



Zingiberaceae Rhizome as Traditional Medicine Based on Dayak Linoh, Malay, and Javanese Local Wisdom

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ABSTRACT

Zingiberaceae rhizomes have been used in the traditional medicine practices of three ethnic groups; Dayak Linoh, Malay, and Javanese, of the Sintang Regency, West Kalimantan, Indonesia for generations. Although, it has been around for a long time, the culture of herbal medicine and knowledge about using Zingiberaceae rhizomes as traditional medicine is still not well documented. This research aims to identify, document, and determine the types, methods of processing, and use of Zingiberaceae rhizomes as traditional medicine. The research methodology was an ethnobotanical survey involving participant observation and interviews with informants in the three tribal communities. The research results showed that the three tribal communities use thirteen (13) species of Zingiberaceae rhizomes as herbal medicine. The most commonly used Zingiberaceae rhizomes were the rhizomes of *K. galanga*, *C. longa*, *Z. officinale*, *A. galanga*, *Z. cassumunar*, and *C. zedoria*, each with a percentage use of 11.54%. The most widely used methods of processing these Zingiberaceae rhizomes were by grinding and boiling. The most widely used mode of application of the Zingiberaceae rhizomes as a traditional medicine was by drinking. Fifteen diseases were reported to be treated using Zingiberaceae rhizomes in these tribal communities. The findings from this study indicated that the three tribal communities studied use the same types of Zingiberaceae rhizomes in their traditional medicine practices, but differ in their method of processing and mode of application of these plants.

Keywords: Javanese, Linoh, Malay, Medicinal plants, Rhizome, Zingiberaceae

Introduction

Zingiberaceae is the most prominent herbaceous family in the plant kingdom, with 50 genera and about 1,400 species.¹ Zingiberaceae is known as the ginger family and is widely used as a spice in Southeast Asia due to its unique flavour and ornamental value. It is also used as a traditional medicine. The Zingiberaceae rhizome extract is utilized as a medicine because it contains many essential oils, including terpenes, alcohols, ketones, flavonoids, and phytoestrogens, which are used as medicines.²

Local Indonesian communities have utilized Zingiberaceae rhizomes as spices and traditional medicinal ingredients for a long time.³ Among the people who still use Zingiberaceae rhizomes as traditional medicine are people in the Sintang Regency, West Kalimantan, Indonesia, namely the Dayak Linoh tribe, the Javanese tribe in the Sungai Tebelian District, and the Malay tribe in the Sintang District.

The three ethnic communities (Dayak Linoh, Malay, and Javanese) have local culture and knowledge of utilizing Zingiberaceae rhizomes as traditional medicine passed down from generation to generation. Unfortunately, these local cultures and knowledge are poorly documented, which could threaten the loss of knowledge about the use of Zingiberaceae rhizomes for the treatment of diseases and for health maintenance.

Other problems that have threatened local knowledge of Zingiberaceae in the Dayak Linoh, Malay, and Javanese tribes are; 1) the decreasing number of community members in the three tribes who still have knowledge of the use of Zingiberaceae as medicine, 2) the lack of interest of the younger generation to learn about various types of Zingiberaceae rhizomes and their medicinal uses, 3) the lack of ability to distinguish various types of Zingiberaceae rhizomes in the three tribal communities.

These problems could threaten the loss of local wisdom in the three tribal communities using Zingiberaceae rhizomes as medicine. This is in line with previous research that proved that local wisdom in a local community is lost due to lack of proper documentation as this knowledge is only passed on orally from generation to generation.⁴⁻⁸ In addition, the lack of interest in learning about the use of Zingiberaceae as traditional medicine by the younger generation is influenced by technological advances. The influence of modern technology has reduced the use of traditional medicine.⁹

Efforts made to overcome the various problems associated with the use of Zingiberaceae as traditional medicine are as follows: 1) conducting research related to the use of Zingiberaceae as traditional medicine, 2) inventorying, identifying, and documenting various types of Zingiberaceae rhizomes as a step to preserving the traditional knowledge of local communities, 3) informing local communities about research findings so that they have an understanding of the use of Zingiberaceae rhizomes as medicine.

This study aims to determine the types (scientific name, local name, family), plant parts used, efficacy, processing methods, and the use of Zingiberaceae rhizomes in the three tribal communities in Sintang Regency, West Kalimantan, Indonesia. The novelty of this research is hinged on the local knowledge in three tribal communities of Dayak Linoh, Malay, and Javanese, in the processing, use, and efficacy of Zingiberaceae rhizomes as traditional medicine.

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Materials and Methods

Study Area

The research was conducted in the Dayak Linoh, Malay, and Javanese tribal communities in the Sintang Regency, West Kalimantan Province, Indonesia (Figure 1) which is traversed by the Equator located between 1° 05' NL and 0° 46' SL and 110° 50' EL and 113° 20' EL. The Dayak Linoh tribe is located in the Sungai Ana village, Sungai Tebelian District, with a population of around 622 people and 163 family heads. The majority of the population are rubber and oil palm farmers. The Javanese community in Merarai 2 village in the Tebelian river sub-district has a population of 2.468. The number of family heads is 785, it has an area of 36.16 km², and the majority of the population are Muslims, with the main livelihoods being oil palm farming, rice farming, and fisheries. The community of the Malay tribe is in Sungai Ana village in Sintang District, with a population of 3.905. It has 1088 family heads, and occupy an area of about 4.86 km². Most of the population are Muslims, with the main livelihoods being rubber farming and mining.

Data Collection

The research data was collected from July to August, 2022 using the survey method through participatory observation, interviews with people in three tribal communities (Dayak Linoh, Malay, and Javanese), and field documentation. Determination of informants through purposive sampling techniques by consulting with tribal leaders or chiefs and several community members from the Dayak Linoh, Malay, and Javanese tribes. Informants used in the study are described in Table 1.

Data Analysis

The research used qualitative and quantitative data analysis techniques. Qualitative data analysis included: 1) data reduction: summarizing and selecting the main/important points according to the research objectives. The reduced data will provide a clearer picture and make it

easier for researchers. 2) Data presentation: presenting data related to utilizing Zingiberaceae by Dayak Linoh, Malay, and Javanese tribes in brief descriptions, tables, and pictures. 3) Data verification: testing data validity using data triangulation techniques from various perspectives, namely; sources and methods. Source triangulation by comparing data obtained with various sources such as relevant reference books, national/international journals, theses, and dissertations. Triangulation of methods by comparing data from the same source with different methods, such as data obtained through interviews compared with data obtained through observation. The quantitative analysis calculated the percentage of Zingiberaceae used by each tribe, method of processing and use, and the name of the disease being treated.

