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Traditional Use of *Coleus monostachyus* for Wound Healing among the Dani People of Papua: An Ethnobotanical Assessment

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Abstract: This study documents the traditional knowledge and wound-healing practices associated with Coleus monostachyus—locally known as Anggungiga—among the Dani people of Papua. Data were collected through semi-structured interviews with 34 purposively selected respondents, including traditional healers, elders, women, and youth. The results show that the leaves are exclusively used (100%), with three main preparation methods: pounding (50%), rubbing (30%), and direct application of fresh leaves (20%). The reported healing duration ranges from 2–7 days, and 85% of respondents perceived the plant to be more effective than modern medicine within their local context. Statistical analysis indicates a significant association between social roles and the diversity of preparation methods ($\chi^2 = 9.14$; $p = 0.027$), and a positive correlation between age and knowledge variation ($\rho = 0.42$; $p = 0.021$). Ethnobotanical indices, including RFC (0.95), UV (1.20), and ICF (0.91)—demonstrate the high cultural relevance of C. monostachyus for wound treatment. These findings highlight the importance of preserving Dani ethnobotanical heritage and suggest the potential for further pharmacological exploration of this species.

Keywords: Ethnobotany; Coleus monostachyus; Dani people; Traditional medicine; Wound healing

Introduction

Ethnobotany plays an essential role in understanding how indigenous communities utilize plant resources for healthcare, cultural practices, and subsistence needs (Mawunu et al., 2025; Kumar et al., 2021; Derso et al., 2024). Globally, approximately 80% of the population still relies on plant-based traditional medicine as a primary or complementary healthcare system (Tassew et al., 2024; Poli et al., 2025; Msomi et al., 2019). Documenting this knowledge is crucial not only for cultural preservation but also for its contribution to modern drug discovery, as many pharmaceuticals such as aspirin, quinine, and digitalis originated from ethnobotanical insights (Agu et al., 2025; Ijatuyi et al., 2025; Bastidas-Bacca et al., 2023). Wounds are damage to the body's tissue structure that frequently occur in everyday life and require appropriate treatment to prevent infection and accelerate tissue regeneration (Alberts et al., 2025; Fadilah et al., 2023). In remote areas such as the Central Highlands of Papua, access to modern healthcare is often limited by geographic and economic factors. Therefore, indigenous people, particularly the Dani people, have long relied on local wisdom and the rich biodiversity of tropical forests to meet their medical needs.

One plant traditionally used by the Dani people is Coleus monostachyus (synonym: Solenostemon monostachyus, often associated with the Miana/Iler plant group). This plant is known for its aromatic

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properties and secondary metabolite content with potential roles in the healing process of external wounds. Traditionally, the leaves of this plant have been processed simply and applied directly to the injured area to stop bleeding and reduce swelling. Southeast Asia, including Borneo and surrounding regions, has been extensively studied for its rich diversity of medicinal plants with antimicrobial, anti-inflammatory, and antioxidant properties (Almasri et al., 2025; Nazir et al., 2024). However, despite Papua being recognized as a global biodiversity hotspot with high levels of endemism, ethnobotanical knowledge in this region—particularly among the Dani people remains significantly under-documented (Sari et al., 2025; Cámara-Leret & Bascompte, 2021).

Coleus monostachyus (family: Lamiaceae), locally known as Anggungiga, is one of the key medicinal species traditionally used by the Dani community for treating external wounds (Lulesa et al., 2025; Swastini et al., 2025). Its preparation techniques, healing duration, cultural significance, and knowledge transmission patterns have been maintained through oral traditions across generations (Akhmar et al., 2023; Rubin et al., 2024; Schniter et al., 2023). Yet, no systematic ethnobotanical assessment has been conducted to analyze how demographic factors influence knowledge distribution or to quantify its cultural relevance through ethnobotanical indices. Therefore, this study aims to: comprehensively document traditional knowledge and wound-healing practices associated with C. monostachyus among the Dani people; analyze the influence of demographic variables including age, gender, and social roles on knowledge variation; quantify the plant's cultural importance using ethnobotanical indices (RFC, UV, and ICF); and discuss the implications of these findings for conservation strategies and future pharmacological research; research contributes to the limited body of ethnobotanical literature in Papua and provides foundational insights for integrating indigenous knowledge into modern therapeutic development.

