Wild Cinnamon: Traditional Medicine to Relieve Colds in Communities Around Gunung Leuser National Park Indonesia

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Abstract: Many people around the Gunung Leuser National Park (GLNP) conservation area, still depend on traditional medicine. The modern health service system is still unable to reach the population, some of whom still live in villages far from cities. The wild cinnamon, tidauruk (*Cinnamomum cuspidatum* Miq.) and tulang tiga (C. *iners* (Reinw.ex Nees & T.Nees) Blume) leaves are traditionally believed to have health benefits. Literature and research regarding these plants are still limited, not present in well-documented, formeven though these two plants are native to Indonesia, especially the islands of Java, Sumatra, and Kalimantan. Objective: The present study aimed to: (1) Identify and preserve the traditional knowledge of the GLNP community regarding the use of wild cinnamon; (2) Find out the chemical compound content of the two types of wild cinnamon. Methods: Direct observation and semi-structured interviews with 10 respondents and 3 key informants who are traditional healers. To determine the chemical content, a qualitative phytochemical screening was carried out. Research data is complemented by secondary data in the form of literature studies. Results: Wild cinnamon is used by the community around GLNP to relieve symptoms of colds, namely tidauruk (mild symptoms), and tulang tiga (moderate symptoms). These two types of wild cinnamon are used by drinking boiled water from the leaves. The chemical compounds contained in both types of wild cinnamon are the same, namely tannins, flavonoids, glycosides, triterpenoids, steroids, essential oils, carotenoids, coumarins, and reducing sugars. Conclusion: From the above findings, it is concluded that tidauruk and tulang tiga are trusted by the people around GLNP to relieve symptoms of colds. Tannins, flavonoids, glycosides, triterpenoids, steroids, essential oils, carotenoids, coumarins, and reducing sugars are the compounds contained in this wild cinnamon.

1 INTRODUCTION

Cinnamomum Schaeff. (family *Lauraceae*) described for the first time from *Cinnamomum verum* J. Presl in 1760 (Schäffer, 1760). There are around 350 species of Cinnamon that grow naturally in South America, Australia, the Pacific, tropical Asia, and subtropical Asia (Werff, 2001), North America, and Southeast Asia (Vairappan et al., 2014). *Cinnamomum* comes from "kin namomon" (Greek) which means spice (Kumar et al, 2012) or cinnamon (Lee et al, 2015).

The bark and leaves emit a delicious aroma that makes *Cinnamomum* famous. The main elements in cinnamon bark essential oil are cinnamaldehyde and trans-cinnamalde hyde (Cin), which plays a role in providing aroma and various biological activities (Yeh et al., 2013); eugenol in the leaves, inhibits several pathogenic bacteria (Ali et al., 2005; Suresh et al. 1992) and camphor in the roots (Senanayake, 1978).

Commercial *Cinnamomum* sold as spices are C. *verum* (true cinnamon, Ceylon cinnamon), C. *cassia* (Chinese cinnamon), C. *burmannii* (Indonesian cinnamon) and C. *loureiroi* (Saigon cinnamon), and C. *Zeylanicum*, (Killday et al., 2011; Vairappan et al., 2014). Cinnamon is used as a food flavoring and pharmaceutical preparation for various diseases (Kumar et al., 2019). There are many types of wild *Cinnamomum* whose potential has not been studied such as tidauruk (C. *cuspidatum* Miq.) and tulang tiga (C. *iners* (Reinw.ex Nees & T.Nees) Blume). Communities around the Gunung Leuser National Park (GLNP) conservation area believe that the leaves of wild cinnamon tidauruk and tulang tiga traditionally have health benefits. This research was conducted

to provide data related to wild cinnamon, both its morphology and its use. Even though these two plants are native to Indonesia, especially the Java, Sumatra, and Kalimantan Islands. The general public is still unfamiliar with wild cinnamon plants and their benefits. *Food and Agricultural Organization* (FAO) stated that there is a threat of loss of biodiversity, cultural assets, and traditional knowledge due to deforestation occurring in tropical regions.