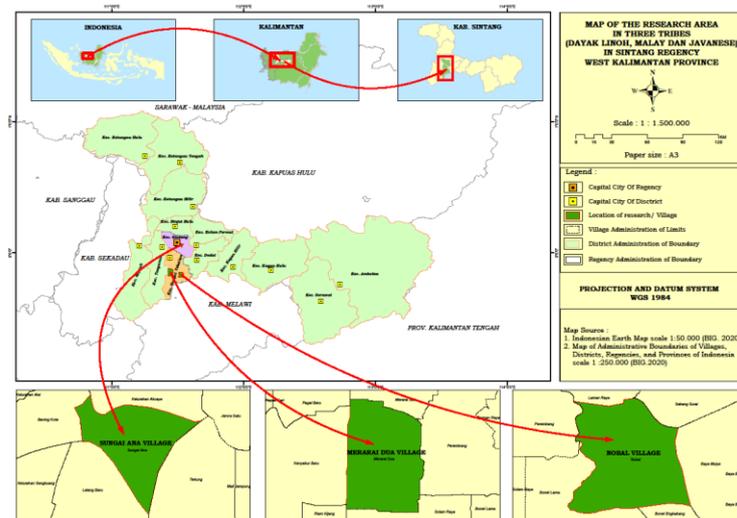


Figure 1: Map of the study areas

Table 1: Research informants

S/N	Informant	Frequency	Community
1	Shamans	1	Dayak Linoh
2	Traditional birth attendants (village midwives)	1	
3	Elders	1	
4	Customary leaders	1	
5	Traditional healers	1	
6	Village heads	1	
7	General populace with knowledge of medicinal plants	5	
8	Shamans	1	Malay
9	Traditional birth attendants (village midwives)	1	
10	Elders	1	
11	Customary leaders	1	
12	Traditional healers	1	
13	Village heads	1	
14	General populace with knowledge of medicinal plants	2	
15	Shamans	1	Javanese
16	Traditional birth attendants (village midwives)	1	
17	Elders	1	
18	Customary leaders	1	
19	Traditional healers	1	
20	Village heads	1	
21	General populace with knowledge of medicinal plants	6	

Results and Discussion

Types of Zingiberaceae rhizomes used as traditional medicine

The study found out that thirteen (13) types of Zingiberaceae rhizomes are used as medicine in the three communities of the Linoh and Javanese Dayak tribes in Sungai Tebelian District and the Melayu tribe in Sintang District, Sintang Regency, West Kalimantan. The Linoh Dayak tribe uses the 13 types, while 6 types are used in the Javanese tribe and the Malay tribe uses as many as 8 types. The Zingiberaceae rhizomes types include; Cokur/galanga (*Kaempferia galanga* L.), Yellow ginger (*Curcuma mangga* Valetton & Zijp), Turmeric or orange ginger (*Curcuma xanthorrhiza* Roxb.), White ginger (*Curcuma zedoria* Christm. Roscoe.), Black ginger (*Curcuma aeruginosa* Roxb.), Turmeric (*Curcuma longa* L.), Galangal (*Alpinia galanga* L. Sw.), Red ginger (*Zingiber officinale* Linn. Var. rubrum.), Small white ginger or Emprit ginger (*Zingiber Officinale* Var. Amarum), Jehe large white or Spiced ginger (*Zingiber officinale* var. Roscoe.), Lempuin or Black lempuyang (*Zingiber zerumbet* (L.) J. E. Smith), Lempuin or White lempuyang (*Zingiber aromaticum* Val.) and Ngemelai or Bangle (*Zingiber cassumunar* Roxb.) (Table 2).

Figure 2 shows the colours and cross-sectional shapes of Zingiberaceae rhizomes used as traditional medicine in the three tribal communities (Dayak Linoh, Malay and Javanese) in Sintang Regency, West Kalimantan.

Uses of Zingiberaceae rhizomes

The most widely used Zingiberaceae rhizomes by the three tribal communities (Dayak Linoh, Malay, and Javanese) are the rhizomes of *Kaempferia galanga* L., *Curcuma longa* L., *Zingiber officinale* var. Rubrum., *Alpinia galanga* (L.) Sw., *Zingiber cassumunar* Roxb., and *Curcuma zedoria* (Christm.) Roscoe, with each having a percentage use of 11.54%. This is followed by *Zingiber Officinale* Var. amarum and *Curcuma xanthorrhiza* Roxb, with 7.69% use each. *Zingiber zerumbet* (L.) J.E. Smith., *Zingiber aromaticum* Val., *Curcuma aeruginosa* Roxb., *Zingiber officinale* var. Roscoe, and *Curcuma mangga* Valetton & Zijp are the less commonly used, with percentage use of 3.85% each (Table.3).

Basically, the use of Zingiberaceae rhizomes in the three tribal communities, namely the Dayak Linoh and Javanese tribes in Sungai

Tebelian District and the Malay tribe in Sintang District, Sintang Regency, West Kalimantan has been going on for a long time. Zingiberaceae rhizomes are used in traditional medicine as first aid given to sick patients before being treated by a medical personnel at the nearest health facility because they are very easy to find, not expensive, and common. In addition, the use of Zingiberaceae rhizomes as medicine is considered safe by the people of these three tribal communities and does not cause side effects. This is in line with previous research which also states that the use of traditional medicine is considered safe.^{7,10} Previous studies have reported that Zingiberaceae is one of the natural resources used as a natural medicine.¹¹ Zingiberaceae rhizome extract contains essential oils, including terpenes, alcohols, ketones, flavonoids, and phytoestrogens which are useful as medicine.¹²

The knowledge of using Zingiberaceae rhizomes as herbal medicine has been passed down from generation to generation, and is maintained to this day and has become local wisdom. In the community, knowledge about medicinal plants used for traditional medicine can be achieved through traditions that have existed for a long time, through oral communication by parents to their children, through local shamans, and through dreams.¹³⁻¹⁵

Method of processing Zingiberaceae rhizomes

Dayak Linoh, Malay, and Javanese communities have different knowledge of processing and utilizing Zingiberaceae rhizomes as traditional medicine. In general, the method of processing Zingiberaceae rhizomes which are used as herbal medicine is by mashing, boiling, pounding, and chewing. Meanwhile, it can also be used by drinking, smearing, sprinkling, rubbing, and sticking on the sick part of the body (Table 4).

