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Ethnobotany of Medicinal Trees Used by the Dayak Meratus Community in Tumingki, Hulu Sungai Selatan, Indonesia

Etnobotani Pohon Obat yang Digunakan Masyarakat Dayak Meratus di Tumingki, Hulu Sungai Selatan, Indonesia

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ABSTRACT

This study identified medicinal tree species used by the Dayak Meratus community in Tumingki, documented their traditional applications, and quantified their ethnobotanical importance. Data were collected through field observations, vegetation sampling in ten 20 × 20 m plots, and structured interviews with eight informants selected through snowball sampling. Use Report (UR), Use Value (UV), Frequency of Citation (FC), and Relative Frequency of Citation (RFC) were calculated. Sixteen tree species were recorded, eight of which (50%) were used medicinally. Bark was the most frequently used plant part (60%). Langsat had the highest UR (16) and UV (2.00), while langsat, keminting, jambu air, and durian were cited by all informants (FC = 8; RFC = 1.00). These findings document culturally important medicinal trees and provide a baseline for conserving local ethnomedicinal knowledge and guiding future pharmacological research.

Kata kunci:

Dayak Meratus;
Desa Tumingki;
Etnobotani;
Pengobatan tradisional;
Pohon obat

ABSTRAK

Penelitian ini mengidentifikasi spesies pohon obat yang digunakan oleh masyarakat Dayak Meratus di Tumingki, mendokumentasikan pemanfaatan tradisionalnya, dan mengukur kepentingan etnobotaninya. Data dikumpulkan melalui observasi lapangan, sampling vegetasi pada sepuluh petak berukuran 20 × 20 m, serta wawancara terstruktur dengan delapan informan yang dipilih melalui snowball sampling. Use Report (UR), Use Value (UV), Frequency of Citation (FC), dan Relative Frequency of Citation (RFC) dihitung. Sebanyak 16 spesies pohon ditemukan, delapan di antaranya (50%) dimanfaatkan sebagai obat. Kulit batang merupakan bagian yang paling sering digunakan (60%). Langsat memiliki UR (16) dan UV (2,00) tertinggi, sedangkan langsat, keminting, jambu air, dan durian disebutkan oleh seluruh informan (FC = 8; RFC = 1,00). Temuan ini mendokumentasikan pohon obat yang penting secara budaya serta memberikan dasar bagi pelestarian pengetahuan etnomedisin lokal dan penelitian farmakologis selanjutnya.

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1. INTRODUCTION

Indonesia is recognized as one of the world's megadiverse countries and is estimated to harbor approximately 30,000 plant species (Ristagari & Arkhan, 2025). This biological richness has long supported indigenous health practices, particularly through the use of medicinal plants. In Kalimantan, 204 medicinal plant species from 74 families have been documented, with Asteraceae and Euphorbiaceae among the most frequently represented families (Sari et al., 2025). These practices form part of local knowledge systems developed and transmitted across generations.

The Dayak Meratus, an indigenous community inhabiting the Meratus Mountain range in South Kalimantan, maintains a strong tradition of plant-based medicine (Annida et al., 2019; Mariska et al., 2021; Mattiro et al., 2023). Previous ethnobotanical studies have documented the use of diverse forest plants, including herbs, shrubs, and trees, with roots and leaves commonly prepared to treat various health conditions. Medicinal plants also remain closely embedded in the daily life and customary practices of Dayak communities (Yayuk et al., 2024).

Ethnomedicinal practices vary across communities within the Meratus region. In Gunung Riut Village, 28 species from 18 families were reported for conditions including toothache, back pain, and skin disorders, with leaves being the most frequently used plant part (26.67%) (Wathan et al., 2023). In Halong District, roots accounted for 40% of the plant parts used, followed by leaves at 30% (Hafizi et al., 2022). These findings illustrate local variation in the selection and use of medicinal plants and highlight the importance of documenting community-specific ethnomedicinal knowledge.

Despite previous ethnobotanical studies in the Meratus Mountains, the medicinal use of tree species by the Dayak Meratus community in Tumingki Village has not been specifically documented. Trees warrant focused investigation because their ecological characteristics, harvesting patterns, and conservation implications differ from those of herbs and shrubs. Documenting this knowledge may also provide a basis for future phytochemical and pharmacological investigation (Mukti, 2024). Accordingly, this study aimed to identify medicinal tree species used by the Dayak Meratus community in Tumingki Village, document their traditional uses and preparation methods, and quantify their ethnobotanical importance using UR, UV, FC, and RFC indices.

