, spans 80 km, consisting of Nanga Liyu and Kanyoling hamlets, with ± 200 households primarily engaging in farming and gardening (Susanti et al. 2023).

Data collection

A qualitative descriptive method was applied to systematically gather data on using the Zingiberaceae plants for traditional medicine by the Dayak Tamambaloh Tribe in Labian Ira'ang and Temau villages. According to Busetto et al. (2020), a qualitative study aims to explain an observed phenomenon. Cropley (2022) reported that qualitative study focuses on deriving meaning from real experiences through narrative words.

The data collection stage consisted of (i) a literature study which collected information on maps and general conditions of the study location. (ii) semi-structured interviews dealing with extracting information from informants about the medicinal use of the Zingiberaceae family plants through a prepared questions guide. (iii) field observation comprising verification of plant species from interviews with informants. (iv) documentation, including searching for data in the form of records, pictures, archives, or any documents in line with the study objectives of the Dayak Tamambaloh Tribe.

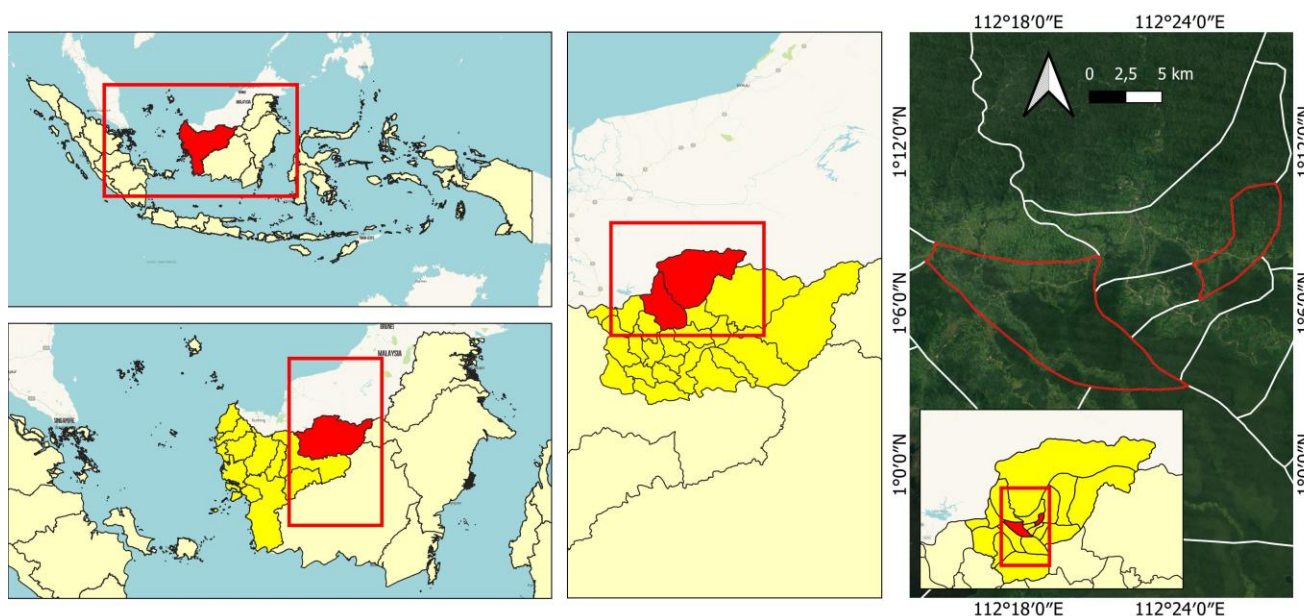


Figure 1. Study sites in Kapuas Hulu District, West Kalimantan, Indonesia: (A) Labian Ira'ang Village, (B) Temau Village

Table 1. Informants

Gender	Age	Type of Informant	Information	Location
Man	70 years	Traditional leader	Main informants	Labian Ira'ang
Woman	65 years	Traditional healer	Key informants	Labian Ira'ang
Woman	74 years	Traditional healer	Key informants	Labian Ira'ang
Woman	68 years	Knew the uses of plants for traditional medicine	Recommendation sources	Labian Ira'ang
Man	68 years	Knew the uses of plants for traditional medicine	Recommendation sources	Labian Ira'ang
Man	75 years	Traditional leader	Main informants	Temau
Man	65 years	Traditional healer	Key informants	Temau
Man	70 years	Traditional healer	Key informants	Temau
Woman	68 years	Traditional healer	Key informants	Temau
Man	50 years	Knew the uses of plants for traditional medicine	Recommendation sources	Temau
Woman	49 years	Knew the uses of plants for traditional medicine	Recommendation sources	Temau

Permission was requested from village heads in Labian Ira'ang and Temau to conduct this study. Data regarding the use of the *Zingiberaceae* family plants among the Dayak Tamambaloh Tribe were obtained from main informants (traditional leaders), key informants (traditional healers), and recommendation sources (individuals knowledgeable about plant uses for traditional medicine). According to Table 1, the total informants were 11, aged between 49-75 years, were interviewed, and their data showed six men and five women with farming occupations, selected using purposive and snowball sampling methods (Tongco 2007; Naderifar et al. 2017).

Data analysis

The collected data were analyzed using the descriptive method in sequential stages, including (i) determining the scientific names of the *Zingiberaceae* family plants used by the Dayak Tamambaloh Tribe. This comprised cross-referencing data through online portals such as Plantamor (plantamor.com), The Plant List (theplantlist.org), Plant of the World Online (POWO) (powo.science.kew.org), The Global Biodiversity Information Facility (gbif.org), International Plant Names Index (IPNI) (ipni.org), and relevant reference books. (ii) Data tabulation and description, data on plant parts used and processing methods were calculated as percentages.

