BIOLOGY, MEDICINE, & NATURAL PRODUCT CHEMISTRY ISSN 2089-6514 (paper)
Volume 14, Number 2, October 2025 | Pages: 1315-1324 | DOI: 10.14421/biomedich.2025.142.1315-1324 ISSN 2540-9328 (online)

Ethnobotanical Study of Plant Utilization in the Life Cycle Ceremonies of the Kaili Tado Ethnic Group in Central Sulawesi

Syech Zainal*, Supriyatman, Aan Febriawan, Amalia Buntu, Muh. Syarif Abd Syukur, Pahriadi, Raya Agni
Department of Natural Science Education, Faculty of Teacher Training and Education, Tadulako University,
Jl. Soekarno Hatta No.KM. 9, Tondo, Kec. Mantikulore, Kota Palu, Sulawesi Tengah 94148, Indonesia.

Corresponding author*
syechzainal97mpd@gmail.com

Manuscript received: 07 October, 2025. Revision accepted: 29 November, 2025. Published: 14 December, 2025.

Abstract

The Kaili Tado ethnic group of Central Sulawesi maintains a rich ethnobotanical tradition in which plants play essential roles in life cycle ceremonies that mark the stages of human existence from birth and marriage to death. This study aimed to identify and analyze the species, uses, symbolic meanings, and conservation status of plants employed in the traditional rituals of the Kaili Tado community. The research was conducted in Langko Village, Lindu District, Sigi Regency, from July to August 2025, using a qualitative descriptive ethnobotanical approach. Data were collected through semi-structured interviews, participatory observation, and field documentation involving twelve key informants, including traditional leaders, ritual practitioners, and elder community members. A total of 11 plant species were recorded, representing diverse functions and cultural symbolism. Plants such as *Oryza sativa* (rice), *Cocos nucifera* (coconut), and *Areca catechu* (areca nut) symbolize prosperity, purity, and strength, respectively, while others like *Kalanchoe pinnata* and *Jatropha curcas* serve as protective and purifying agents. Most species are easily available around home gardens, but a few such as *Piper betle* and *Calamus* sp. are becoming scarce. The study demonstrates that the Kaili Tado community's ritual plant use reflects deep ecological awareness and moral philosophy, emphasizing balance between humans and nature. Ethnobotanical documentation of these practices is essential not only for preserving cultural heritage but also for promoting biodiversity conservation and environmental education.

Keywords: Ethnobotany; Kaili Tado; Life cycle ceremonies; Traditional knowledge; Cultural symbolism; Biodiversity conservation.

INTRODUCTION

Indonesia is known as one of the world's centers of biodiversity, not only in terms of flora and fauna but also in the diversity of its ethnic groups, cultures, and local wisdom (Arifin & Nakagoshi 2011; Prawiradilaga & Soedjito 2013). This rich biodiversity has long been intertwined with cultural traditions and daily life, particularly in rural and indigenous communities that maintain close relationships with nature (Sangha et al. 2018). Among these, ethnobotany plays a vital role in understanding how local people utilize plants for various purposes, including medicine, food, rituals, and socio-cultural practices. Ethnobotanical studies provide insights into traditional knowledge systems that have been inherited through generations and reflect the intimate bond between humans and their natural environment (Cariño & Ferrari 2021; Turner et al. 2022; Levis et al. 2024).

The Kaili people are one of the major ethnic groups inhabiting Central Sulawesi, Indonesia, and they are divided into several sub-ethnic groups, including the Kaili Tado community in Lindu District, Sigi Regency (Siradjuddin 2020; Siradjuddin 2021). The Kaili Tado ethnic group maintains a rich cultural heritage characterized by diverse traditional ceremonies that represent different stages of human life, from pregnancy, birth, childhood, and adulthood to marriage and death (Septiwiharti et al. 2020). These ceremonies known collectively as *upacara siklus hidup* or life cycle rituals serve not only as cultural expressions but also as manifestations of gratitude, protection, and continuity of life (Wahyuningtyas et al. 2022; Hariyanto et al. 2024; Manan et al. 2024).

Each of these traditional ceremonies involves the use of various plant species that possess symbolic, spiritual, and practical meanings (Sapkota 2013). For instance, *Oryza sativa* (rice) symbolizes prosperity and sustenance, *Cocos nucifera* (coconut) represents purity and completeness, while *Kalanchoe pinnata* (cocor bebek) and *Bacopa sp.* are used in infant protection rituals symbolizing growth and vitality (Liu et al. 2022). The utilization of such plants in rituals reflects the community's deep understanding of nature, its resources,

and the meanings attached to them. However, these ethnobotanical practices are gradually diminishing due to modernization, acculturation, and the declining transmission of traditional knowledge among younger generations (Hanazaki et al. 2013; Dean 2024).