Diseases treated using Zingiberaceae rhizomes

Fifteen (15) diseases can be treated using Zingiberaceae rhizomes in the three tribal communities (Dayak Linoh, Malay, and Javanese). The diseases most often cured using Zingiberaceae rhizomes in the three tribal communities were postpartum malaise, wounds, and pain and aches (Table 5).

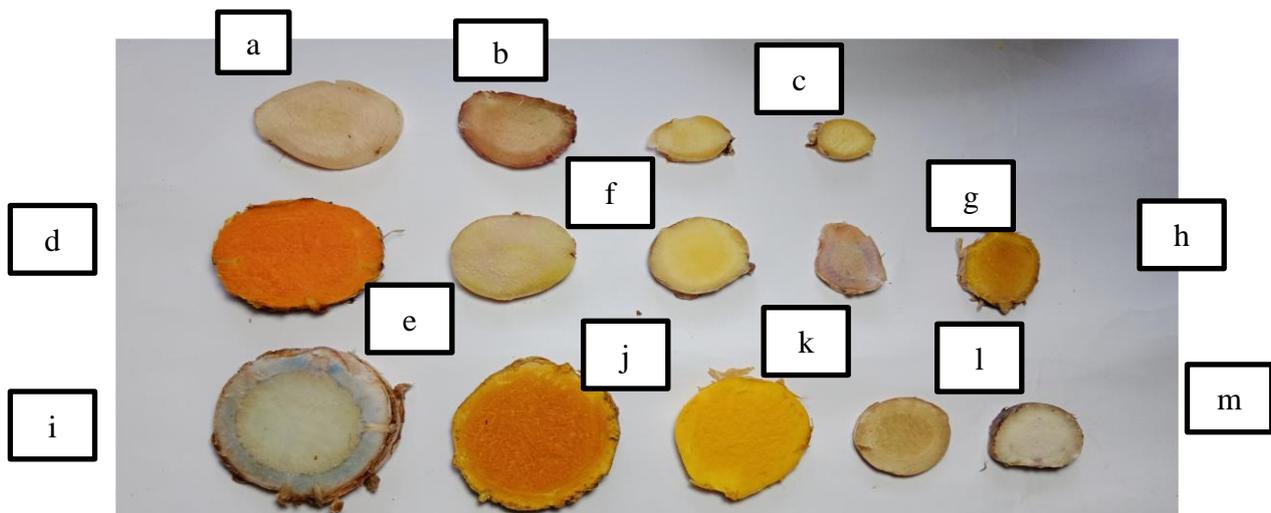


Figure 2: Colours and cross-sectional shapes of Zingiberaceae rhizomes used as traditional medicine by three tribal communities (Dayak Linoh, Malay and Javanese). (a). *Zingiber officinale* var. Roscoe (large white ginger/Elephant Ginger); (b). *Zingiber officinale* var. Rubrum. (Red ginger); (c). *Zingiber Officinale* Var. amarum (small white ginger/Ginger Emprit); (d). *Curcuma longa* L. (Turmeric); (e). *Alpinia galanga* (L.) Sw. (Galangal); (f). *Zingiber cassumunar* Roxb. (Neglect/bangle); (g). *Zingiber zerumbet* (L.) J.E. Smith. (Black Lempuin); (h). *Zingiber aromaticum* Val. (Lempuin Putih); (i). *Curcuma aeruginosa* Roxb. (black ginger); (j). *Curcuma xanthorrhiza* Roxb. (Turmeric or orange ginger); (k). *Curcuma mangga* (Mango Curcuma)/Yellow Entomu; (l). *Curcuma zedoria* (Christm.) Roscoe. (white ginger); (m). *Kaempferia galanga* L. (Cekur/Kencur).

Table 2: List of Zingiberaceae plants used as medicine in three tribal communities (Dayak Linoh, Javanese and Malay tribes)

Ethnic group	No	Scientific name	Local name	Family	Part(s) used	Benefits	How to use
Linoh Dayak tribe	1	<i>Kaempferia galanga</i> L.	Cokur (Kencur)	<i>Zingiberaceae</i>	Rhizome	Treats vomiting, colds, relieves coughs and helps restore postpartum stamina	It is crushed by kneading or mashing, then sprayed or smeared on the stomach.
	2	<i>Cucurma mangga</i> Valetton & Zijp	Entomu mango (Yellow Entomu)	<i>Zingiberaceae</i>	Rhizome	Helps restore postpartum stamina and treats jaundice (hepatitis B)	Boiled, together with alang roots, yellow bamboo roots, turmeric, and yellow roots are drunk
	3	<i>Curcuma xanthorrhiza</i> Roxb.	Entomu Turmeric or Orange	<i>Zingiberaceae</i>	Rhizome	Helps restore postpartum stamina and treats jaundice (hepatitis B)	Boiled, together with alang roots, yellow bamboo roots, turmeric, and yellow roots are drunk
	4	<i>Curcuma zedoria</i> (Christm.) Roscoe.	White Entomu (white ginger)	<i>Zingiberaceae</i>	Rhizome	Helps restore stamina after childbirth	The rhizomes are mixed with red ginger, turmeric, galangal and a little kandis, crushed, drunk directly or boiled and then drunk mixed with honey.
	5	<i>Curcuma aeruginosa</i> Roxb.	Entomu Black	<i>Zingiberaceae</i>	Rhizome	Treats coughs and neutralize toxins in the body	Boiled or extracted directly and drunk
	6	<i>Curcuma longa</i> L.	Turmeric	<i>Zingiberaceae</i>	Rhizome	Helps restore stamina after childbirth, stomach acid (ulcers) and gastric wounds, reduces swelling and wounds in the body	Red ginger mixed with turmeric, galangal and a little kandis is crushed, drunk directly or boiled and then drunk mixed with honey
	7	<i>Alpinia galanga</i> (L.) Sw.	Longkas (Galangal)	<i>Zingiberaceae</i>	Rhizome	Treating skin diseases such as tinea versicolor, scabies, ringworm	Pureed and rubbed on sore skin
	8	<i>Zingiber officinale</i> Linn. Var. rubrum.	Red Loyak (Red Ginger)	<i>Zingiberaceae</i>	Rhizome	Helps restore stamina after childbirth, reduces boils and swelling inside and outside the body	Red ginger mixed with turmeric, galangal and a little kandis is crushed, drunk directly or boiled and then drunk mixed with honey
	9	<i>Zingiber Officinale</i> Var. Amarum	Rice Loyak/Small White Ginger (Ginger Emprit)	<i>Zingiberaceae</i>	Rhizome	Helps restore stamina after childbirth	Emprit ginger mixed with turmeric, galangal and a little 7 kandis are crushed, drunk directly or boiled, then drunk mixed with honey
	10	<i>Zingiber officinale</i> var. Roscoe	Loyak Bumbu (Large white ginger/Ginger Gajah)	<i>Zingiberaceae</i>	Rhizome	Helps restore stamina after childbirth	Pounded, boiled and drunk
	11	<i>Zingiber zerumbet</i> (L.) J.E.Smith.	Lempuin hitam	<i>Zingiberaceae</i>	Rhizome	Treats pain and aches in the body from the back through to the chest	Chewed and sprayed on the sick part of the body
	12	<i>Zingiber aromaticum</i> Val.	Lempuin Putih	<i>Zingiberaceae</i>	Rhizome	Treats pain and aches in the body from the back to the chest, treat joint pain and stomach cramps.	Chewed or crushed and spitted out or stuck on the sick part of the body