RESULTS AND DISCUSSION

The results of interviews conducted among the Dayak Tamambaloh Tribe showed plant species from the *Zingiberaceae* family used for traditional medicine as presented in Table 2.

Based on Table 2, the tribes in Labian Ira'ang and Temau Villages used eight and nine species of the *Zingiberaceae* family, respectively, for traditional medicinal purposes. Each region had different knowledge regarding the uses of medicinal plants, even though the species were similar.

Labian Ira'ang inhabitants used (i) *lengkua* (*Alpinia galanga*) to increase sexual arousal and cure rheumatism,

(ii) *lalamas* (*A. nieuwenhuizii*) for infantile fever treatment, (iii) *kunus baute* (*Curcuma zedoaria*) for skin infections/itching management, and (iv) *kunus kuning* (*C. longa*) to cure appendicitis, typhoid, dysentery, vaginal discharge, and menstrual irregularities. Other species used were (v) *tantamu kuning* (*C. xanthorhiza*) to manage ulcers, constipation, and chickenpox, (vi) *sakur* (*Kaempferia galanga*) to cure influenza, headache, diarrhea, and stomach inflammation, (vii) *japa* (*Zingiber montanum*) for treating eye pain, and (viii) *laia* (*Z. officinale*) for managing wounds from falls and itching.

Tribe in Temau used (i) *langkuas* (*A. galanga*) to treat ringworm and scabies, (ii) *kunus baute* (*C. zedoaria*) as an anti-cancer, tumor, and blood purifier in ulcers, (iii) *kunus* (*C. longa*) to treat external wounds and postpartum bleeding, (iv) *tantamu kuning* (*C. xanthorhiza*) for curing nosebleeds and ulcers, (v) *katimbang* (*Etlingera coccinea*) for pinworms, and vomiting, (vi) *randar* (*Hornstedtia havilandii*) for deworming, (vii) *sakur* (*K. galanga*) to get rid of bad body odor, and repel colds, (viii) *japa* (*Z. montanum*) to treat slight wounds, and (ix) *laiya* (*Z. officinale*) for repelling colds and promoting post-natal recovery.

The *A. galanga* rhizome contains various compounds such as essential oils, flavonoids, phenolic acids, saponins, terpenoids, galangal acetate, kaempferol, and 1,8-cineole (Jaju et al. 2009; Chudiwal et al. 2010; Ghosh and Rangan 2013; Aziman et al. 2014; Hamad et al. 2016; Basri et al. 2017). This species was used to cure dizziness, fever, and muscle pain (Inta et al. 2023) and might be essential in COVID-19 treatment (Khairullah et al. 2020). Chudiwal et al. (2010) reported that *A. galanga* rhizome was used to improve appetite, taste, and voice, as well as treat bronchitis, heart disease, stomach medicine, aphrodisiac, tonic, diuretic, headache, rheumatic pain, sore throat, belching, pain in the chest, diabetes, liver burning, glandular tuberculosis, and kidney disease. Verma et al. (2011) stated that *A. galanga* could be traditionally applied as an antifungal, antitumor, antihelmintic, antidiuretic, and gastritis, as well as for managing heart disease, rheumatic pain, chest pain, dyspepsia, fever, diabetes, liver burning, and kidney disease.

Table 2. List of plants used by the Dayak Tamambaloh Tribe in Labian Ira'ang and Temau Villages, Kapuas Hulu District, West Kalimantan, Indonesia

Botanical Name	Vernacular Name	Parts Used	Processing Method	Medicinal Benefits	Location (Village)
<i>Alpinia galanga</i> (L.) Sw.	<i>Lengkuas</i>	Rhizome	Grated, mixed with water, and drunk	Augmentation of sexual desire and remedy for rheumatism	Labian Ira'ang
<i>Alpinia nieuwenhuizii</i> Valetton.	<i>Lalamas</i>	Root, leaf	Boiled. The boiled water is used for bathing	Curing fever in infants	Labian Ira'ang
<i>Curcuma zedoaria</i> (Berg.) Rosc.	<i>Kunus baute</i>	Rhizome	Grated, applied to itchy parts of the body	Treatment of skin infection/itching	Labian Ira'ang
<i>Curcuma longa</i> L.	<i>Kunus kuning</i>	Rhizome	Three rhizomes boiled, mixed with a little salt, drunk	Remedy for appendicitis, typhoid, dysentery, vaginal discharge, and menstrual irregularities	Labian Ira'ang
<i>Curcuma xanthorrhiza</i> Roxb	<i>Tantamu kuning</i>	Rhizome	Grated, squeezed, boiled, drunk	Management of ulcers, constipation, chickenpox, mouth ulcers	Labian Ira'ang
<i>Kaempferia galanga</i> L.	<i>Sakur</i>	Rhizome	Chewed, eaten	Influenza, headache, diarrhea, and stomach inflammation	Labian Ira'ang
<i>Zingiber montanum</i> (J.Koenig) Link ex A.Dietr.	<i>Japa</i>	Rhizome	Grated, smeared	Eye pain	Labian Ira'ang
<i>Zingiber officinale</i> Linn. Var. <i>rubrum</i>	<i>Laia</i>	Rhizome	Grated, applied to the affected part of the body	Treating wounds from falls, and itching	Labian Ira'ang
<i>Alpinia galanga</i> (L.) Sw.	<i>Langkuas</i>	Rhizome	Applied directly on the affected part of the body	Ringworm, scabies	Temau
<i>Curcuma zedoaria</i> (Berg.) Rosc.	<i>Kunus baute</i>	Rhizome	Grated, boiled, drunk	Anti-cancer, tumor suppressor, blood purifier in ulcers	Temau
<i>Curcuma longa</i> L.	<i>Kunus</i>	Rhizome	Grated, then applied to wounds	External wounds	Temau
<i>Curcuma xanthorrhiza</i> Roxb.	<i>Tantamu kuning</i>	Rhizome	Shredded, boiled, drunk	Postpartum bleeding	Temau
<i>Etlingera coccinea</i> (Blume).	<i>Katimbang</i>	Young stem	Grated, boiled, drunk	Managing nosebleeds and ulcers	Temau
<i>Hornstedtia havilandii</i> (K.Schum.) K.Schum.	<i>Randar</i>	Young shoots	Burned, eaten	Control of pinworm infestation and vomiting	Temau
<i>Kaempferia galanga</i> L.	<i>Sakur</i>	Rhizome, leaf	Eaten	Deworming	Temau
<i>Zingiber montanum</i> (J.Koenig) Link ex A.Dietr.	<i>Japa</i>	Rhizome	Grated, boiled, drunk	Elimination of unpleasant body odor and repelling of colds	Temau
<i>Zingiber officinale</i> Linn. var. <i>rubrum</i>	<i>Laiya</i>	Rhizome	Grated, applied to the affected part of the body	Slight wounds	Temau
			Boiled, drunk	Repelling of colds and postpartum recovery promotion	Temau