2. METHODS

2.1. Study Area

This study employed a descriptive exploratory survey design and was conducted in Tumingki Village, Loksado District, Hulu Sungai Selatan Regency, South Kalimantan, Indonesia. The study area is located within the Meratus Mountains at approximately 2.830208° S and 115.490077° E, at an elevation of 302 m above sea level (**Figure 1**). The vegetation is characterized by tropical montane forest with high humidity and dense canopy cover. The study site was selected because the surrounding forest is used by the local Dayak Meratus community as a source of medicinal plants. The study documented tree species occurring within the sampled forest area and investigated their recognized medicinal uses within the community.

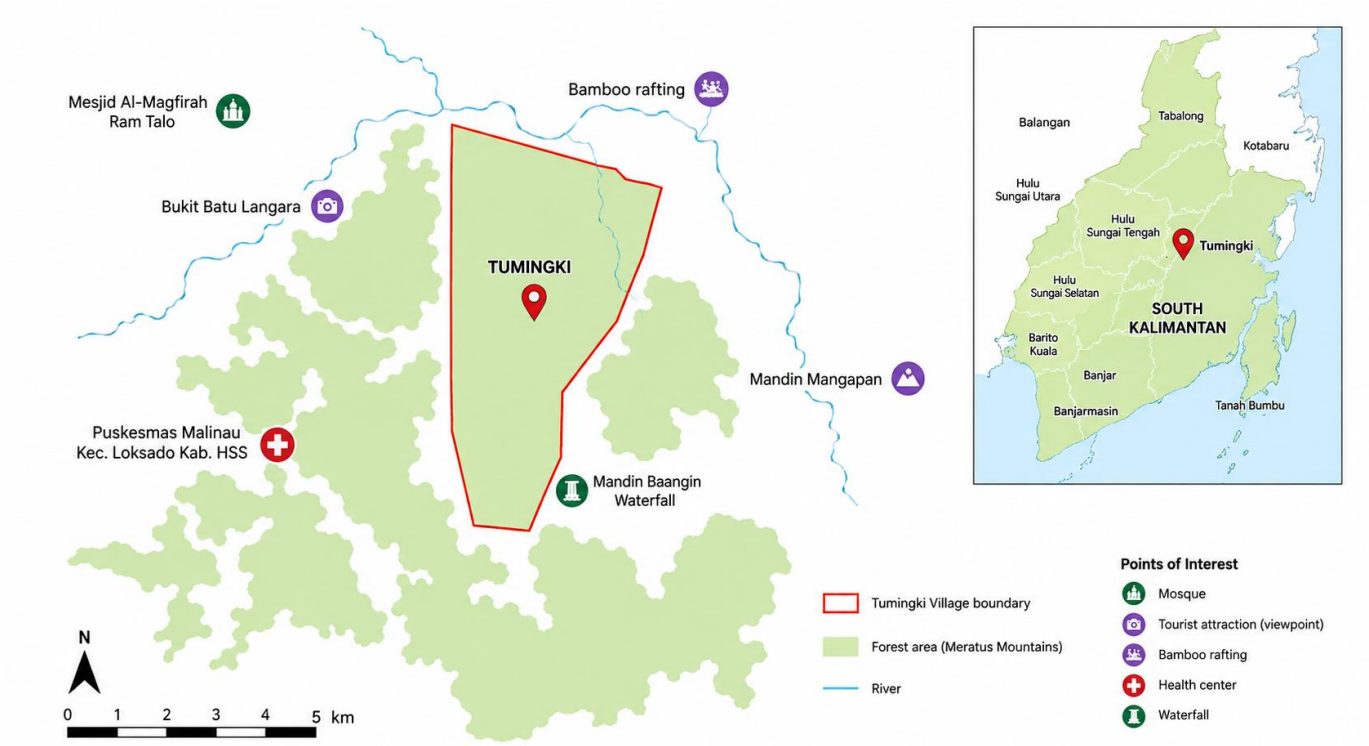

Figure 1. Map of the study area in Tumingki Village, South Kalimantan. The inset map (upper right) shows the geographical position of the village within South Kalimantan Province.