For this reason, this ethnobotanical research was carried out to introduce this plant and preserve biodiversity, cultural assets, and public knowledge about using wild cinnamon for health.

2 MATERIALS AND METHODS

2.1 Place and time

The research was conducted in the Ketambe Research Station area, Gunung Leuser National Park, Southeast Aceh. The plant specimens to be investigated were identified at Herbarium Bogoriense. Laboratory analysis was carried out at the Research Center for Biology - BRIN, Bogor.

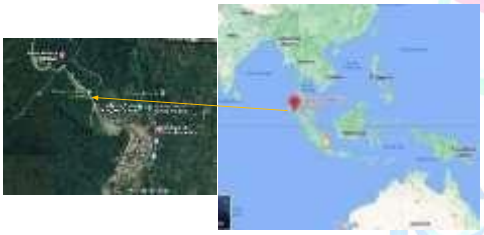

Figure 1. Research locations at Ketambe, GLNP, Southeast Aceh (Google.co.id, 2023)

2.2 Materials

The materials used were leaves of the tidauruk and tulang tiga plants obtained from around Ketambe GLNP, Nanggroe Aceh Darussalam.

The chemicals used were: Libermann Bouchard's reagent, Dragendorf's reagent, Stiasny's reagent, and Mayer's reagent.

2.3 Procedure

Data collection of local knowledge from the community about wild cinnamon plants carried out using exploration, field observation methods, and semi-structured interviews with 10 respondents and 3 key informants who are traditional healers in the Ketambe RS conservation area. Collections include herbarium specimens for plant identification and leaf sampling to determine the chemical content. Research data is complemented by secondary data with literature studies.

2.4 Simplicia preparation

The leaves washed, cut into pieces and dried until the moisture content is 5-10%. The dry ingredients are ground to become simplicia powder.

2.5 Phytochemical screening (qualitative)

2.5.1 Identify alkaloids content

The extract was added with Dragendorf's reagent to produce an orange precipitate if positive; there was a brown precipitate with bouchardat's reagent if positive.

2.5.2 Identify saponin content

The extract was added with hot H_2O then cooled and shaken vigorously. Foam forms that do not disappear when hydrochloric acid is added if positive.

2.5.3 Identify tannin content

The extract was added with $FeCl_3$ the color becomes blackish green or dark blue if positive.

2.5.4 Identify flavonoid content

The extract was added with $FeCl_3$ then HCl(p); if positive, a red color will appear.

2.5.5 Identify glycoside content

The extract was added with glacial acetic acid or $FeCl_3$ or H_2SO_4(p); if positive it will form a purple ring.

2.5.6 Identify triterpenoid content

The extract was added with H_2SO_4(p) or ether or anhydrous acetic acid; if positive, each reaction will produce a red/purple color.

2.5.7 Identify steroid content

The extract was added with ether or anhydrous acetic acid or H_2SO_4(p); if positive, each reaction would produce a green color.

2.5.8 Identify essential oils

Wild cinnamon leaf simplicia was analyzed for its essential oil content qualitatively through organoleptic observation by smelling the aroma. If it has a specific aromatic smell, it can be concluded that simplicia contains essential oils.

2.5.9 Identify carotenoid content

The ether extract was evaporated to dryness, and added with Carr-Price reagent (antimony trichloride solution in chloroform). With the addition of concentrated sulfuric acid, carotenoids generally turn dark blue/green.

2.5.10 Identify coumarin

The ether extract was evaporated. Evaporation residue was dissolved in hot water. After cooling, the solution is made alkaline by adding ammonia. The presence of coumarins & their derivatives is demonstrated by the occurrence of strong fluorescence under UV light.

2.5.11 Identify reducing sugar

The alcohol extract was given Fehling's solutions A and B and then heated. If it contains reducing sugar, a brick-red precipitate will form.