The *A. nieuwenhuizii* comprises numerous flavonoids, tannins, and polyphenolics with anti-inflammatory, antimicrobial, anti-cancer, and therapeutic potential (Ghosh and Rangan 2013). Meanwhile, *C. zedoaria* contains secondary metabolites such as sesquiterpenoids, phenolics, tannins, saponins, alkaloids, terpenoids, and steroids with anticholesterol, antitumor/cancer, anti-inflammatory, antipyretic, analgesic, and antimicrobial properties (Handajani 2013; Silalahi 2020). Kim et al. (2021) reported using *C. zedoaria* in treating headaches, fever, and symptoms associated with hypertension in Asian countries, including Korea, China, and Japan.

Curcumin contains phenols, essential oils, steroids, triterpenoids, alkaloids, saponins, glycosides, tannins, and flavonoids (Mitayani et al. 2022). Curcumin has a substance called Curcumin, which is useful in traditional medicine applications due to its antioxidant, anti-inflammatory, anti-cancer, antidiabetic (Hamidpour et al. 2015), antimicrobial, and anti-clotting potential (Sabir et al. 2021). Curcumin was used by Siddha an Ayurveda medical practitioner in the Indian system of medicine and Chinese medicine (Ahmed et al. 2018). Meanwhile, *C. xanthorrhiza* is used in traditional alternative medicine systems against asthma, malaria, fever, dysentery, diarrhea, epilepsy, skin diseases, snake bites (Kustina et al. 2020), lack of appetite, stomach disorders, liver disease, constipation, arthritis, fever in children, hypotriglyceridaemia, hemorrhoids, vaginal discharge, rheumatism, and skin eruptions (Rahmat et al. 2021). The *C. xanthorrhiza* possesses antioxidant, antimicrobial, anti-inflammatory, anti-cancer, antitumor, antidiabetic, skincare, and hepatoprotective properties (Rahmat et al. 2021).

The *E. coccinea* has phenolic content, volatile oil, antioxidant activity, and antimicrobial function capable of curing fever, cough, and muscle fatigue (Chan et al. 2007; Chiang et al. 2010; Tachai et al. 2014; Mendez 2023). In Sabah, Malaysia, *E. coccinea* was used by various indigenous people as a remedy for stomach pain, food poisoning, and gastric problems (Poulsen 2006; Daula et al. 2015). Similarly, *H. havilandii* majorly contains β -pinene, α -humulene, germacrene D, β -selinene, and antimicrobial activity (Hashim et al. 2014). The *H. havilandii* has antioxidant phytochemical compounds, namely flavonoids, tannins, and saponins (Martang et al. 2020).

The *K. galanga* rhizome contains monoterpenoids, sesquiterpenoids, and phenylpropanoids (Liu et al. 2014). This species was used to treat diseases such as colds, fever, and malaria by the Bunong people in Mondulkiri Province, Cambodia (Chassagne et al. 2016). Batak ethnic tribe in North Sumatra Province, Indonesia, applied *K. galanga* to manage diarrhea, malnutrition, rheumatism, and stomach pain (Silalahi and Nisyawati 2019). The Dayak Tomun tribe in Central Kalimantan used *K. galanga* rhizome for pregnancy and postpartum care (Santoso et al. 2019). Additionally, local people in North Cotabato, Philippines, applied it to treat bleeding wounds, goiter, and punctures (Rubio and Naive 2018).

The *Z. montanum* rhizome performs anti-fever, anti-dry cough, anti-sickness, anti-sore throat, anti-headache, anti-

difficulty breathing, anti-fatigue, anti-cold, anti-loss of taste/smell, anti-nausea, anti-phlegm, anti-muscle and joint pain, and anti-diarrhea activities (Mudja 2021). This species was used by people in Phatthalung province, Peninsular Thailand, to treat flatulence and reduce muscle pain, tension, and skin swelling (Maneenoon et al. 2015). Moreover, its extract can prevent and reduce COVID-19 symptoms (Mudja 2021).