In recent years, cultural transformation and environmental degradation have posed significant threats to the preservation of indigenous knowledge (Nguyen et al. 2023), particularly in small ethnic groups like the Kaili Tado. The younger generation is increasingly detached from traditional customs, and the documentation of local ethnobotanical knowledge remains scarce (Ramavhunga 2025). As a result, valuable information on the identity, symbolic function, and ecological importance of ritual plants risks being lost (Geng et al. 2017; Prasetyo 2023). Such knowledge loss not only threatens cultural identity but also undermines the potential of traditional wisdom as a source for biodiversity conservation, sustainable resource management, and educational development (Kakoty 2018; Abas et al. 2022; Sinthumule 2023).

Ethnobotanical research offers a scientific approach to preserving and revitalizing traditional ecological knowledge (Kumar et al. 2021). By documenting plant species used in rituals and understanding their symbolic, functional, and ecological roles, ethnobotany bridges cultural heritage with scientific inquiry. Studies in other regions, such as those conducted by Baydoun et al. (2017) and Uchôa (2024), have revealed that indigenous rituals often involve the use of medicinal and culturally important plants that play significant roles in maintaining both ecological balance and social harmony. In this context, the Kaili Tado community provides a valuable example of how traditional beliefs are deeply connected to natural resource use and conservation ethics (Malone et al. 2014).

Furthermore, the ethnobotanical study of ritual plants contributes not only to cultural preservation but also to environmental education (Abas et al. 2022). Documenting and integrating this knowledge into educational materials can increase local awareness of biodiversity, promote cultural pride, and support character education rooted in local values. For this reason, exploring and analyzing the ethnobotanical aspects of the Kaili Tado life cycle ceremonies is essential for both scientific and educational purposes (Baydoun et al. 2017; Uchôa 2024). This study aims to document and analyze the types of plants used in the life cycle ceremonies of the Kaili Tado ethnic group, their functions, symbolic meanings, and current availability in the local environment. The results are expected to provide comprehensive ethnobotanical data that can serve as a reference for biodiversity conservation, cultural preservation, and future educational material development. In addition, the study contributes to the broader understanding of how traditional societies maintain ecological wisdom through cultural expressions, emphasizing that the relationship between humans and plants goes beyond mere utility it embodies respect, spirituality, and sustainability.

MATERIALS AND METHODS

Time, Place, and Research Subjects

This research was conducted from July to August 2025 in Langko Village, Lindu District, Sigi Regency, Central Sulawesi, Indonesia. Langko Village was chosen purposively because it is one of the main settlements of the Kaili Tado ethnic group, which still actively preserves traditional cultural practices, particularly the life cycle ceremonies that mark various stages of human life such as birth, marriage, and death. The village is located within the Lindu highland ecosystem, an area surrounded by forest vegetation, agricultural land, and traditional settlements, providing rich biodiversity that supports the availability of plant species used in ritual activities. The geographical and cultural characteristics of this location make it an ideal site for studying the relationship between traditional ecological knowledge and plant utilization.

The research subjects consisted of members of the Kaili Tado community who possess deep knowledge and direct experience in performing traditional ceremonies and using ritual plants. Informants were selected using a purposive sampling technique, with specific criteria that included: (1) individuals recognized as traditional leaders (*to tua adat*), (2) elder community members who have participated in and inherited ritual practices, and (3) women practitioners who play key roles in preparing plant-based ritual materials. In total, twelve informants were involved in this study, comprising three traditional leaders, five elder community members, and four women practitioners.

These informants were considered credible sources of ethnobotanical knowledge because they represent both the cultural authority and practical experience of the community. Their involvement ensured that the collected data reflected the authenticity of local traditions and the continuity of indigenous knowledge transmission within the Kaili Tado ethnic group. Additionally, younger villagers were occasionally included as supporting participants to provide insights into generational perspectives regarding the preservation and transformation of ethnobotanical practices.

Type of Research

This research employed a qualitative descriptive approach within the framework of ethnobotanical study. The qualitative method was selected to obtain in-depth understanding of the cultural meanings, symbolic values, and practical functions of plants used in the traditional life cycle ceremonies of the Kaili Tado ethnic group. The descriptive nature of this study aimed to present a

comprehensive depiction of how the community identifies, selects, and utilizes various plant species within their ritual context. Ethnobotany, as an interdisciplinary science that combines botany, anthropology, and ecology, was used as the main approach to explore the relationship between the Kaili Tado people and their surrounding plant resources.