3 RESULTS AND DISCUSSION

3.1 Results

3.1.1 Tidauruk (C. cuspidatum Miq.) plant *morphology*

Figure 2. Tidauruk plant morphology*: a. Ketambe; b. Herbarium Bogoriense; c. Kew's Herbarium - K000778676Herbarium, RBG Kew*

Observing the morphology of two types of wild cinnamon plants in the field, it was found that the tidauruk (tiga urat) leaf has a smaller and more slender leaf size than the tulang tiga leaf. The base and tips of the leaves are very sharp. The stem of the tidauruk plant has a fragrant smell.

3.1.2 Tulang tiga (C. iners) plant morphology

Figure 3. *Tulang tiga plant morphology: a.& b. Ketambe; c. Herbarium Bogoriense; d. Kew's Herbarium - K000778639Herbarium, RBG Kew*

In the field, the morphology of the tulang tiga was found to be bigger, longer, and wider (more extensive) compared to tidauruk leaves. The base of tulang tiga leaves is slightly pointed with the tips of the leaves tend to be blunt. The stems of the tulang tiga plant also have a fragrant smell, although with a different sensation from tidauruk.

3.1.3 Local Knowledge

Tidauruk and tulang tiga are known as wild cinnamon. Both types of plants are empirically believed by the community around the GLNP conservation area to have health benefits. Local people around GLNP use tidauruk to relieve symptoms of colds (mild symptoms), while tulang tiga is used to relieve symptoms of cold with influenza and dry throat (moderate symptoms). The way to use the two types of *Cinnamomum* for health is to drink the boiled water from the leaves.

3.1.4 Phytochemical screening

Tidauruk and tulang tiga phytochemical screening results can be read in table 1.

Table 1. Phytochemical screening of tidauruk and tulang tiga leaves

No	Phytochemical test	Tidauruk	Tulang tiga

3.2 Discussion

3.2.1. Cinnamomum Schaeff.

All types of *Cinnamomum* are trees or shrubs, of medium height, but some reaches 50m and 3m in diameter. The bark usually smells good, the texture is smooth/slightly cracked. The leaves in most species are opposite, a few species have alternate leaves. The bracts are located at the base of the leaf axils, are usually shaped like leaves and are indistinguishable from leaves, but are usually much smaller. Spices usually come from the bark, fruit, and flowers of only a few species. Cinnamon is widely cultivated in tropical areas and can be used as a shade tree (de Kok, 2019). An important character in recognizing this genus can be seen in the leaf venation. Stearn (1992) stated that *Cinnamomum* leaf venation is most often described as triplinerved.

The density of hairs underside of leaves is an important character in identification. Some species have leaf surfaces covered with hairs, while other species are no hair et all. The fresh leaves are crushed, and the inner bark gives off a strong aromatic odor. Inflorescences are usually axillary, rarely terminal (de Kok, 2019).

3.2 .2. Tidauruk (C. *cuspidatum* Miq.)

Taxonomy. C. *cuspidatum* is a species of tree in *Lauraceae*. First published in Annales Musei Botanici. Lugduno-Batavi 1 (1864) (Miquel, 1864). This species status is accepted. Comes from West Malesia. It is a a small tree, growing to 7.5 metres tall and usually grows in wet tropical biomes (Wuu-Kuang, 2011).

Habitus. Tree or shrub, 2 to10 m high, dbh 5 to10 cm. Bark purplish brown, smooth; inner skin purplish brown; sapwood has light reddish brown. Leaves subopposite, domatia absent, young leaves yellowish white, triplinerved at the base; terminal yellowish white, triplinerved at the base; terminal leaf bud lanceolate in outline, apex acuminate; fruit with calyx, rim entire to lobed; bark usually smelling cinnamon. Inflorescences glabrous to sparsely hairy (white to yellow) when young; long acuminate (de Kok, 2019).

Distribution. C. *cuspidatum* native to Borneo, Jawa, Malaya Peninsular Malaysia, Sumatera (Wuu-Kuang, 2011; IPNI, 2023; POWO, 2023). In Borneo, it is found in Sarawak and Brunei. Grows in mixed dipterocarp and kerangas forest to 1000 metres elevation (Wuu-Kuang, 2011), Malaysia (Peninsular and northern Sarawak), Brunei (de Kok, 2019).