The *Z. officinale* exerts antimicrobial, anti-cancer, antioxidant, antidiabetic, anti-inflammatory, nephroprotective, hepatoprotective, larvicidal, analgesic, and immunomodulatory activities (Ghasemzadeh et al. 2010; Kumar et al. 2011; Bhargava et al. 2012; Ho et al. 2013; Wang et al. 2017). This species effectively treated nausea, cholesterol-lowering, gout, rheumatoid arthritis, and inflammation (Akram et al. 2011). Bager (2012) reported the applications of *Z. officinale* in managing nausea and vomiting caused by pregnancy, as well as postoperative nausea and vomiting. Intiyaz et al. (2013) stated that *Z. officinale* treats gastrointestinal, pulmonary, cardiovascular, and sexual disorders. Syafitri et al. (2018) also reported its beneficial effects in controlling inflammation, free radicals, diabetes mellitus, bacterial infections, cancer, and nausea.

The plant parts used by the Dayak Tamambaloh Tribe in Labian Ira'ang and Temau Villages are presented in Table 3.

Table 3. Percentage of plant parts used

Plant parts used	Species	Percentage (%)
Rhizome	13	76.47
Rhizome, leaf	1	5.88
Root, leaf	1	5.88
Young stem	1	5.88
Young shoots	1	5.88
Total	17	100

Table 4. Processing methods for medicinal plants

Processing Method	Total	Percent. (%)
Grated, boiled, drunk	3	17.64
Grated, applied to the affected part of the body	2	11.76
Grated, mixed with water, and drunk	1	5.88
Boiled. The boiled water is used for bathing	1	5.88
Grated, applied to itchy parts of the body	1	5.88
Three rhizomes boiled, mixed with a little salt, drunk	1	5.88
Grated, squeezed, boiled, drunk	1	5.88
Chewed, eaten	1	5.88
Grated, smeared	1	5.88
Applied directly on the affected part of the body	1	5.88
Grated, then applied to wounds & shredded, boiled, drunk	1	5.88
Burned, eaten	1	5.88
Eaten	1	5.88
Boiled, drunk	1	5.88
	17	100

The Dayak Tamambaloh people in Labian Ira'ang and Temau villages utilize rhizome, leaf, root, young stem, and young shoots for several reasons, such as the knowledge is obtained from the ancestors that have been passed down to this day, obtained from deceased ancestors through dreams, and performing ritual processes to ask the ancestors for guidance.

The medicinal use of rhizomes in China accounts for the largest share (Bai et al. 2018). Jadid et al. (2020) reported that rhizomes are used to treat internal medical diseases (hypertension and fever) and respiratory-nose, ear, oral/dental, and throat problems (cough). Sitanggang et al. (2022) reported the applications of leaves, rhizomes, stems, fruits, roots, bulbs, flowers, piths, and seeds by the Batak ethnic tribe (Indonesia). Ege et al. (2022) stated that the Dayak Jangkang tribe (Indonesia) used roots, tubers, rhizomes, stems, bark, stumps, fruits, leaves, fruits, and seeds to treat diseases.

Ege et al. (2021) reported the use of leaves as traditional medicine for several reasons such as (i) the availability of leaves in nature is always there or does not depend on the season, (ii) leaves are very easy to process into traditional medicine, (iii) taking leaves in nature will not make plants die or become extinct, (iv) processing does not require a large number of leaves, (v) people strongly believe that the leaves used as medicine do not have harmful side effects, and (vi) using leaves as medicine is more economically affordable.

Supiandi et al. (2020) reported that the use of roots in traditional medicine is due to several reasons such as (i) simple processing, namely boiling, drinking, pounding, and applying to certain parts of the body, (ii) having a mystical element, (iii) people believe that roots are part of plants that have high medical properties and are very effective in treating diseases, while the data related to processing methods are presented in Table 4.

Labian Ira'ang and Temau inhabitants generally processed the Zingiberaceae family plants for traditional medicine. It is simple because it is easy to do, does not require expensive costs, and the processing process is fast. Ege et al. (2022) stated that the Dayak Jangkang people processed medicinal plants by pounding, boiling, drinking, and rubbing. Nugroho et al. (2022) reported that local people processed plants by sticking, rubbing, washing, sprinkling, and inhaling to cure external diseases, while those present within the body were treated by drinking or gargling the obtained extracts.

In conclusion, the Dayak Tamambaloh Tribe in both Labian Ira'ang and Temau Villages had essential local knowledge regarding using the Zingiberaceae family plants for traditional medicine. The results showed that each region had distinctive knowledge of plant species applications for therapeutic purposes. However, limitations of this study included constrained numbers of informants due to the exclusive participation of parents possessing treatment knowledge and the absence of laboratory-scale testing. The results could serve as a basis for other studies specifically related to exploring the potential of the Zingiberaceae family plants for treatment purposes.

ACKNOWLEDGEMENTS

The authors are grateful to DRTPM Kemdikbudristek, Indonesia, for the financial support provided through contract numbers 001/B10/H5/IV/2023 and 003/B10/H5/IV/2023. The authors are also grateful to village heads, all informants, survey officers, field assistants, and study assistants.