	13	<i>Zingiber cassumunar</i> Roxb.	Ngemelai (Bangle)	<i>Zingiberaceae</i>	Rhizome	Speeds up postpartum recovery, relieves pain and body aches	Finely ground and distributed throughout the body
Javanese ethnic	1	<i>Zingiber officinale</i> var. <i>Rubrum</i> .	Red ginger	<i>Zingiberaceae</i>	Rhizome	Speeds up postpartum recovery	Boiled and drunk as a herbal medicine for childbirth
	2	<i>Curcuma longa</i> L.	Kunyet (Turmeric)	<i>Zingiberaceae</i>	Rhizome	Facilitates breastfeeding and speeds up postpartum recovery	Grated/mashed, boiled and drunk as a herbal medicine for childbirth
	3	<i>Curcuma zedoaria</i> (Berg.) Roscoe.	Kunyet white (White Curcuma)	<i>Zingiberaceae</i>	Rhizome	Ulcers, Vomiting due to stomach acid, Poisoning	Pureed by grating and drinking
	4	<i>Kaempferia galanga</i> L.	Aromatic ginger	<i>Zingiberaceae</i>	Rhizome	Increases appetite and speeds up postpartum recovery	Pounded and boiled to make kencur rice herbal medicine
	5	<i>Alpinia galanga</i> (L.) Sw.	Laos (Galangal)	<i>Zingiberaceae</i>	Rhizome	Treating tinea versicolor, ringworm and scabies	Pureed by pounding and rubbing on the skin affected by tinea versicolor and scabies
	6	<i>Zingiber cassumunar</i> Roxb.	Ngemelai (Bangle)	<i>Zingiberaceae</i>	Rhizome	Overcomes postpartum aches and joint pain	Smoothened and spread all over the body
Malay tribe	1	<i>Kaempferia galanga</i> L.	Cokur (Aromatic ginger)	<i>Zingiberaceae</i>	Rhizome	Accelerates healing of internal wounds	Mashed, boiled and drunk
	2	<i>Zingiber officinale</i> Linn. Var. <i>rubrum</i> .	Red Ginger (Liok Jeronang)	<i>Zingiberaceae</i>	Rhizome	Accelerates healing of internal wounds	Mashed, boiled and drunk
	3	<i>Zingiber Officinale</i> Var. <i>Amarum</i>	Small White Ginger (ginger emprit)	<i>Zingiberaceae</i>	Rhizome	Accelerates healing of internal wounds	Mashed, boiled and drunk
	4	<i>Curcuma longa</i> Linn.	Turmeric	<i>Zingiberaceae</i>	Rhizome	Accelerates healing of internal wounds	Mashed, boiled and drunk
	5	<i>Alpinia galangal</i> (L.) Sw.	Galangal	<i>Zingiberaceae</i>	Rhizome	Treats tinea versicolor, scabies and ringworm	Smoothened and stuck/rubbed
	6	<i>Zingiber cassumunar</i> Roxb.	Ngemelai (Bangle)	<i>Zingiberaceae</i>	Rhizome	Overcomes postpartum aches and joint pain	Smoothened and spread all over the body
	7	<i>Curcuma xanthorrhiza</i> Roxb.	Turmeric or Orange ginger	<i>Zingiberaceae</i>	Rhizome	Accelerates healing of internal wounds	Mashed, boiled and drunk
	8	<i>Curcuma zedoria</i> (Christm.) Roscoe.	White Curcuma	<i>Zingiberaceae</i>	Rhizome	Accelerates healing of internal wounds	Mashed, boiled and drunk

Several medicinal plants from the Zingiberaceae family are used to treat several health problems; for example, *Kaempferia galanga* L. is used to treat vomiting and relief cough in children, *Curcuma xanthorrhiza* Roxb. is used for restoring stamina after childbirth and for treating jaundice (hepatitis B), *Alpinia galanga* L. is used for tinea versicolor, scabies and ringworm, *Zingiber officinale* Linn. Var. rubrum is used to restore stamina after childbirth, reduce boils and swelling on the inside and outside of the body, *Curcuma zedoaria* (Christm.) Roscoe and *Zingiber officinale* Var. amarum are used to restore stamina after childbirth, *Curcuma longa* L. is used to restore stamina after childbirth, treat stomach ulcers, reduces swelling and wounds in the body. *Zingiber zerumbet* (L.) J.E. Smith is used to treat aches and pains in the back and chest, while *Zingiber cassumunar* Roxb is used as an analgesic and to speed up recovery after childbirth.¹⁶

Kaempferia galanga L. (Aromatic ginger (Kencur))

The rhizome of *Kaempferia galanga* L. (Cekur/Kencur) grows in clusters. The epidermis on the rhizome is brown while the inside is watery white. It has a very sharp and distinctive aroma. Young rhizomes have a yellowish white colour and contain more water than old rhizomes. The roots of kencur are clustered and branched with white strings. The kencur plant has soft, split stems with a grayish-black colour. The stems also form gaps. These stems usually grow around 30-70 cm.