Figure 4. Distribution C. *cuspidatum* (IPNI, 2023*;* POWO, 2023*).*

Ecology. Habitat in lowland to montane forests, sometimes in kerangas forests, at an altitude 90–1200 m. Usually flowers in February-March; fruiting in April-July. Endangered status of provisional IUCN conservation assessment. Known only from a small number of collections from Southeast Asia. Vernacular name. Medang teja (Malay) (de Kok, 2019).

Notes. This rare phenomenon of the Cinnamomum genus has two-celled anthers on some of its stamens (Soh, 2011) and van der Werff (2001), which makes this type easy to recognize when it is flowering. If not from the flowers, it can be seen from the long and pointed tips of the leaves, the small and slender flowers, and the glabrous and double-striped leaves (de Kok, 2019).

Utilization. Infusion of C. *cuspidatum* leaves can be used as a stimulant (de Kok, 2019). C. *cuspidatum* oil can inhibit *Listeria monocytogenes* and *Staphylococcus aereus*. These results highlight the possibility of using essential oils derived from wild cinnamon species to fight food-borne pathogens (Vairappan et al., 2014). The Dayak tribe of North Kalimantan uses tabar (*C. cuspidatum*) to treat problems with the digestive system (Susanti & Zuhud, 2019).

3.2.3. Tulang tiga (C. *iners* (Reinw. ex Nees & T.Nees) Blume, Fl. Ned. Ind. 11: 570 (1826))

Shrub or tree with a height of 2–10 m. Bark purplish brown, smooth; inner bark purplish brown; sapwood brown to pink. Leaves are opposite, young leaves are yellowish white, leaf blades are oval, elliptical to lanceolate, leaf tip is long pointed, the base of the leaf is pointed-rounded, leaf edge is flat, the blade is three-striped; the lower surface is slightly shiny, green, bare brown veins. Inflorescence a few-flowered slender panicle, axillary. Cupule margin clearly lobed (de Kok, 2019).

Distribution. The native range of *C. iners* is Borneo, Assam, Cambodia, Bangladesh, China South- Central, China Southeast, Christmas I., India, Java, Laos, Malaya, Myanmar, Philippines, Sri Lanka, Thailand, Tibet, Sumatera, Vietnam (Wuu-Kuang, 2011; IPNI, 2023; POWO, 2023), Singapore, Bali (Lê, 2003).

Figure 5. *Distribution* C. *iners (IPNI, 2023; POWO, 2023).*

Ecology. It grows in mountain forests, primary and secondary lowlands, also on abandoned land, and along river banks. Seeds are spread by animals such as birds, bats, and squirrels (Corner, 1952). Flowers all year round; fruiting from February to October.

Vernacular names. Kayu manis, medang teja, medang enijur, teja badak (Malay); medang tenyo (Temuan); medang tajoh (Sakai); wild cinnamon (English).

Notes. New leaves grow several times a year, after a rainy season followed by a dry season. After that, flowers are produced which emit a rancid odor to attract small beetles, flies, and many other small insects (Burkill, 1966). This species often has galls in place of the fruit (Blume, 1836).

Utilization. C. *iners* is often used as shade tree or an ornamental tree. The wood usually used to make fragrant incense, as wood, to make "kulit lawang" essential oil in Peninsular Malaysia. The roots are used as medicine, by boiling them and giving them to women after giving birth, as well as someone who has a fever. Indigenous people use the leaf juice as medicine for anti-aris poisoning, by squeezing the leaf juice into the wounds. The leaves are used traditionally as an antirheumatic poultice. Cinnamon fruit can be eaten by children (Burkill, 1966). The Sakai tribe in Peninsular Malaysia grinds the stem and leaves then rubs them on the body to relieve pain; a decoc of the roots is used to treat fever in women after childbirth; The mucilage is used in making mosquito coils, perfumed incense, and formica (Pereira & Hastie, 2014).