REFERENCES

- Ahmed KKM, Gupta BM, Gupta R. 2018. *Curcuma longa* (medicinal plants) research: A scientometric assessment of global publications output during 1997-2016. *Pharmacogn J* 10 (5): 998-1006. DOI: 10.5530/pj.2018.5.170.
- Akram M, Shah MI, Usman K, Mohiuddin E, Sami A, Asif M, Shah SMA, Ahmed K, Shaheen G. 2011. *Zingiber officinale* Roscoe (A medicinal plant). *Pak J Nutr* 10 (4): 399-400. DOI: 10.3923/pjn.2011.399.400.
- Aziman N, Abdullah N, Noor ZM, Kamarudin WSSW, Zulkifli KS. 2014. Phytochemical profiles and antimicrobial activity of aromatic Malaysian herb extracts against food-borne pathogenic and food spoilage microorganisms. *J Food Sci* 79 (4): M583-M592. DOI: 10.1111/1750-3841.12419.
- Az-Zahra FR, Sari NLW, Saputry R, Nugroho GD, Sunarto, Pribadi T, Setyawan AD. 2021. Review: Traditional knowledge of the Dayak Tribe (Borneo) in the use of medicinal plants. *Biodiversitas* 22 (10): 4633-4647. DOI: 10.13057/biodiv/d221057.
- Bager S. 2012. Assessment report on *Zingiber officinale* Roscoe, rhizome. European Medicines Agency 16d (1): 1-49. https://www.ema.europa.eu/en/documents/herbal-report/final-assessment-report-zingiber-officinale-roscoe-rhizoma_en.pdf
- Bai M, Chang B, Miao M. 2018. Application of root and rhizome of Chinese traditional medicine flower. *Adv Soc Sci Educ Hum Res* 180: 277-284. DOI: 10.2991/essd-18.2018.76.
- Basri AM, Taha H, Ahmad N. 2017. A review on the pharmacological activities and phytochemicals of *Alpinia officinarum* (Galangal) extracts derived from bioassay-guided fractionation and isolation. *Pharmacogn Rev* 11 (21): 43-56. DOI: 10.4103/phrev.phrev_55_16.
- Bhargava S, Dhabhai K, Batra A, Sharma A, Malhotra B. 2012. *Zingiber officinale*: Chemical and phytochemical screening and evaluation of its antimicrobial activities. *J Chem Pharm Res* 4 (1): 360-364.
- Busetto L, Wick W, Gumbinger C. 2020. How to use and assess qualitative research methods. *Neurol Res Pract* 2: 14. DOI: 10.1186/s42466-020-00059-z.
- Cao Y, Li R, Zhou S, Song L, Quan R, Hu H. 2020. Ethnobotanical study on wild edible plants used by three trans-boundary ethnic groups in Jiangcheng County, Pu'er, Southwest China. *J Ethnobiol Ethnomed* 16: 66. DOI: 10.1186/s13002-020-00420-1.
- Chan EWC, Lim YY, Omar M. 2007. Antioxidant and antibacterial activity of leaves of *Etlingera* species (Zingiberaceae) in Peninsular Malaysia. *Food Chem* 104: 1586-1593. DOI: 10.1016/j.foodchem.2007.03.023.
- Chassagne F, Hul S, Deharo E, Bourdy G. 2016. Natural remedies used by Bunong people in Monduliri Province (Northeast Cambodia) with special reference to the treatment of 11 most common ailments. *J Ethnopharmacol* 191: 41-70. DOI: 10.1016/j.jep.2016.06.003.
- Chiang ECW, Yan LY, Mohd Ali MA. 2010. Composition and antibacterial activity of essential oils from leaves of *Etlingera* species (Zingiberaceae). *Intl J Adv Sci Arts* 1 (2): 1-12.
- Chudiwal A, Jain D, Somani R. 2010. *Alpinia galanga* Willd.- An overview on phytopharmacological properties. *Indian J Nat Prod Resour* 1 (2): 143-149.
- Cropley A. 2022. Introduction to Qualitative Research Methods: A Practice-Oriented Introduction. Editura Intaglio Publishing House, University of Hamburg, Hamburg.
- Dapar MLG, Alejandro GJD, Meve U, Schumann SL. 2020. Quantitative ethnopharmacological documentation and molecular confirmation of medicinal plants used by the *Monobo* tribe of Agusan del Sur, Philippines. *J Ethnobiol Ethnomed* 16: 14. DOI: 10.1186/s13002-020-00363-7.