Kaempferia galanga L. (Cokur/Kencut) is widely used by the three tribal communities (Dayak Linoh, Malay and Javanese) for traditional treatment and has become a habit in traditional medicine practice. In the Dayak Linoh tribe, kencur is used to treat vomiting, colds, relieve coughs and help restore stamina after childbirth. In the Javanese tribe, kencur is used to increase appetite and speed up postpartum recovery, and in the Malay tribe, kencur is used as a medicine to speed up the healing of internal wounds. *K. galanga* is a potential medicinal plant with aromatic rhizomes, traditionally used as a medicine for diabetes, hypertension, coughs, asthma, joint fractures, rheumatism, urticaria, vertigo and intestinal wounds.¹⁷ Traditionally, galangal rhizomes are used by mashing, grating or pounding, the grated materials are then mixed with warm water, filtered and drunk regularly until coughs, colds and colds are cured. For the treatment of cold, it can also be used by rubbing the grated galangal rhizome on the forehead and stomach of children directly.¹⁸ *Kaempferia galanga* is widely used by the three tribal communities (Dayak Linoh, Malay and Javanese) in traditional healing culture. This is in line with the work of Labrooy *et al.* (2018)¹⁹ which reported that *K. galanga* is widely used as an ethnomedicine in communities. *Kaempferia galanga* is widely used as herbal medicine because it has various secondary metabolites such as terpenoids,

phenolics, cyclic dipeptides, diarylhaptanoids, flavonoids, polysaccharides and essential oils.²⁰

Curcuma mangga Valeton & Zijp (Mango ginger or Yellow Entemu)

The 50 - 200 cm tall *Curcuma mangga* Val. and Zijp (*C. mango*) plant grows wild in Indonesia, particularly on the island of Java, Malaysia, and Thailand. The rhizome, which has a yellowish brown exterior section, a white top part, and a yellow inner part with a mango-like odour, is the part that is used.²¹ *C. mangga* has antioxidant and anticancer properties and are used in traditional medicine to treat conditions like fever, chest pain, and stomachaches.^{21,22} *Curcuma mangga* rhizomes contain many active secondary metabolites, including flavonoids, saponins, glycosides, terpenoids and steroids.²³



Figure 3: A. Rhizome shape and B. Cross-section and colour of the rhizome of the rhizome of *Kaempferia galanga* L. (Kencur)



Figure 4: A. Rhizome shape and B. Cross-section and colour of the rhizome of *Curcuma mangga* Valeton & Zijp. (Mango Curcuma)

Table 3: Percentage of Zingiberaceae rhizomes that are widely used in the three tribal communities (Dayak Linoh, Malay and Javanese)

S/N	Scientific Name	Ethnic group	Frequency	Percentage
1	<i>Kaempferia galanga</i> L.	Dayak Linoh, Malay, and Javanese	3	11.54%
2	<i>Curcuma longa</i> L.	Dayak Linoh, Malay, and Javanese	3	11.54%
3	<i>Zingiber officinale</i> var. Rubrum.	Dayak Linoh, Malay, and Javanese	3	11.54%
4	<i>Alpinia galanga</i> (L.) Sw.	Dayak Linoh, Malay, and Javanese	3	11.54%
5	<i>Zingiber cassumunar</i> <u>Roxb.</u>	Dayak Linoh, Malay, and Javanese	3	11.54%
6	<i>Curcuma zedoaria</i> (Christm.) Roscoe.	Dayak Linoh, Malay, and Javanese	3	11.54%
7	<i>Zingiber Officinale</i> Var. amarum	Dayak Linoh, and Malay	2	7.69%
8	<i>Curcuma xanthorrhiza</i> Roxb.	Dayak Linoh, and Malay	2	7.69%
9	<i>Zingiber zerumbet</i> (L.) J.E.Smith.	Dayak Linoh	1	3.85%
10	<i>Zingiber aromaticum</i> Val.	Dayak Linoh	1	3.85%
11	<i>Curcuma aeruginosa</i> Roxb.	Dayak Linoh	1	3.85%
12	<i>Zingiber officinale</i> var. Roscoe	Dayak Linoh	1	3.85%
13	<i>Curcuma mangga</i> Valeton & Zijp	Dayak Linoh	1	3.85%

Cucurma mangga Valetton & Zijp is used by the three tribal communities of Dayak Linoh, Malay and Javanese as a traditional medicine to help restore stamina after childbirth and treat jaundice (hepatitis B). According to previous study, *C. mangga* contains curcumin and is very effective against various cancer cells.²⁴

Curcuma xanthorrhiza Roxb. (*Curcuma Turmeric/orange*)

Curcuma xanthorrhiza Roxb. (Yellow/orange Curcuma) is a perennial herbaceous plant with a group of false stems 1 to 2 m high that grow from underground rhizomes. Each pseudostem is made of up to 8 leaves with blades that can measure 40 – 90 cm long and 15 – 21 cm wide. The rhizome is branched and yellow, harvested when the shoots have wilted. The leaves are up to 120 cm high, ovate to lanceolate, with parallel venation. The flowers are purple or dark red. The inflorescence grows from the rhizome next to the leaf shoot, with a stalk 10 - 25 cm long; The flower spike is cylindrical, 15 - 25 cm long, 10 - 20 cm in diameter, equipped with 15 - 35 bracts arranged spirally, each bract carrying a flower.

The three tribal communities (Dayak Linoh, Malay and Javanese) use *Curcuma xanthorrhiza* Roxb. (Yellow Curcuma) to treat liver function disorders, such as hepatitis B, stomach disorders, internal wounds, and to increase appetite. Traditionally *Cucurma xanthorrhiza* is used to treat various diseases such as liver damage, hypertension, diabetes, and cancer, 25 lack of appetite, stomach disorders, liver disease, constipation, bloody diarrhea, dysentery, arthritis, childhood fever, hypotriglyceridemia, hemorrhoids, vaginal discharge, rheumatism, and skin eruptions.²⁶

Curcuma zedoria (Christm.) Roscoe. (*White Curcuma*)

The Dayak Linoh and Malay tribes know white ginger as Entemu Putih, while the Javanese tribe knows it better as white ginger. White ginger (*Curcuma zedoria* (Christm.) Roscoe.) grows wild around plantations and in forests overgrown with reeds. Meanwhile in the yard there are quite a few. Generally, *Curcuma zedoria* is easy to find in the highlands with moderate humidity.