2.2. Informant Selection

Informants were recruited using snowball sampling. Eight informants participated in the study, comprising one key informant and seven community informants. The key informant was a traditional healer or community elder with extensive knowledge of traditional medicine, whereas the other informants were community members who regularly used medicinal plants. All informants were men aged 46–63 years. The inclusion criteria were: (1) registered residency in Tumingki Village; (2) knowledge of or experience with medicinal plant use; (3) age of at least 18 years; and (4) provision of informed consent. Individuals who were unable to complete the interview or provide sufficiently complete information were excluded. Data saturation was considered to have been reached when successive interviews yielded no additional information on medicinal tree species, plant parts used, therapeutic applications, preparation methods, or modes of administration.

2.3. Ethical Approval and Consent

Prior to data collection, ethical approval was obtained from the Ethics Committee of Research, Universitas Sari Mulia (approval no. 277/KEP-UNISM/I/2022). Informed consent was obtained from all informants before participation. Informants were informed about the purpose and procedures of the study and their right to withdraw at any time without consequence.

2.4. Vegetation Sampling

Vegetation sampling was conducted in the forest area of Tumingki Village. Trees with a diameter at breast height (DBH) greater than 10 cm were included in the survey. Eligible trees were located using a purposive sampling approach. The first sampling plot was established at 2.831473° S and 115.486319° E. From this starting point, ten 20 × 20 m plots, each covering 400 m^2, were established using a line-plot sampling design. The plots extended sequentially northward and were positioned alternately on the right and left sides of the transect at 20 m intervals. The total sampled area was 4,000 m^2 (0.4 ha). Within each plot, trees with DBH > 10 cm were identified and recorded, whereas individuals with DBH ≤ 10 cm were excluded from the analysis.

2.5. Plant Identification

Local and Indonesian plant names were recorded during field observations together with relevant plant characteristics. Preliminary identification was performed using Heyne (1987). Scientific names were subsequently checked against botanical references and authoritative databases, including Plants of the World Online (POWO) and the Global Biodiversity Information Facility (GBIF), to confirm taxonomic identity and nomenclature.

2.6. Interview Procedures

Interviews were conducted at locations selected by the informants to maintain comfort and privacy. Tree species recorded during vegetation sampling were used as references during the interviews to determine whether they were recognized and used medicinally by the local community. A structured interview guide collected information on: (1) species and local names; (2) reported medicinal uses; (3) plant parts used; (4) preparation methods, including boiling, pounding, and steeping; and (5) modes of administration, including oral and topical use. Follow-up and clarification questions were used when necessary to obtain complete responses.

Interviews were conducted in Indonesian or the local Dayak Meratus language according to each informant's preference and lasted no longer than 60 minutes. Interviews were not audio-recorded. Responses were recorded directly on structured interview forms and expanded into detailed field notes immediately after each interview. Information provided in the local language was translated into Indonesian, and the intended meanings were confirmed with the informants to improve interpretive accuracy.

2.7. Data Analysis

Field and interview data were analyzed descriptively. Local plant names and recorded plant characteristics were matched with scientific names using botanical references. Ethnomedicinal information was organized according to plant species, reported condition, plant part used, preparation method, and mode of administration. The findings were subsequently interpreted within an ethnobotanical context (Silambarasan et al., 2023). Quantitative ethnobotanical indices were calculated using the ethnobotanyR package in R through RStudio.

A Use Report (UR) was defined as one distinct medicinal use of a plant species reported by one informant. For each species, UR represented the total number of distinct medicinal-use reports across all informants. Repeated reports of the same species-use combination by the same informant were counted only once.

Use Value (UV) represented the average number of use reports per informant for a given species and was calculated as:

$$UV_i = \frac{UR_i}{N}$$

where URi is the total number of use reports recorded for species i, and N is the total number of informants.

Frequency of Citation (FC) was defined as the number of informants who cited a given species at least once. Each informant was counted once for a species regardless of the number of medicinal uses reported for that species.

$$FC_i = \sum_{j=1}^{N} I_{ij}$$

where Iij = 1 when informant j cited species i, and Iij = 0 when species i was not cited by informant j.

Relative Frequency of Citation (RFC) represented the proportion of informants who cited a given species and was calculated as:

$$RFC_i = \frac{FC_i}{N}$$

RFC values range from 0 to 1, with values closer to 1 indicating that the species was cited by a larger proportion of informants. For example, langsat generated 16 use reports from eight informants, yielding a UV of 2.00. All eight informants cited the species, corresponding to FC = 8 and RFC = 1.00.