- Daula SUA FM, Kamariah AS, Lim LBL, Ahmad N. 2015. Phytochemical screening, antioxidant, and antimicrobial activities of leaves, stems, and rhizomes of *Etilingera coccinea* (Blume) S. Sakai & Nagam. *Intl J Pharmacogn Phytochem Res* 7 (5): 873-883.
- Donadu MG, Le NT, Ho DV, Doan TQ, Le AT, Raal A, Usai M, Marchetti M, Sanna G, Madeddu S, Rappelli P, Diaz N, Mollicotti P, Carta A, Piras S, Usai D, Nguyen HT, Cappuccinelli P, Zanetti S. 2020. Phytochemical compositions and biological activities of essential oils from the leaves, rhizomes and whole plant of *Hornstedtia bella* Škorniček. *Antibiotics* 9: 334. DOI: 10.3390/antibiotics9060334.
- Dubost JM, Phakeovilay C, Her C, Bochaton A, Elliott E, Deharo E, Xayvue M, Bouamanivong S, Bourdy G. 2019. Hmong herbal medicine and herbalists in Lao PDR: Pharmacopeia and knowledge transmission. *J Ethnobiol Ethnomed* 15: 27. DOI: 10.1186/s13002-019-0307-2.
- Ege B, Julung H, Supiandi MI, Mahanal S, Zubaidah S. 2022. Utilization Zingiberaceae as traditional medicinal plants in the Dayak Jangkang tribe community, Sanggau Regency. *JPBIO (Jurnal Pendidikan Biologi)* 7 (2): 290-299. DOI: 10.31932/jpbio.v7i2.1939.
- Ege B, Supiandi MI, Julung H, Zubaidah S, Mahanal S. 2021. Usage of leaves in traditional medicine in Dayak Desa community, Indonesia. *Med Plants Intl J Phytomed Relat Ind* 13 (1): 120-130. DOI: 10.5958/0975-6892.2021.00013.7.
- Gartaula H, Patel K, Shukla S, Devkota R. 2020. Indigenous knowledge of traditional foods and food literacy among youth: Insights from rural Nepal. *J Rural Stud* 73: 77-86. DOI: 10.1016/j.jrurstud.2019.12.001.
- Ghanimi R, Ouhammou A, Ahouach A, Cherkaoui M. 2022. Ethnobotanical study on wild edible plants traditionally used by Messiya people, Morocco. *J Ethnobiol Ethnomed* 18: 16. DOI: 10.1186/s13002-022-00500-4.
- Ghasemzadeh A, Jaafar HZE, Rahmat A, Wahab PEM, Halim MRA. 2010. Effect of different light intensities on total phenolics and flavonoids synthesis and antioxidant activities in young ginger varieties (*Zingiber officinale* Roscoe). *Intl J Mol Sci* 11 (10): 3885-3897. DOI: 10.3390/ijms11103885.
- Ghosh S, Rangan L. 2013. *Alpinia*: The gold mine of future therapeutics. *3 Biotech* 3 (3): 173-185. DOI: 10.1007/s13205-012-0089-x.
- Hamad A, Alifiah A, Permadi A, Hartanti D. 2016. Chemical constituents and antibacterial activities of crude extract and essential oils of *Alpinia galanga* and *Zingiber officinale*. *Intl Food Res J* 23 (2): 837-841.
- Hamidpour R, Hamidpour S, Hamidpour M, Sohraby M, Hamidpour R. 2015. Turmeric (*Curcuma longa*): from a variety of traditional medicinal applications to its novel roles as active antioxidant, anti-inflammatory, anti-cancer, and anti-diabetes. *Intl J Pharmacol Phytochem Ethnomed* 1: 37-45. DOI: 10.18052/www.scipress.com/IJPE.1.37.
- Handajani NS. 2013. Cytostatic activity of white encounter (*Curcuma zedoaria* (Berg) Roscoe) in mice spermatogenic cells (*Mus musculus* L.). *Biosmart* 5 (2): 120-123.
- Hartati R, Suganda AG, Fidrianny I. 2014. Botanical, phytochemical and pharmacological properties of *Hedychium* (Zingiberaceae)—A review. *Procedia Chem* 13: 150-163. DOI: 10.1016/j.proche.2014.12.020.
- Hashim SE, Sirat HM, Khong HY. 2014. Chemical compositions and antimicrobial activity of the essential oils of *Hornstedtia havilandii* (Zingiberaceae). *Nat Prod Commun* 9: 119-120. DOI: 10.1177/1934578X1400900133.
- Ho SC, Chang KS, Lin CC. 2013. Anti-neuroinflammatory capacity of fresh ginger is attributed mainly to 10-gingerol. *Food Chem* 141 (3): 3183-3191. DOI: 10.1016/j.foodchem.2013.06.010.
- Hussain S, Hussain W, Nawaz A, Badshah L, Ali A, Ullah S, Ali M, Hussain H, Bussmann RW. 2022. Quantitative ethnomedicinal study of indigenous knowledge on medicinal plants used by the tribal communities of Central Kurram, Khyber Pakhtunkhwa, Pakistan. *Ethnobot Res Appl* 23 (5): 1-30. DOI: 10.32859/era.23.5.1-31.
- Imtiyaz S, Rahman K, Sultana A, Tariq M, Chaudhary SS. 2013. *Zingiber officinale* Rosc.: A traditional herb with medicinal properties. *Tang Humanitas Tradit Med* 3 (4): e26. DOI: 10.5667/tang.2013.0009.
- Inta A, Trisonthi C, Pongamornkul W, Panyadee. 2023. Ethnobotany of Zingiberaceae in Mae Hong Son, Northern Thailand. *Biodiversitas* 24 (4): 2114-2124. DOI: 10.13057/biodiv/d240422.
- Jadid N, Kurniawan E, Himayani CES, Andriyani, Prasetyowati I, Purwani KI, Muslihah W, Hidayati D, Tjahjaningrum ITD. 2020. An ethnobotanical study of medicinal plants used by the Tengger Tribe in Ngadisari village, Indonesia. *PLoS ONE* 15 (7): e0235886. DOI: 10.1371/journal.pone.0235886.