Figure 5: A. Rhizome shape and B. Cross section and colour of the rhizome of *Curcuma xanthorrhiza* Roxb rhizome. (Turmeric/Orange Curcuma)

Table 4: Methods of processing Zingiberaceae rhizomes as traditional medicine by three tribal communities (Dayak Linoh, Malay and Javanese)

S/N	Ethnic group	Method of processing	Frequency	Percentage (%)
1	Dayak Linoh	It is crushed by kneading or mashing, then sprayed or smeared on the stomach.	1	7.69
2		Boiled, together with alang roots, yellow bamboo roots, turmeric, and yellow roots, and drunk	2	15.38
3		The rhizomes are mixed with red ginger, turmeric, galangal and a little kandis, crushed, drunk directly or boiled and then drunk mixed with honey.	1	7.69
4		Boiled or extracted directly and drunk		
5		Red ginger mixed with turmeric, galangal and a little kandis is crushed, drunk directly or boiled and then drunk mixed with honey	2	15.38
6		Pureed and rubbed on sore skin	1	7.69
7		Emprit ginger mixed with turmeric, galangal and a little kandis are crushed, drunk directly or boiled then drunk mixed with honey	1	7.69
8		Pounded, boiled and drunk	1	7.69
9		Chewed and sprayed on the sick part of the body	2	15.38
10		Finely ground and distributed throughout the body	1	7.69
1	Javanese	Boiled and drunk as a herbal medicine for childbirth	1	16.67
2		Grated/mashed, boiled and drunk as a herbal medicine for childbirth	1	16.67
3		Pureed by grating and drinking	1	16.67
4		Pounded and boiled to make kencur rice herbal medicine	1	16.67
5		Pureed by pounding and rubbing on the skin affected by tinea versicolor and scabies	1	16.67
6		Smoothened and spread all over the body	1	16.67
1	Malay	Mashed, boiled and drunk	6	75
2		Smoothened and stuck/rubbed	1	12.5
3		Smoothened and spread all over the body	1	12.5

In the three tribal communities (Dayak Linoh, Malay and Javanese), the rhizome of white ginger is used as a herbal medicine to treat ulcers, vomiting due to stomach acid, poisoning in the Javanese tribe and for treating internal wounds, and postpartum malaise in the Dayak Linoh and Malay tribes. *Curcuma zedoria* is used as an ethnomedicine because of its many biological activities such as antimicrobial, antifungal, anti-inflammatory, hepatoprotective, antioxidant, anti-cancer, insecticidal, anti-allergic, anti-ulcer, immunomodulatory, and wound healing properties.²⁷ *Curcuma zedoria* is used as a herbal medicine to treat blisters on the skin, treat wounds such as cuts on the skin and to increase the body's immunity. To boost immunity, it is consumed directly when fresh, the rhizomes are sliced, then boiled and the boiled water is consumed. It can also be ground by grating, then clean water is added, and filtered before consumption.²⁸

Curcuma aeruginosa Roxb. (black ginger)

Curcuma aeruginosa grows very well in soil with moderate humidity, and distributed mostly in the highlands and in the valleys. Meanwhile, in home gardens and vegetable plantations, the plant is cultivated mainly for household medicinal purposes. The rhizome is fleshy and has horizontal branches with the inner part when sliced crosswise showing circles of blackish blue, greenish blue or violet, and some white colours.

Curcuma aeruginosa contains phytochemicals in the form of tannins, saponins, triterpenoids, flavonoids, phenolics, alkaloids, stenoids, curcuminoids, sterols, organic acids, fatty acids and sugars.²⁹ *Curcuma aeruginosa* is used traditionally to treat coughs by consuming the rhizomes mixed with red jerangau rhizomes and fresh tuba roots. In its method of preparation, black ginger rhizomes, plain tuba roots and red jerangau rhizomes are sliced into small pieces and dried in the sun for preservation purposes, then it is consumed by brewing it with hot water and drunk.

Curcuma longa L. (Turmeric)

Turmeric (*Curcuma longa*) is almost similar to *Curcuma xanthorrhiza*, except that the flowers are yellow. Turmeric is a perennial herbaceous plant with funnel-shaped yellow flowers on short stalks and pointed leaves that grows up to one meter in height.³⁰ It reproduces using underground rhizomes. The rhizome is branched, yellow to orange in colour and has a strong aroma. Turmeric leaves are arranged alternately

and in two rows. The false stem grows from the leaf midrib which is oval to elliptical in shape with a narrow tip.

Tropical and subtropical forests, particularly those in Asia, are home to *Curcuma longa*. It has been used as herbal remedy for a number of conditions, such as wound infection, and inflammation.³¹ Curcuminoids are found in *C. mangga* and *C. longa*, and they have antioxidant and anti-inflammatory properties.³²



Figure 6: A. Rhizome shape and B. Cross section of the rhizome and colour of the rhizome of *Curcuma zedoria* (Christm.) Roscoe. (White Curcuma)



Figure 7: A. Rhizome view and B. Cross section of the rhizome and colour of the rhizome of *Curcuma aeruginosa* Roxb. (Black ginger)

Table 5: Names of diseases treated using Zingiberaceae rhizomes by the three ethnic communities (Dayak Linoh, Malay and Javanese)

S/N	Disease name	Ethnic group	Frequency
1	Postpartum malaise	Dayak Linoh, Malay, and Javanese	12
2	Wounds	Dayak Linoh, and Malay.	8
3	Body aches/pains	Dayak Linoh, Malay, and Javanese	5
4	Tinea versicolor, scabies and ringworm	Dayak Linoh, Malay, and Javanese	3
5	Inflammation	Dayak Linoh	2
6	Cough	Dayak Linoh	2
7	Ulcer (Stomach Acid)	Javanese	2
8	Hypolactation	Javanese	1
9	Poisoning	Javanese	1
10	Boil	Dayak Linoh	1
11	<i>Muntaber</i> (Stomach flu)	Javanese	1
12	Cold	Dayak Linoh	1
13	Hepatitis B	Dayak Linoh	1
14	Toxaemia	Dayak Linoh	1
15	Anorexia	Javanese	1

The three tribal communities (Dayak Linoh, Malay and Javanese) use turmeric as a traditional medicine to treat ulcers, internal wounds after childbirth, boils, swelling or bruising due to falls. *C. longa* is also used in the treatment of postpartum malaise, diarrhea, stomach ache, flatulence, and as antiseptic.³³ Also, in these communities, *C. longa* has been used to boost immunity, as an antioxidant, antidiabetic, hepatoprotective and as an anticarcinogenic agent.³⁴ Its rhizomes has been shown to contain active compounds such as curcumin, curcuminoids, dimethoxycurcumin, bisdemethoxycurcumin and essential oils.³⁵ Previous research has shown *C. longa* to have anti-inflammatory, hepatoprotective, anti-cancer, anti-fungal and neuroprotective activities.³⁶

Alpinia galanga (L.) Sw. (Galangal)