3.2.4. Local Knowledge

Traditional knowledge has an important role in regional management and conservation (SCBD, 2006, Gerique, 2006). The interdependence between local communities, biodiversity, and their traditional knowledge of managing nature has received worldwide recognition (Ghimire & Bastakoti, 2009). In developing countries like Indonesia, traditional knowledge about medicinal plants is very helpful and is recognized by communities around forest areas, buffer zones, and remote rural areas where modern health services are still limited (MoF, 2002).

Tidauruk and tulang tiga are empirically believed by the community around the GLNP conservation area to have health benefits. Local people around GLNP use tidauruk to relieve symptoms of colds, while tulang tiga is used to relieve symptoms of influenza and dry throat. The way to use the two types of *Cinnamomum* for health is by drinking boiled water from the leaves.

Empirical data from the community was obtained that tulang tiga (C. *iners*) is used to relieve symptoms of colds with influenza and dry throat (moderate sympton). Burkill stated C. *iners* was used as a shade tree. Its wood to make scented incense. The essential oil known as "kulit lawang", is extracted from the bark of various types of plants, including C. *rhynchophyllum* and C. *iners*, sold in Peninsular Malaysia. The content of aromatic substances varies greatly depending on the species. Several species (C. *javanicum*, C. *iners*, C. *sintoc*, and C. *pendulum* Cammerl.) are the sintoc bark material which is often found in drug stores in Malaysia. This bark smells very good, smells of cloves, and is very similar to the aroma of "kulit lawang" except that it tastes astringent and bitter. This bark in Peninsular Malaysia is used in powder form for wounds and treating numbness in the feet (Burkill, 1966).

Several species of *Cinnamomum* have been introduced for agriculture, medicine, spices, shade trees, or as sources of chemicals. The dried fruit of C. *cassia* is used to treat coughs, sore throats, chest complaints, and as a food flavoring. C. *camphora* oil is used as a source of camphor. (Burkill, 1966). C. *javanicum* bark is used to extract masoia, which was previously used as a natural food flavoring. The several species bark (C. *cassia*, C. *verum*, and C. *burmannii*) is used as a cooking spice or as betel juice (C. *mollissimum*).

3.2.5. *Phytochemical analysis*

Analysis was carried out to determine the chemical content qualitatively of wild cinnamon plants. Phytochemical screening is carried out as an initial stage to provide an overview of the chemical compound content in a natural product, which will later be used for medicinal, cosmetic, aromatic, and so on. Screening can be carried out quantitatively, semi-quantitatively, or qualitatively. The qualitative method is carried out through color reactions using certain reagents.

The screening results showed that these two types of *Cinnamomum* contain same chemical compounds such as flavonoids, glycosides, tannins, triterpenoids, steroids, essential oils, carotenoids, coumarins, and reducing sugars. These compounds are useful in helping to overcome health problems.

Tannins are phenols, that have the ability to tan the skin and have a bitter taste. Some tannins can function as antioxidants, inhibit tumor growth, inhibit enzyme activity (Robinson, 1995), as astringents, and as anti-diarrhea. The pharmacological and physiological effects of tannins are due to their ability to react with proteins (Mahtuti and Yohani, 2004).

Flavonoids are used as antioxidants that can neutralize free radicals (Mahtuti & Yohani, 2004). Flavonoids include many of the pigments that are very common in the plant world. Play a role in growth, a regulator of photosynthesis, antimicrobial, antiviral agents, and components formed in response to infection/injury (Ovando et al., 2009), curing alzheimer's disease, cancer, and atherosclerosis (Burak and Imen, 1999; Ovando et al, 2009).

Glycosides are chemically acetals or sugar ethers (Bohé and Crich, 2014; Khattak and Khan, 2018). Most of the triterpenoid compounds have physiological activities such as treating diabetes, liver damage, malaria, antipredator, antifungal, menstrual disorders, antibacterial, antiviral, snake venom, skin disorders, and insecticide. Steroids play an important role in maintaining the body's salt balance, controlling metabolism, and improving the function of the sexual organs (Bhawani et al, 2010).