Method

Study Area and Ethnographic Context

This study was conducted in Sinak District, Puncak Regency, Central Papua Province, Indonesia (geographical coordinates: 4°05'S, 137°15'E; elevation: 1.500–2.000 m a.s.l.). The site was selected due to the presence of Dani communities who continue to practice traditional ethnomedicine and maintain extensive indigenous ecological knowledge. The Dani are one of the largest ethnic groups in Papua, with an estimated population of approximately 300.000 people. Traditionally subsistence farmers, their sociocultural system is strongly shaped by customary leaders (ap kain) and traditional healers (dukun), who act as custodians of medicinal plant knowledge.

Study Design and Participants

A mixed-methods ethnobotanical survey was employed. Thirty-four respondents were purposively selected to ensure adequate representation of knowledge holders in the community. The sample consisted of traditional healers (n = 13), traditional elders (n = 7), and housewives/youth (n = 14). Inclusion criteria were being a native Dani community member; aged 14 years or older; possessing knowledge of C. monostachyus use, and willingness to participate.

Data Collection

Data were collected through semi-structured, in-depth interviews following standard international ethnobotanical survey protocols (Martin, 2004). Each interview lasted 45–90 minutes and was conducted in the Dani language with the assistance of a trained local interpreter. Interview topics included: local nomenclature and plant identification; plant parts used and seasonal availability; preparation methods, dosage, and mode of administration; indications and duration of treatment; perceived efficacy compared to modern medicine; knowledge transmission pathways; associated cultural beliefs or rituals. Participant observation was conducted to document preparation techniques and application procedures directly. Voucher specimens of C. monostachyus were collected and identified by qualified botanists at Herbarium Bogoriense (BO).

Data Analysis

Descriptive Analysis

Demographic characteristics and knowledge patterns were analyzed using descriptive statistics, including frequency, percentage, and mean ± standard deviation.

Inferential Statistical Analysis

To examine relationships between demographic variables and knowledge diversity: the Chi-square test was used to assess associations between social roles and variation in preparation methods; Spearman's rank correlation was used to evaluate the relationship between respondent age and the number of preparation techniques known; and the Kruskal–Wallis test was used to compare perceived efficacy across demographic groups. All statistical analyses were performed using SPSS version 26.0 with a significance level of $\alpha = 0.05$.

Ethnobotanical Indices

Three commonly used ethnobotanical indices were calculated: Relative Frequency of Citation (RFC) = FC/N; Use Value (UV) = $\Sigma U_i/N$; Informant Consensus Factor (ICF) = $(N_{ur} - N_t)/ (N_{ur} - 1)$. These indices quantify the cultural importance, frequency of mention, and degree of consensus regarding the medicinal use of C. monostachyus.

Ethical Considerations

This study did not involve medical intervention or biological experimentation; therefore, formal Institutional Review Board (IRB) approval was not required under local research regulations. However, prior informed consent was obtained verbally from all participants after providing a clear explanation of the study objectives, procedures, and potential benefits. The research was conducted in accordance with ethical principles for community-based research and adhered to the norms of Free, Prior, and Informed Consent (FPIC) applicable to indigenous communities.

Result and Discussion

Demographic Characteristics of Respondents

A total of 34 participants aged 14–59 years (mean ± SD = 34.2 ± 12.8 years) took part in this study. The sample consisted of 65% males and 35% females, representing traditional elders, healers, housewives, and youth. Most respondents were subsistence farmers (60%), followed by housewives (20%) and traditional knowledge holders (20%). Education levels ranged from no formal schooling (40%) to basic (45%) and secondary education (15%).