3. RESULTS AND DISCUSSION

3.1. Diversity and Medicinal Use of Tree Species

Vegetation sampling in the forest area of Tumingki Village recorded 16 tree species representing several botanical families (**Table 1**). Eight of these species (50%) were reported by informants as having medicinal uses: keminting, bunglai, langsat, gintungan, jambu air, ulin, durian, and lurus. The specimen codes (PM-001 to PM-016) serve as field identification codes to distinguish plant specimens recorded during field sampling; these specimens are not preserved as herbarium specimens. Scientific names and family assignments were determined from the recorded local names and plant characteristics and subsequently checked against botanical references and taxonomic databases.

The eight medicinal species represented half of the tree species recorded within the sampled plots. This number is lower than the total numbers of medicinal plant species reported in several ethnobotanical studies from other communities in Kalimantan, including the Dayak Kenyah, Dayak Linoh, Dayak Tomun, Dayak Deah, Dayak Lundayeh, Dayak Penihing, and Dayak Tunjung Benuaq communities (Diana & Matius, 2017; Efendi et al., 2024; Fadhillah & Kustiawan, 2025; Hendra et al., 2025; Julung et al., 2023; Rupa et al., 2025; Tampubolon et al., 2024). Direct numerical comparison, however, should be made cautiously because the present study was restricted to trees with DBH > 10 cm and excluded shrubs, lianas, herbs, grasses, and other growth forms. Differences in study scope and sampling design may therefore account for much of the variation in the number of medicinal species reported among studies.

3.2. Utilization of Medicinal Trees

Interviews with eight informants documented medicinal uses for the eight tree species identified as ethnomedicinally relevant. Reported uses included the treatment or management of toothache, headache, *lungsur wisa*, stomachache, hemorrhoids, greying hair, back pain, *muntaber*, and *rastung*. The plant materials used included stem sap, leaves, and bark, including bark obtained from stems or roots. Preparation methods included direct application, heating, boiling, mixing or rubbing with coconut oil, and maceration or rubbing in water. Detailed uses and preparation procedures are presented in **Table 2**.

Decoction was the most frequently reported preparation method for bark. It was used for preparations involving langsat, gintungan, jambu air, ulin, and durian. Decoction is also widely used in established traditional medicine systems, including Ayurveda and Traditional Chinese Medicine (Kumar et al., 2022; Maddesiya et al., 2024). Heating plant material in water can facilitate the extraction of water-soluble phytochemicals, including certain phenolic and flavonoid compounds, although extraction efficiency depends on the plant matrix, temperature, processing duration, and chemical properties of the compounds involved (Haida et al., 2020; Krochmal-Marczak & Kiełtyka-Dadasiewicz, 2018). Thermal processing may also affect microbial load and facilitate the release of compounds from relatively rigid plant tissues (Ghisleni et al., 2016; Fan et al., 2025; Ran et al., 2026). In the present study, bark preparations were generally subjected to boiling, whereas some leaf preparations required less intensive processing. This contrast suggests that the Dayak Meratus community applies plant-part-specific preparation practices based on locally transmitted knowledge. However, because this study did not measure extraction efficiency, microbial reduction, or phytochemical composition, the chemical and pharmacological consequences of these preparation methods cannot be established from the present data.

Table 1. Tree species recorded in the study area and their medicinal-use status

Specimen code	Local name	Family	Scientific name*	Medicinal use
PM-001	Kapuk	Malvaceae	*Ceiba pentandra* (L.) Gaertn.	No
PM-002	Kapul	Phyllanthaceae	*Baccaurea macrocarpa* (Miq.) Müll.Arg.	No
PM-003	Binjai	Anacardiaceae	*Mangifera caesia* Jack	No
PM-004	Keminting	Euphorbiaceae	*Aleurites moluccanus* (L.) Willd.	Yes
PM-005	Bunglai	Bignoniaceae	*Radermachera gigantea* (Blume) Miq.	Yes
PM-006	Kayu manis	Lauraceae	*Cinnamomum verum* J.Presl	No
PM-007	Langsat	Meliaceae	*Lansium domesticum* Corrêa	Yes
PM-008	Gintungan	Phyllanthaceae	*Bischofia javanica* Blume	Yes
PM-009	Manggis	Clusiaceae	*Garcinia mangostana* L.	No
PM-010	Jambu air	Myrtaceae	*Syzygium aqueum* (Burm.f.) Alston	Yes
PM-011	Ulin	Lauraceae	*Eusideroxylon zwageri* Teijsm. & Binn.	Yes
PM-012	Kapayang	Achariaceae	*Pangium edule* Reinw.	No
PM-013	Pauh	Anacardiaceae	*Mangifera quadrifida* Jack	No
PM-014	Durian	Malvaceae	*Durio zibethinus* L.	Yes
PM-015	Lurus	Lamiaceae	*Peronema canescens* Jack	Yes
PM-016	Maritam	Sapindaceae	*Nephelium ramboutan-ake* (Labill.) Leenh.	No