This wild cinnamon above contain essential oils. Vairappan et al (2014) reveal that the essential oil composition from the bark of C. *cuspidatum* by

hydrodistillation was benzyl benzoate (29.9%), terpinen-4-ol (12.7%), α-humulene (4.3%), α-terpineol (4.1%). %), copaene (3.7%), pentacosane (3.5%), calamenene (3.4%), eucalyptol (3.1%). Terpenes are active antimicrobial compounds from essential oils.

Carotenoids are a group of metabolites that have a very unique character that is not shared by other metabolites, namely functioning as a precursor for the formation of vitamin A. In general, carotenoids are known as a group of natural dyes or pigments that have a yellow, orange to red color (Syukri, 2021). Coumarins are commonly found in the plant kingdom. They are found in large quantities in cinnamon bark oil (7,000 ppm) (Lake, 1999).

In plants, sugars play an important role as signaling centers, nutrients, and regulatory molecules that modulate plant metabolism, development, growth, stress responses, and disease resistance. Non- reducing and reducing sugars plays an important role in the central metabolic pathway and helps the production of secondary metabolites that have medicinal properties in plants (Rolland et al, 2002; Arsenault et al, 2010).

Commercially valuable cinnamon usually contains high levels of eugenol and cinnamaldehyde in the bark and/or leaf oil (Abeysinghe et al., 2021). Chemical constituents in C. *iners* stem are terrpinenes (1,8-cineole, *a*-terpinol, terpinen-4- ol); (E)-caryophyllene; acetate ((E)-phytol acetate); linalool; (E)-b-ocimene; b-pinene; *a*- selinene (E)-nerolidol; *a*-humulene; geraniol; b- selinene; *a*-pinene; (Barceloux, 2009; Suhaimi et al., 2017).

Medicinal use are abdominal pain (Quattrocchi, 2012), appetite problems (Mustaffa 2011), asthma (Ahmad & Holdsworth, 1994), breathing problem (Mustaffa 2011), body ache (Uddin, 2006), cardiac disorders (Ramalingam & Balasubramanian, 2015), constipation (Butkhup & Samappito, 2011), cough and cold (Ahmad & Holdsworth, 1994; Delang, 2007), diarrhoea (Das et al., 2012), digestive ailments (Mustaffa 2011), dysentery (Kirtikar & Basu, 1999; Drury, 2010), dyspepsia (Kumar A et al., 2016), dyspnoea (Delang, 2007), flatulence (Kumar A et al., 2016), gynaecological disorder (Uphof, 2001), headache (Mustaffa F et al., 2013), influenza (Kraisintu, 2003), insects bite (Bahekar et al, 2012), jaundice (Lingaraju et al, 2013), nausea, vomiting (Quattrocchi, 2012; Singh & Jain, 2003), postpartum (Quattrocchi, 2012), (Mustaffa F et al., 2013), pyrexia (Uphof, 2001; Kumar A et al., 2016), rheumatism (Wiart, 2006), stomach complains (Butkhup & Samappito, 2011), (Das et al., 2012), urinary diseases (Kumar A et al., 2016), wounds (Darusman, 2014).

All the chemical compounds contained in cinnamon leaves and bark provide antiseptic, antibacterial, antifungal, antiviral, astringent, carminative, digestive, blood cleansing, warming benefits, and lower blood sugar levels and cholesterol (Kumar et al., 2019).

4. CONCLUSIONS

Tidauruk and tulang tiga are known as wild cinnamon. Both types of plants are empirically believed by the community around the Gunung Leuser National Park conservation area to have health benefits. Local people around GLNP use tidauruk to relieve symptoms of colds (mild symptoms), while tulang tiga is used to relieve symptoms of colds with influenza and dry throat (moderate symptoms). The way to use the two types of *Cinnamomum* for health is by drinking boiled water from the leaves. Phytochemical screening to provide data regarding the secondary metabolite content from tidauruk and tulang tiga.

Screening results show that these two types of wild cinnamon contains several chemical compounds such as flavonoids, tannins, glycosides, triterpenoids, steroids, essential oils, carotenoids, coumarins, and reducing sugars.

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