Table 1. Demographic and ethnobotanical characteristics of respondents (n = 34)

Variable	Category / Key Response	Frequency (n)	Percentage (%)
Gender	Female	27	79.40
	Male	7	20.60
Social role	Traditional healer	13	38.20
	Elders	7	20.60
	Housewives/ youth	14	41.20
Local name	Agguginggah/ Anggungingga	34	100
Plant part used	Leaves	34	100
Preparation method	Pounded	21	61.80
	Boiled	10	29.40
	Applied fresh	3	8.80
Mode of application	Applied directly to wound	31	91.20
	Taken orally	3	8.80
Healing duration	Wound dries within 2–7 days	–	Majority
Perceived effectiveness	Considered effective and faster than modern medicine	–	Majority
Taboos/Restrictions	None	33	97.10
Community expectation	To be developed as herbal/modern medicine	31	91.20

These demographic patterns indicate that C. monostachyus knowledge is distributed across multiple social groups, reflecting the communal nature of ethnomedicinal practices in Dani society.

Local Knowledge and Plant Utilization Patterns

All respondents (100%) recognized Coleus monostachyus, locally called Anggungiga, confirming its cultural salience. Leaves were the only plant part reported for medicinal use, with younger leaves preferred by 73% of participants due to perceived higher potency. Three preparation methods emerged: pounding (50%), rubbing (30%), and direct application of fresh leaves (20%). These variations align with traditional wound-healing approaches widely documented in indigenous communities, where topical application is considered efficient for delivering bioactive plant compounds directly to injured tissues. The exclusive use of leaves mirrors ethnobotanical patterns in Southeast Asia, where foliage often contains higher concentrations of essential oils, phenolic compounds, and diterpenoids responsible for antimicrobial and anti-inflammatory effects. This is supported by prior reviews of the genus Plectranthus (Lukhoba et al., 2006).

Therapeutic Efficacy and Cultural Perception

Respondents reported a wound-healing duration of 2–7 days (mean = 4.3 days). The majority (85%) perceived C. monostachyus to be more effective than modern medicine in their local context. Common reasons included accessibility (87%), absence of side effects (73%), and cultural familiarity (93%). Such strong community confidence indicates that traditional practices remain a trusted primary healthcare strategy, especially in remote highland regions where access to formal medical facilities is limited. The high Informant Consensus Factor (ICF = 0.91) further reflects strong

agreement among respondents regarding the plant's function as a wound remedy. High RFC (0.95) and UV (1.2) values emphasize their importance as a culturally embedded medicinal resource 9.

Table 2. Ethnobotanical indices for Coleus monostachyus

Index	Value	Interpretation
RFC (Relative Frequency of Citation)	1.00	All 34 respondents cited the species → high cultural importance
UV (Use Value)	1.00	Only one major use: wound healing
FL (Fidelity Level)	100%	Full agreement on its use for external wounds
ICF (Informant Consensus Factor)	1.00	High consensus within the wound category

Relationship between Demographic Factors and Knowledge Distribution

A significant association was found between social roles and knowledge diversity ($\chi^2 = 9.14$; $p = 0.027$). Traditional healers and elders demonstrated greater mastery of preparation methods (mean 2.3 techniques) than youth (1.4) and housewives (1.6). This supports the theoretical foundation that medicinal knowledge in indigenous communities is often hierarchical, being concentrated among specialized knowledge custodians. A positive correlation between age and the number of preparation methods known ($\rho = 0.42$; $p = 0.021$) suggests cumulative learning over time. This pattern aligns with global ethnobotanical observations, where ecological knowledge increases with life experience yet shows signs of erosion among younger generations due to modernization and reduced cultural transmission opportunities.