Galangal is very easy to find in both lowlands and highlands, and grows best in damp and cool places. The rhizome of *Alpinia galanga* (galangal) has a reddish-white surface with the flesh of the rhizome being white, stringy and has a fragrant aroma and spicy taste. *A. galangal* rhizomes is used in the three tribal communities (Dayak Linoh, Malay and Javanese) as a traditional medicine in the treatment of skin diseases such as tinea versicolor, scabies and ringworm. Laokor and Juntachai (2021)³⁶ stated in their work that Zingiberaceae has long been used in traditional medicine to treat fungal skin disorders. *A. galanga* is an important medicinal plant with many medicinal benefits, and has been shown to have anti-fungal, anti-tumor, antimicrobial, anti-inflammatory, antioxidant, and anti-ulcer properties.³⁷

Zingiber officinale Linn. Var. *rubrum*. (Red ginger)

Zingiber officinale Linn. Var. *rubrum*. (Red Ginger) is also called liak jerombang by the Dayak and Malay tribes in West Kalimantan. Red ginger has a single root that enlarges according to its growth age, thus forming rhizomes and shoots that will grow into new plants.³⁸ The rhizome is branched and the outer part of the rhizome is reddish and scaly. The rhizome is aromatic and spicy. The false stems and leaves form a dense stem-like shape. It has a bung measuring 2.0 - 2.5 cm long and 1.0 - 1.5 cm wide. The flowers are 30 cm long, yellowish white and have purple red spots; leaves grow close together. It has a tapered base at the tip of the leaf, while the edge of the leaf is flat. The length of the leaves reaches up to 15 - 23 cm and the width of the leaves is around 8.0 - 12.5 cm. The stems have 3 - 7 leaves per stem. Flowers emerge from rhizomes, and are about 25 cm long.³⁹

In the three tribal communities of Dayak Linoh, Malay and Javanese, red ginger is used to increase stamina and help speed up recovery after childbirth, it is also used as an anti-bacterial to facilitate the healing of internal and external wounds. Red ginger is widely used as an herbal medicine because it is considered safe and is known to have positive biological activity such as anti-inflammatory, antioxidant, antiemetic, antibacterial and anti-diabetic activities.³⁸ The plant herb is processed by grinding, mashing or grating, bruising or slicing, and then boiled with enough water to remove the extract from the red ginger. The extract is drunk while warm with one spoonful of forest honey added to it.²⁸

Zingiber officinale Var. *Amarum* (Small White Ginger/Emprit Ginger)

Zingiber officinale Var. *Amarum*, also called small white ginger, emprit ginger, Loyak sunti, loyak padi, loya lapis (by the Dayak and Linoh tribes) in West Kalimantan. *Zingiber officinale* has a small, branched and layered rhizome with yellowish white flesh and has a fragrant aroma and spicy taste. It is the most popular spice used by many people for cooking and producing essential oils, because even though the rhizomes are small in size, they are soft in fiber and have a strong aroma. The Dayak Linoh and Malay tribes use *Z. officinale* as a herbal medicine to restore stamina after childbirth. *Z. officinale* is processed as a herbal medicine by mashing and rubbing on the stomach, crushing, and then consumed directly or boiled with water, and drunk. The utility of *Zingiber officinale* as an herbal medicine could result from its content of bioactive ingredients such as 6-gingerol, 6-shogaol, 6-paradol, zingerone and zerumbone. These compounds function to promote enzyme action, maintain blood circulation, and enhance general physical wellbeing.⁴⁰

The health benefits of emprit ginger, or *Zingiber officinale*, include enhanced endogenous antioxidant enzymes,⁴¹ xanthine oxidase inhibition,⁴² anti-inflammatory effects,⁴³ antimicrobial activity against a number of pathogenic microorganisms and acting as a chemopreventive agent against carcinogens.⁴⁴ The major bioactive phytochemicals in the plants are phenolic substances like shogaol and gingerol which are known for their antioxidant activity.⁴⁵



Figure 8: A. Rhizome view and B. Cross section and colour of the rhizome of *Curcuma longa* L. (Turmeric)



Figure 9: A. Rhizome illustration; and B. Cross section and colour of the rhizome of *Alpinia galanga* (L.) Sw. (Galangal)



Figure 10: A. Rhizome illustration; and B. Cross section and colour of the rhizome of *Zingiber officinale* Linn. Var. *rubrum*. (Red ginger)

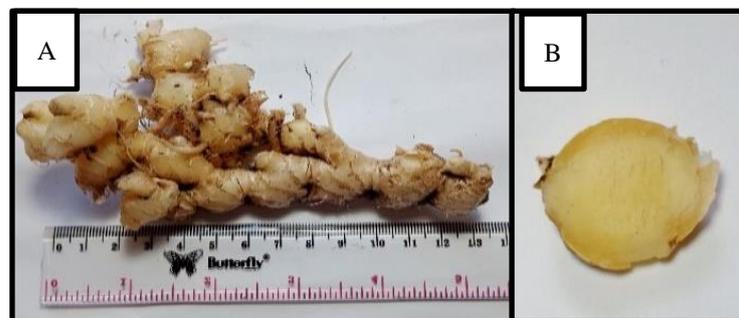


Figure 11: A. View of the rhizome and B. Cross section and colour of the rhizome of *Zingiber Officinale* Var. *Amarum* (Small Puti Ginger/Emprit Ginger)

Zingiber officinale var. Roscoe (Large White Ginger/ Elephant Ginger)
Zingiber officinale var. Roscoe (Large White Ginger/ Elephant Ginger) or spiced ginger has upright stems reaching a height of up to 2 m. Ginger rhizomes grow horizontally underground at shallow depths and are irregularly branched with a pale white epidermis. The side of the rhizome tastes slightly bitter. All the leaves are green, the inflorescence grows from the rhizome, 15 - 35 cm long and slender. Bracts are oval or elliptical, 20 - 30 mm long and 15 - 20 mm wide with a yellow-green colour. Flowers are short-lived, surrounded by bracteoles.³⁹

Zingiber officinale var. Roscoe is better known by the three tribal communities as Loyak Bumbu (Dayak Linoh), Liok spice (Malay) and ginger bubu in the Javanese tribe. The use of *Z. officinale* as a herbal medicine for postpartum stamina recovery is often by mashing, boiling and drinking the boiled water. *Z. officinale* is also used by crushing, mixed with vegetables or as a condiment for clear dishes after delivery. Ginger, or *Zingiber officinale* Roscoe., is a rhizomatous monocot plant that is used extensively as a medical remedy worldwide. A number of illnesses, including diabetes, rheumatic disorders, pneumonia, fever, cold symptoms, motion sickness, and gastrointestinal conditions have been treated with *Z. officinale*.⁴⁶ The biological and therapeutic effects of *Z. officinale* have primarily been linked to its bioactive components, including flavonoids, other phenolics, 6-gingerol, and 6-shogaol. The most effective anti-rheumatic chemicals found in *Zingiber officinale* var. Roscoe are Zingerone, 6-Gingerol, and 8-Gingerol.⁴⁷ Indeed, pharmacological activity of the primary component, 6-gingerol, have been shown to include anti-inflammatory, antioxidant, anticancer, anti-lipidemic, antidiabetic, analgesic, and antipyretic effects.^{48,49}