Through this method, the research emphasized naturalistic observation, open-ended interviews, and cultural interpretation rather than experimental manipulation. The aim was to document traditional ecological knowledge that has been transmitted orally through generations and to describe how such knowledge reflects both cultural identity and environmental adaptation. The study also followed the principles of participatory observation, allowing researchers to be directly involved in community activities and ceremonies to gain a holistic understanding of plant usage patterns.

Furthermore, the research design was aligned with the objectives of ethnobotanical documentation and cultural preservation, ensuring that the findings not only identify the plant species used in rituals but also interpret their symbolic meanings within the socio-cultural system of the Kaili Tado community. This type of research provides qualitative evidence that connects biodiversity utilization with traditional wisdom, contributing to the broader fields of cultural anthropology, biodiversity conservation, and environmental education.

Research Procedures

The research procedures were conducted systematically through several stages to ensure that data collection and analysis were accurate, ethical, and representative of the Kaili Tado cultural context.

Preliminary Preparation

The initial stage involved conducting a comprehensive literature review on ethnobotany, traditional ceremonies, and previous studies related to the Kaili ethnic group. This review provided theoretical and contextual foundations for the research. During this phase, the researchers also obtained necessary research permits from the local government and ethical clearance from the Faculty of Teacher Training and Education, Tadulako University. In addition, coordination meetings were held with community leaders in Langko Village, Lindu District, to introduce the research objectives and secure their consent and support. Establishing early communication with the community ensured mutual understanding and ethical collaboration throughout the research process.

Field Observation and Informant Identification

The second stage focused on field reconnaissance and informant identification. Researchers visited Langko Village to directly observe the local environment and social dynamics related to traditional ceremonies. Informants were selected using a purposive sampling technique, emphasizing individuals recognized by the community as to tua adat (traditional leaders), ritual practitioners, and women responsible for preparing ritual materials. These individuals were considered the most knowledgeable about plant use in ceremonial practices. Interviews during this phase aimed to determine the sequence of life cycle ceremonies, their symbolic components, and the key plant species associated with each ritual.

Data Collection

The third stage involved intensive data collection through semi-structured interviews, participant observation, and documentation. Semi-structured interviews were used to gather detailed information on local plant names, uses, parts utilized, symbolic meanings, and specific ritual contexts. Participant observation was conducted during several ceremonies, including *Mosaviraka Ngana* (baby swing ceremony), *Membua Soibou* (house-moving ceremony), *Adam Pocembola* (marriage ceremony), and *Motapusi Posarara* (severing kinship ceremony). Researchers observed how plants were selected, prepared, and positioned within rituals, while also recording oral narratives and explanations from community elders. Photographs and field notes documented each ritual step, and plant specimens were collected for scientific identification.

Plant Identification and Verification

All plant specimens collected in the field were analyzed for morphological characteristics and taxonomic classification using references such as *Flora of Sulawesi*. To ensure scientific accuracy, the identified specimens were validated by comparison with preserved materials at the Herbarium Celebense (CEB), Tadulako University. This verification ensured that each species listed in the ethnobotanical record corresponded accurately to its scientific identity, supporting the reliability of both cultural and biological data.

Data Organization and Interpretation

In this stage, data from interviews, field observations, and documentation were compiled, coded, and organized into thematic categories: plant species, local names, plant parts used, symbolic meanings, and conservation status. Data were analyzed using the qualitative interactive model proposed by Huberman & Miles (1994), consisting of data reduction, data display, and conclusion drawing. To enhance analytical depth, the Use Value (UV) Index was calculated following Phillips & Gentry (1993) to quantify the relative cultural importance of each plant species based on its frequency and diversity of use.

Validation and Reporting

The final stage involved data triangulation to confirm validity and reliability. This was achieved by cross-checking information from different informants,

comparing interview results with direct observations, and reviewing relevant literature. Findings were then presented to community leaders in Langko Village for verification, ensuring that interpretations accurately reflected cultural realities. Finally, the results were compiled into a comprehensive ethnobotanical documentation of plant use in the life cycle ceremonies of the Kaili Tado ethnic group. The final output contributes to biodiversity conservation, cultural preservation, and local education development providing a scientific foundation for integrating traditional ecological knowledge into modern educational and conservation frameworks.