- Jaju SB, Indurwade NH, Sakarkar DM, Fuloria NK, Ali MD, Das S, Basu SP. 2009. Galanga of flavonoid isolated from rhizome of *Alpinia galanga* (L) sw (Zingiberaceae). *Trop J Pharm Res* 8 (6): 545-550. DOI: 10.4314/tjpr.v8i6.49402.
- Khairullah AR, Solikhah TI, Ansori ANM, Fadholly A, Ramandinianto SC, Ansharieta R, Widodo A, Riwu KHP, Putri N, Proboningrat A, Kusala MKJ, Rendragraha BW, Putra ARS, Anshori A. 2020. A review of an important medicinal plant: *Alpinia galanga* (L.) Willd. *Syst Rev Pharm* 11 (10): 387-395. DOI: 10.31838/srp.2020.10.62.
- Kim KM, Lee JY, Jeon BH, Quan KT, Na M, Nam KW, Chae S. 2021. Extract of *Curcuma zedoaria* R. prevents atherosclerosis in apolipoprotein E-deficient mice. *Nutr Res Pract* 15(3): 319-328. DOI: 10.4162/nrp.2021.15.3.319.
- Kumar GL, Karthik KV, Rao B. 2011. A review on pharmacological and phytochemical properties of *Zingiber officinale* Roscoe (Zingiberaceae). *J Pharm Res* 4 (9): 2963-2966.
- Kustina E, Zulharmita, Misfadhila S. 2020. Traditional uses, phytochemistry and pharmacology of *Curcuma xanthorrhiza* Roxb.: A review. *Intl J Sci Healthcare Res* 5 (3): 494-500.
- Liu XC, Liang Y, Shi WP, Liu QZ, Zhou L, Liu AZL. 2014. Repellent and insecticidal effects of the essential oil of *Kaempferia galanga* rhizomes to *Liposcelis bostrychophila* (Psocoptera: Liposcelidae). *J Econ Entomol* 107 (4): 1706-1712. DOI: 10.1603/ec13491.
- Mahwasane ST, Middleton L, Boaduo N. 2013. An ethnobotanical survey of indigenous knowledge on medicinal plants used by the traditional healers of the Lwamondo area, Limpopo province, South Africa. *South Afr J Bot* 88: 69-75. DOI: 10.1016/j.sajb.2013.05.004.
- Maneenoon K, Khuniat C, Teanuan Y, Saedan N, Prom-in S, Rukleng N, Kongpool W, Pinsook P, Wongwiwat W. 2015. Ethnomedicinal plants used by traditional healers in Phatthalung Province, Peninsular Thailand. *J Ethnobiol Ethnomed* 11: 43. DOI: 10.1186/s13002-015-0031-5.
- Martang NS, Majito N, Jasnje F, Chor-Wai L. 2020. Preliminary phytochemical evaluation and vitamin C content of *Tolidus (Hornstedtia havilandii)* (K.Schum) K. Schum) from Sabah. *Borneo Akademika UiTM Cawangan Sabah* 4 (10): 14-19.
- Mekonnen Z, Kidemu M, Abebe H, Semere M, Gebreyesus M, Worku A, Tesfaye M, Chernet A. 2021. Traditional knowledge and institutions for sustainable climate change adaptation in Ethiopia. *Curr Res Environ Sustain* 3: 100080. DOI: 10.1016/j.crsust.2021.100080.
- Mendez NP. 2023. Phenolic content and antioxidant activity of leaves and rhizomes of *Etilingera coccinea* (Blume) S.Sakai and Nagam. (Zingiberaceae). *J Trop Biol Conserv* 20: 81-95. DOI: 10.51200/jtbc.v20i.4648.
- Mitayari, Kuan-Meng S, Sansuwito TB, Nasution N, Silalahi RD, Utami R, Zulmardi, Febriyanti. 2022. Phytochemical screening of turmeric (*Curcuma longa* Linn.) extract with 97% ethanol solution. *Jundishapur J Microbiol* 15 (2): 926-931.
- Musdja MY. 2021. Potential bangle (*Zingiber montanum* J.König) rhizome extract as a supplement to prevent and reduce symptoms of COVID-19. *Saudi J Biol Sci* 28: 2245-2253. DOI: 10.1016/j.sjbs.2021.01.015.
- Naderifar M, Goli H, Ghaljaie F. 2017. Snowball sampling: A purposeful method of sampling in qualitative research. *Strides Dev Med Educ* 14 (3): e67670. DOI: 10.5812/sdme.67670.
- Nguyen TS, Xia NH, Chu TV, Sam HV. 2019. Ethnobotanical study on medicinal plants in traditional markets of Son La province, Vietnam. *For Soc* 3 (2): 171-192. DOI: 10.24259/fs.v3i2.6005.
- Nugroho Y, Soendjoto MA, Suyanto, Matatula J, Alam S, Wirabuwana PYAP. 2022. Traditional medicinal plants and their utilization by local communities around Lambung Mangkurat education forests, South Kalimantan, Indonesia. *Biodiversitas* 23 (1): 306-314. DOI: 10.13057/biodiv/d230137.
- Poulsen AD. 2006. *Etilingera* of Borneo. Natural History Publications, Kota Kinabalu, Sabah.
- Premar AS, Parki A, Chaubey P, Prakash O, Kumar R, Punetha H, Pant AK. 2018. Phytochemical diversity among parts of *Zingiber roseum* Rosc. extracts with their antioxidant and antifungal activity. *J Biol Act Prod Nat* 8 (4): 255-264. DOI: 10.1080/22311866.2018.1499439.
- Qamariah N, Mulia DS, Fakhri D. 2020. Indigenous knowledge of medicinal plants by Dayak community in Mandomai Village, Central Kalimantan, Indonesia. *Pharmacogn J* 12 (2): 386-390. DOI: 10.5530/pj.2020.12.60.