*Scientific names and family assignments were verified against Plants of the World Online (POWO) and the Global Biodiversity Information Facility (GBIF).

Table 2. Medicinal tree species, plant parts used, reported conditions, and preparation methods

Local name	Plant part used	Reported condition/use	Preparation method
Keminting	Stem sap	Toothache	Stem sap was applied directly to the affected tooth.
Bunglai	Young leaves	Headache	Young leaves were heated over a fire or rubbed with lime and then applied to the forehead or head.
Langsat	Stem bark	Lungsur wisa (poison-related condition)	Stem bark was boiled, and the decoction was consumed orally.
	Root or stem bark	Stomachache	Root or stem bark was boiled, and the decoction was consumed orally.
Gintungan	Root or stem bark	Hemorrhoids	Root or stem bark was boiled, and the decoction was consumed orally.
Jambu air	Stem bark	Stomachache	Stem bark was boiled, and the decoction was consumed orally.
Ulin	Leaves	Prevention of greying hair	Leaves were rubbed with coconut oil and applied to the hair.
	Root or stem bark	Back pain	Root or stem bark was boiled, and the decoction was consumed orally.
Durian	Stem bark	Muntaber (vomiting and diarrhea)	Stem bark was boiled, and the decoction was consumed orally.
Lurus	Leaves	Nosebleed (rastung)	Leaves were rubbed in approximately one glass of water, strained, and the liquid was consumed orally.

The interviews documented culturally specific illness terms, particularly *lungsur wisa*, *rastung*, and *muntaber*. Such terms should not automatically be treated as direct equivalents of biomedical diagnoses because ethnomedical disease categories may incorporate symptoms, cultural interpretations, and locally defined causes of illness. Similar challenges in translating local illness concepts into biomedical terminology have been described in ethnomedical research (Workneh et al., 2018; Yunarti et al., 2016).

Lungsur wisa was described by informants in relation to poisoning and was treated using a decoction of langsat bark. In the context of this study, the term may broadly refer to poisoning-related conditions, including manifestations associated with toxic exposure, food poisoning, or envenomation. However, it should not be equated with a specific biomedical diagnosis because indigenous concepts of poisoning may encompass a broader range of symptoms and culturally defined interpretations. Ethnomedical classifications of poisoning may be based on symptom patterns rather than laboratory-confirmed toxicological mechanisms (Arumugam et al., 2023). Previous studies have documented antioxidant-related and other bioactivities in *Lansium domesticum* preparations (Apridamayanti et al., 2018; Nur et al., 2025). These reports provide a rationale for further investigation but do not establish the efficacy of the langsat preparation documented in Tumingki for poisoning-related conditions.

Rastung was associated by informants with nosebleed and was managed using a preparation of lurus leaves. Because local illness terminology may encompass symptoms and interpretations that extend beyond biomedical categories, *rastung* is treated in this study as a culturally defined condition associated primarily with nosebleed rather than as an exact biomedical diagnosis. Previous ethnomedical studies have similarly shown that traditional illness categories may combine physical symptoms with culturally defined etiologies (Manshoor & Simmonds, 2025; Otoluwa et al., 2025).

Muntaber, an Indonesian contraction of *muntah dan berak*, refers to the simultaneous occurrence of vomiting and diarrhea. In biomedical terms, this symptom complex may occur in acute gastroenteritis, although the traditional term itself does not specify an underlying etiology. Acute gastroenteritis may result from viral, bacterial, or parasitic infection or foodborne causes (Domachowske & Dennehy, 2025). In this study, *muntaber* was reportedly managed using durian bark preparations. Previous studies have described pharmacological properties in different parts of *Durio zibethinus* (Alkandahri et al., 2021), but these reports do not directly validate the particular preparation or indication recorded in the present study. The tentative correspondence between local terms and biomedical interpretations is summarized in **Table 3**.