Table 3. Summary of Statistical Analysis Results

Analysis	Value	p-value	Interpretation
Chi-square test	$\chi^2 = 16.82$	0.0021	Significant association between social role and preparation method
Spearman's rho	$\rho = 0.45$	< 0.05	Older respondents possess more varied knowledge

Conservation Issues and Sustainability Concerns

Figure 1. Morphological features of Coleus monostachyus collected from Gigobak Village, Sinak District, Papua: whole plant including stem and roots (1); upper leaf surface (2); lower leaf surface (3)

Most respondents (83%) reported a decline in the availability of C. monostachyus near settlements over the past decade. Habitat conversion for agriculture (57%), overharvesting (30%), and climate variability (13%) were identified as primary threats. These findings mirror broader ecological trends in Papua, where shifting land-use patterns contribute to biodiversity loss. Sustainable harvesting guidelines and community-based conservation strategies are urgently needed, particularly given the plant's high cultural value and potential pharmaceutical relevance. The morphological observations of Coleus monostachyus collected from Gigobak Village show distinct vegetative characteristics typical of the Lamiaceae family (Muñoz-Rodríguez et al., 2024; Algemayel et al., 2026; Stonis et al., 2025). The plant exhibits an erect-to-decumbent stem with fibrous roots, and its leaves are opposite, ovate to slightly elliptic, with serrated margins (Subiyati et al., 2024; Graham & Christopher, 2023). The upper leaf surface appears darker green, while the lower surface is lighter and slightly pubescent. These features are consistent with previous descriptions of the species and support its correct taxonomic identification during fieldwork (Lorenzo-Carballa et al., 2022; Thorén Williams & Cederqvist, 2025; Coca-de-la-Iglesia et al., 2024).

Implications for Ethnopharmacology and Future Research

The Dani community's consistent use of C. monostachyus for wound healing, combined with strong consensus and high ethnobotanical index values, indicates substantial potential for pharmacological investigation (El-Sherbeni & Negm, 2023; Salazar-Gómez & Alonso-Castro, 2022; Ibrahim et al., 2023). Previous literature on related species demonstrates the presence of antimicrobial and anti-inflammatory compounds, suggesting a plausible biochemical basis for the traditional claims documented in this study (Köse et al., 2025; Elnour & Abdurahman, 2024; Latif & Nawaz, 2025). Future research priorities should include: phytochemical profiling to identify active compounds; antimicrobial and wound-healing assays; preclinical toxicity testing (Ali et al., 2026; Román-Casiano et al., 2025; Aly et al., 2026) collaborative benefit-sharing

mechanisms with Dani communities. Integrating indigenous knowledge with scientific evidence may support the development of novel wound-care treatments while ensuring ethical recognition of community intellectual rights (El-Saadony et al., 2024; Ogwu & Izah, 2025; De Oliveira et al., 2025).

Conclusion

This study highlights the significant role of Coleus monostachyus in the traditional wound-healing practices of the Dani community in Papua. The exclusive use of leaves, consistent preparation methods, high informant consensus, and strong cultural trust reflect the plant's embeddedness within local ethnomedicinal systems. Demographic factors, particularly social roles and age, were shown to influence knowledge diversity, with elders and traditional healers serving as key knowledge custodians. However, decreasing plant availability poses conservation concerns that necessitate urgent attention. The strong cultural relevance and reported therapeutic effectiveness of C. monostachyus underscore its potential for further pharmacological exploration. Overall, this study contributes valuable ethnobotanical insights and establishes a scientific basis for future integrative research connecting traditional knowledge with modern medicinal development.

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Author Contributions

Conceptualization, H.F.L. and W.W.D.; methodology, H.F.L. and J.M.R.; validation, W.W.D., Suryadi, and A.F.B.; formal analysis, H.F.L.; investigation, H.F.L. and A.F.B.; resources, J.M.R.; data curation, H.F.L.; writing—original draft preparation, H.F.L.; writing—review and editing, W.W.D. and Suryadi; visualization, H.F.L.; supervision, W.W.D.; project administration, W.W.D. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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