- Rahmat E, Lee J, Kang Y. 2021. Javanese turmeric (*Curcuma xanthorrhiza* Roxb.): Ethnobotany, phytochemistry, biotechnology, and pharmacological activities. *Evid-Based Complement Alternat Med* 2021: 9960813. DOI: 10.1155/2021/9960813.
- Rubio MM, Naive MAK. 2018. Ethnomedicinal plants used by traditional healers in North Cotabato, Mindanao, Philippines. *J Biodivers Environ Sci* 13 (6): 74-82.
- Sabir SM, Zeb A, Mahmood M, Abbas SR, Ahmad Z, Iqbal N. 2021. Phytochemical analysis and biological activities of ethanolic extract of *Curcuma longa* rhizome. *Braz J Biol* 81 (3): 737-740. DOI: 10.1590/1519-6984.230628.
- Santoso EA, Jumari, Utami S. 2019. Inventory of medicinal plants for pregnant and postpartum women in Dayak Tomun of the Lopus Village Lamandau Regency of Central Kalimantan. *Biosaintifika* 11 (1): 25-31. DOI: 10.15294/biosaintifika.v11i1.17917.
- Shah IA, Burni T, Badshah L, Uza NU. 2023. Indigenous knowledge and conservation status of wild plants collected from Garyaun North Waziristan, Pakistan. *Ethnobot Res Appl* 25 (40): 1-17. DOI: 10.32859/era.25.40.1-17.
- 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 (2): 78-95. DOI: 10.46359/jte.v4i2.54.
- Silalahi M, Nisyawati. 2019. An ethnobotanical study of traditional steam-bathing by the Batak people of North Sumatra, Indonesia. *Pac Conserv Biol* 25 (3): 266-282. DOI: 10.1071/PC18038.
- Silalahi M. 2020. *Curcuma zedoaria* (Christm.) Roscoe: Benefits and bioactivity. *Eureka Herba Indonesia* 1 (2): 41-48. DOI: 10.37275/ehi.v1i2.10.
- Singer CL, Routh MR, Grabke MJ, Andrew L, Carrière S, Guile A, Andre A, Thompson A, Simmons D, Cooper K, Yonge L, Rabesca M, Larter NC, Jacobsen P, Natho R, Winbourne J, Bathe A. 2023. Equal use of indigenous and scientific knowledge in species assessments: A case study from the Northwest Territories, Canada. *Biol Conserv* 281: 109995. DOI: 10.1016/j.biocon.2023.109995.
- Sitanggang NDH, Zuhud EAM, Masy'ud B, Soekmadi R. 2022. Ethnobotany of the Toba ethnic community in Samosir District, North Sumatra, Indonesia. *Biodiversitas* 23 (12): 6114-6118. DOI: 10.13057/biodiv/d231204.
- Soetarto E, Sitorus MTF, Napiri MY. 2001. Decentralisation of Administration, Policy Making and Forest Management in Ketapang District, West Kalimantan. Center for International Forestry Research, Jakarta.
- Sulaiman, Shah S, Khan S, Bussmann RW, Ali M, Hussain D, Hussain W. 2020. Quantitative ethnobotanical study of indigenous knowledge on medicinal plants used by the tribal communities of Gokand Valley, District Buner, Khyber Pakhtunkhwa, Pakistan. *Plants* 9 (8): 1001. DOI: 10.3390/plants9081001.
- Supiandi MI, Julung H, Ege B, Mahanal S, Zubaidah S. 2020. Potential of plant roots as traditional medicines of the Dayak Desa Tribe in Pakak, West Kalimantan, Indonesia. *Med Plants-Intl J Phytomed Relat Ind* 12 (2): 275-282. DOI: 10.5958/0975-6892.2020.00036.2.
- Supiandi MI, Julung H, Susanti Y, Zubaidah S, Mahanal S. 2023. Potential of traditional medicinal plants in the Dayak Tamambaloh Tribe, West Kalimantan, Indonesia. *Biodiversitas* 24 (6): 3384-3393. DOI: 10.13057/biodiv/d240634.
- Supiandi MI, Mahanal S, Zubaidah S, Julung H, Ege B. 2019. Ethnobotany of traditional medicinal plants used by Dayak Desa community in Sintang, West Kalimantan, Indonesia. *Biodiversitas* 20 (5): 1264-1270. DOI: 10.13057/biodiv/d200516.
- Susanti Y, Supiandi MI, Julung H, Zubaidah S, Mahanal S. 2023. Lexicon of medicinal plants in traditional medicine in the Dayak Tamambaloh Tribe (West Kalimantan, Indonesia): An ethnolinguistic approach. *Biodiversitas* 24 (1): 391-398. DOI: 10.13057/biodiv/d240146.
- Syafitri DM, Levita J, Mutakin M, Diantini A. 2018. A review: Is ginger (*Zingiber officinale* var. Roscoe) potential for future phytomedicine. *IJAS* 8(1): 1-6. DOI: 10.24198/ijas.v8i1.16466.
- Syafruddin D, Supiandi MI, Gandasari A, Mahanal S, Zubaidah S. 2022. Potential of medicinal plants against cancer and tumors: Ethnobotanical study of the Dayak Tamambaloh Tribe, Indonesia. *J Pharm Negat Results* 13 (4): 1514-1520. DOI: 10.47750/pnr.2022.13.04.213.
- Tachai S, Wangkarn S, Nuntawong N. 2014. Chemical constituents of the rhizome oils of *Etilingera pavieana* (Pierre ex Gagnep.) R.M.Sm. *Biochem Syst Ecol* 57: 410-415. DOI: 10.1016/j.bse.2014.09.018.
- Tamokou JDD, Mbaveng AT, Kuete V. 2017. Chapter 8-Antimicrobial Activities of African Medicinal Spices and Vegetables. Academic Press, University of Dschang, Cameroon. DOI: 10.1016/B978-0-12-809286-6.00008-X.
- Tongco MDC. 2007. Purposive sampling as a tool for informant selection. *Ethnobot Res Appl* 5: 147-158. DOI: 10.17348/era.5.0.147-158.
- Trejo JM. 2021. Protection of traditional knowledge and its resulting innovation. *Scientia et PRAXIS* 01 (01): 1-8. DOI: 10.55965/setp.1.01.a1.
- Verma RK, Mishra G, Singh P, Jha KK, Khosa RL. 2011. *Alpinia galanga*-An important medicinal plant: A review. *Der Pharmacia Sinica* 2 (1): 142-154.
- Wang J, Ke W, Bao R, Hu X, dan Chen F. 2017. Beneficial effects of ginger *Zingiber officinale* Roscoe on obesity and metabolic syndrome: a review. *Ann NY Acad Sci* 1398 (1): 83-98. DOI: 10.1111/nyas.13375.
- Zaki PH, Gandaseca S, Rashidi NM, Ismail MH. 2019. Traditional usage of medicinal plants by Temiar tribes in the State of Kelantan, Peninsular Malaysia. *For Soc* 3 (2): 227-234. DOI: 10.24259/fs.v3i2.6424.
- Zhao M, Wang K, Gu R, Zhong S. 2019. A comparative study on shared-use medicines in tibetan and chinese medicine. *J Ethnobiol Ethnomed* 15: 43. DOI: 10.1186/s13002-019-0320-5.