3.3. Tree Parts Used

Bark accounted for 60% of the ten reported plant-part uses, followed by leaves (30%) and stem sap (10%) (**Table 4**). This distribution indicates that bark was the most frequently reported plant material among the medicinal tree uses documented in Tumingki.

This pattern differs from several ethnobotanical studies in Kalimantan in which leaves (Saputra et al., 2023; Zahra et al., 2024) or roots (Tampubolon et al., 2024) were the predominant plant parts used. Other studies of Dayak medicinal practices have also documented the use of stems, bark, seeds, fruits, and other plant materials (Patiola et al., 2023). Variation among communities may reflect differences in local plant availability, cultural traditions, transmitted recipes, and study design (Alrhmoun et al., 2025; Gillani et al., 2024; Umartani & Nahdi, 2021). Bark can contain diverse secondary metabolites involved in plant defense, including tannins, flavonoids, alkaloids, and other

compounds, although composition varies considerably among species and tissues (Akintola et al., 2020; Brennan et al., 2020; Gérardin et al., 2020). This botanical characteristic may provide one hypothesis for the longstanding ethnomedicinal use of bark, but the present study did not analyze the phytochemical composition of the recorded species.

3.4. Ethnobotanical Indices

Quantitative ethnobotanical analysis showed variation in UR, UV, FC, and RFC among the eight medicinal tree species (**Table 5**). Langsat had the highest UR (16) and UV (2.00), indicating an average of two medicinal-use reports per informant. Its reported uses included *lungsur wisa* and stomachache. Ulin ranked second in UR and UV, with 11 use reports and a UV of 1.375. Keminting, jambu air, and durian each had eight use reports and a UV of 1.00; bunglai and gintungan each had six use reports and a UV of 0.75; and lurus had the lowest values, with two use reports and a UV of 0.25. Higher UR and UV values indicate a greater number and diversity of reported uses within the surveyed group but should not be interpreted as evidence of pharmacological efficacy. Instead, these indices describe the prominence and versatility of a species within the documented ethnomedicinal knowledge system (Flores et al., 2025; Tunny et al., 2025). Species with relatively high ethnobotanical values may therefore warrant further phytochemical or pharmacological investigation, subject to independent experimental validation.

Keminting, langsat, jambu air, and durian were cited by all eight informants (FC = 8; RFC = 1.00), indicating that each of these species was recognized for medicinal use by every informant interviewed. Ulin was cited by seven informants (FC = 7; RFC = 0.875), whereas bunglai and gintungan were each cited by six informants (FC = 6; RFC = 0.75). Lurus had the lowest citation frequency, with two informants reporting its medicinal use (FC = 2; RFC = 0.25). Species with high citation values may be useful priorities for further phytochemical and pharmacological investigation, but the indices themselves do not demonstrate efficacy (Akhtar et al., 2025).

The distinction between UR-UV and FC-RFC is important when interpreting the ethnobotanical profile of each species. FC and RFC describe how widely a species was cited among informants, whereas UR and UV reflect the number and diversity of reported medicinal uses. Keminting, jambu air, and durian were cited by all informants but each had a UV of 1.00, indicating an average of one reported medicinal use per informant. Langsat combined universal citation (RFC = 1.00) with the highest UV (2.00), indicating both broad recognition and a greater diversity of reported uses. Ulin also showed relatively high use diversity despite not being cited by every informant. These patterns identify langsat and ulin as particularly relevant candidates for further investigation while emphasizing that ethnobotanical indices measure reported cultural use rather than therapeutic efficacy (Sulaiman et al., 2020).