Zingiber zerumbet (L.) J.E.Smith. (Black Lempuin/ Lempuyang)
Zingiber zerumbet (L.) J.E. Smith. (Black lempuin) grows very well in cool and humid habitats. The rhizomes are fragrant, blackish red in colour. It has leafy stems that can grow up to 1.2 m, the leaves are arranged alternately and the midrib is attached to the stem, the pseudostem is green with a white stem. The flowers are oval-conical or ellipsoid like pine flowers, about 7 - 15 cm long and 3 cm wide. The flower's appearance is red with a white crown.³⁹ The Dayak Linoh and Malay tribes know *Zingiber zerumbet* (L.) J.E.Smith. by the name Lempuin, and use it as a traditional medicine to treat pain and aches, especially back and chest pain. *Z. zerumbet* has enormous potential for the treatment of various diseases, and its pharmacological properties have been attributed to the presence of phytochemicals like sesquiterpenes, monoterpenes and phenolic compounds.⁵⁰ *Z. zerumbet* is processed as medicine by pureeing, pounding, and then spraying or rubbing on the sick part of the body.

Zingiber aromaticum Val. (White Lempuin/ Lempuyang)
The white lempuin or lempuyang is often found in damp and cool habitats. The leaves are arranged alternately along curved pseudostems and can grow up to 1 to 2 m long. The false stem is 50 - 200 cm high. The leaves have short petioles, with lanceolate or oval lanceolate leaf midribs, 15 to 20 cm long, and 3 - 8 cm wide. The rhizome has a fragrant aroma, light yellow white to slightly yellowish in colour. The flowers are oval-shaped or ellipsoid, about 7 - 15 cm long and 3 - 5 cm wide. The flower is red in appearance with a white crown.³⁹ Traditionally, lempin or lempuyang is used by the Dayak Linoh tribe as a herbal medicine to treat pain and aches from the back to the chest, joint pain, stomach disorders, coughs, anemia, malaria, jaundice, arthritis, and infections. Lempin or Lempuyang has been found to possess numerous pharmacological properties such as antidiabetic, antimicrobial, antimalarial, antihyperlipidemic, antioxidant, anti-inflammatory, renoprotective, retinoprotective, hepatoprotective, dermatoprotective, wound healing and anti-aging properties.⁵¹ Herbal preparation of *Z. aromaticum* is usually made by grinding or pounding, and then spraying or rubbing on the affected part of the body.

Zingiber cassumunar Roxb. (Ngemelai (Bangle)
Zingiber cassumunar Roxb. (Ngemelai (Bangle) grows very well in cool habitats with moderate humidity. It has false stems that grow up to a height of 30 to 100 cm with alternate leaves. The leaves are lanceolate, 13 - 30 cm long, and 2 - 5 cm wide. The bracelet flower is shaped like

a fruit. The pineapple is dark red, with a length of 3.5 - 5.0 cm and a width of 1.5 - 1.75 cm. When young, the flower bracelet has a green tip. The rhizome is reddish white when young and yellowish when old and has a smell which stings.⁵²

Zingiber cassumunar Roxb. (Ngemelai/ Bangle) has long been used as a herbal medicine by the three tribal communities of Dayak Linoh, Malay and Javanese. In these communities, *Zingiber cassumunar* rhizome is used to speed up recovery after childbirth, to relieve pain and aches. Previous research has reported *Zingiber cassumunar* to be used in the treatment of diseases such as inflammation, pain and respiratory problems and has been shown to possess antioxidant, anti-inflammatory, anticancer, neuroprotective/neurotropic, and antifungal/antimicrobial activities.⁵³ *Zingiber cassumunar* is processed as a herbal medicine by grinding and rubbing it all over the body where there is pain and ache resulting from the impact childbirth.

Conclusion

The study carried out in three tribal communities (Dayak Linoh, Malay and Javanese) in Sintang Regency, West Kalimantan has identified thirteen (13) species of Zingiberaceae rhizomes that have the potential to be used as traditional medicine. All the thirteen Zingiberaceae rhizomes are used as medicine by the Dayak Linoh tribe, eight (8) are used by the Malay tribe and six (6) by the Javanese tribe. Rhizomes of *kaempferia galanga* L. (Cekur/Kencur), *Curcuma longa* L. (Turmeric), *Zingiber officinale* var. Rubrum. (Red ginger), *Alpinia galanga* (L.) Sw. (Galangal), *Zingiber cassumunar* Roxb. (Ngemelai/bangle), and *Curcuma zedoria* (Christm.) Roscoe. (White ginger) were the most commonly used.



Figure 12: A. Rhizome view and B. Cross section and colour of the rhizome of *Zingiber officinale* var. Roscoe (Great White Ginger/ Elephant Ginger)

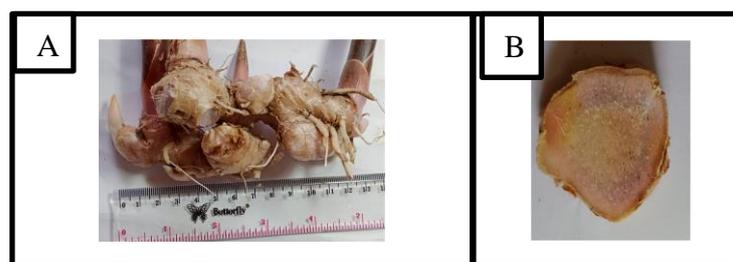


Figure 13: A. View of the rhizome and B. Cross section and colour of the rhizome of *Zingiber zerumbet* (L.) J.E.Smith. (Black Lempuin/ Lempuyang)



Figure 14: A. Rhizome view and B. Cross section and colour of the rhizome of *Zingiber aromaticum* Val. (White Lempuin)



Figure 15: A. Rhizome view and B. Cross section and colour of the rhizome of *Zingiber cassumunar* Roxb. (Ngemelai (Bangle)).

Conflict of Interest

The authors declare no conflict of interest.

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

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