Table 3. Local disease terms and their tentative biomedical interpretations

Local term	Literal meaning	Informant-described symptoms	Tentative biomedical equivalent	Interpretive uncertainty
Lungsur wisa	Antidote for poison	Symptoms related to poisoning, including weakness, nausea, or toxic exposure	Poisoning-related conditions (e.g., food poisoning, envenomation)	High
Rastung	Not directly translatable	Nosebleed, possibly accompanied by headache, dizziness, or nasal discomfort	Epistaxis (nosebleed)	Low
Muntaber	Vomiting and diarrhea	Simultaneous vomiting and diarrhea	Acute gastroenteritis	Low

Table 4. Frequency of tree parts used

Plant part	Number of use reports	Percentage (%)
Bark	6	60
Leaves	3	30
Stem sap	1	10
Total	10	100

Table 5. Ethnobotanical indices of medicinal tree species

Local name	UR	UV	FC	RFC
Keminting	8	1.00	8	1.00
Bunglai	6	0.75	6	0.75
Langsat	16	2.00	8	1.00
Gintungan	6	0.75	6	0.75
Jambu air	8	1.00	8	1.00
Ulin	11	1.375	7	0.875
Durian	8	1.00	8	1.00
Lurus	2	0.25	2	0.25

Note: UR, Use Report; UV, Use Value; FC, Frequency of Citation; RFC, Relative Frequency of Citation.

3.5. Limitations

This study has several limitations. First, only eight informants participated, all of whom were men aged 46–63 years. The findings may therefore not capture the full diversity of medicinal plant knowledge across sex and age groups within the wider community. Second, vegetation sampling was restricted to trees with DBH > 10 cm, excluding smaller woody individuals and other growth forms such as shrubs, lianas, and herbs. The recorded medicinal diversity should therefore be interpreted as specific to the sampling scope rather than as a complete inventory of medicinal plants used in Tumingki. Third, no phytochemical, toxicological, or pharmacological assays were performed; consequently, the reported medicinal uses represent ethnobotanical knowledge and should not be interpreted as evidence of therapeutic efficacy or safety. Finally, biomedical interpretations of local terms such as *lungsur wisa* and *rastung* remain tentative and may not fully reflect their cultural meanings.

3.6. Implications and Future Research

The findings provide a documented record of medicinal tree knowledge among the Dayak Meratus community in Tumingki and identify species that are widely cited or associated with multiple reported uses. Langsat and ulin, in particular, showed relatively high ethnobotanical values and may warrant targeted phytochemical, toxicological, and pharmacological investigation. Such studies would be necessary before traditional use could be translated into evidence-based therapeutic claims. Future ethnobotanical research should include a larger and more diverse informant group, particularly women and younger community members, to examine variation in knowledge and intergenerational transmission. Comparative studies across Dayak Meratus communities could further clarify geographical and cultural variation in medicinal tree use. Because several remedies involve bark, future research may also consider the sustainability of harvesting practices and the conservation status of frequently used tree species. Community participation should remain central to any conservation or knowledge-documentation initiative.

4. CONCLUSION

This study documented 16 tree species in the forest area of Tumingki Village, eight of which were reported as medicinally used by the Dayak Meratus community. Bark was the most frequently reported plant part, accounting for 60% of recorded uses. Langsat had the highest Use Report (UR = 16) and Use Value (UV = 2.00), while langsat, keminting, jambu air, and durian were cited by all eight informants (FC = 8; RFC = 1.00). These findings identify medicinal tree species that are prominent within the documented local ethnomedicinal knowledge system. The results provide a baseline for conserving traditional knowledge and prioritizing species for further phytochemical, toxicological, and pharmacological investigation. Because the reported uses were not experimentally validated, the ethnobotanical indices should be interpreted as measures of reported cultural use rather than evidence of therapeutic efficacy.

AUTHOR CONTRIBUTIONS

Conceptualization, B.H.M., M.R., and B.P.; methodology, B.H.M. and M.R.; formal analysis, B.H.M., M.R., and B.P.; data curation, M.R.; writing - original draft preparation, B.H.M. and M.R.; writing - review and editing, M.R. All authors have read and agreed to the published version of the manuscript.

INSTITUTIONAL REVIEW BOARD STATEMENT

The study was approved by the Ethics Committee of Research, Universitas Sari Mulia (approval no. 277/KEP-UNISM/I/2022).

INFORMED CONSENT STATEMENT

Informed consent was obtained from all informants involved in the study.

DATA AVAILABILITY STATEMENT

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

ROLE OF FUNDERS

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DECLARATION OF GENERATIVE ARTIFICIAL INTELLIGENCE (AI) USE

During the preparation of this manuscript, the authors used DeepSeek and ChatGPT (OpenAI) to assist in improving the clarity, structure, readability, and language of the text. After using these tools, the authors thoroughly reviewed, edited, and verified the manuscript to ensure that the final content accurately represented their data, scientific reasoning, and interpretations. The authors take full responsibility for the accuracy, integrity, and originality of the published work.

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