Data Analysis Techniques

The data obtained from interviews, observations, and documentation were analyzed using qualitative descriptive techniques following the interactive model of Huberman & Miles (1994), which consists of three main stages: data reduction, data display, and conclusion drawing or verification. In the data reduction stage, raw data collected from the field were carefully selected, summarized, and categorized according to the main research variables, such as local plant names, scientific names, parts used, ritual types, symbolic meanings, and availability status. This process was intended to simplify the data while retaining essential information relevant to the research objectives.

In the data display stage, the organized information was presented in narrative descriptions and tabular formats to show the relationship between plant diversity, ritual function, and cultural significance. The use of tables and descriptive summaries allowed for a clearer interpretation of patterns and relationships between plant species and their ritual applications within the Kaili Tado community. The conclusion drawing and verification stage involved interpreting the meaning of the data and verifying its accuracy through cross-checking between different sources, including multiple informants, field observations, and supporting literature. Triangulation was applied to ensure the validity and reliability of the findings by comparing the consistency of information obtained from various data collection methods.

RESULTS AND DISCUSSION

Types of Plant Species Used in the Life Cycle Ceremonies of the Kaili Tado Ethnic Group

Field observations and interviews with traditional leaders and elder informants revealed a total of 11 plant species commonly used in these rituals. These plants vary in morphology, function, and cultural significance, reflecting the community's deep ecological knowledge and long-standing relationship with the surrounding natural environment (Table 1).

Table 1. List of Plant Species Used in the Life Cycle Ceremonies of the Kaili Tado Ethnic Group.

Scientific Name	Indonesian Name	Local Name
Oryza sativa L.	Rice	Pae
Cocos nucifera L.	Coconut	Kaluku
Musa paradisiaca L.	Banana	Loka Dano
Kalanchae pinnata L.	Cocor bebek	Pomata
Areca catechu L.	Areca nut	Kalosu
Eleusine indica L.	Goosegrass	Kavoko
Hibiscus tiliaceus L.	Waru	Kalibau
Piper betle L.	Betel	Boulu
Sida rhombifolia L.	Sidaguri	Sidagori
Bacopa sp.	Creeping weed	Languntale
Calamus sp.	Rattan	Bolago

The results identified 11 plant species utilized in various life cycle ceremonies performed by the Kaili Tado community in Langko Village, Lindu District, Central Sulawesi. These species span multiple families, predominantly Arecaceae, Poaceae, Malvaceae, and Piperaceae. The diversity of plants used reflects the deep ethnobotanical knowledge embedded in Kaili Tado cultural traditions. Each plant fulfills a symbolic and functional purpose within the rituals. For example, *Oryza sativa* (rice) symbolizes sustenance, prosperity, and life continuity values closely tied to agrarian societies. Similarly, *Cocos nucifera* (coconut) represents purity, unity, and spiritual strength. The widespread availability of these plants around the community's home gardens signifies an ecological adaptation and a sustainable relationship between people and their environment.

Cultural traditions often use plants as mediators between humans and the spiritual realm. In the Kaili Tado worldview, natural objects such as plants are imbued with spiritual power (*pue*), which connects the material and immaterial worlds (Geng et al. 2017; Prasetyo 2023). The repeated use of the same species in multiple rituals indicates their high symbolic rank and perceived potency (Kakoty 2018). For instance, *Areca catechu* and *Piper betle* common ritual plants throughout Indonesia are also prominent in Kaili Tado ceremonies,

reinforcing their significance in fostering social and marital harmony.

These findings align with similar ethnobotanical studies among other Kaili sub-ethnic groups (Hanazaki et al. 2013; Nguyen et al. 2023), which documented comparable plant species being employed for healing, cleansing, and symbolic offerings. The consistency across regions underscores a shared cultural framework emphasizing balance between humans and nature (Liu et al. 2022). Moreover, the predominance of easily cultivated species indicates that the Kaili Tado community actively conserves culturally significant flora through domestic planting. This ensures long-term availability and supports cultural sustainability (Turner et al. 2022; Levis et al. 2024). The presence of *Calamus* sp. (rattan), which is ecologically rarer, demonstrates that even forest-dependent species continue to hold strong cultural importance, reflecting traditional ecological ethics that discourage overexploitation (Nguyen et al. 2023).

Status of Plant Availability in the Kaili Tado Community

The availability of ritual plants plays a vital role in determining the continuity of traditional ceremonies among the Kaili Tado community. Plants that are easy to access are more likely to be preserved through ongoing use, while those that have become rare risk being excluded from ritual practices. To assess this aspect, researchers documented the presence and accessibility of each identified plant species within the local ecosystem whether they are cultivated, grow naturally, or require collection from forested areas (Table 2).

Table 2. List of Plant Species Used in the Life Cycle Ceremonies of the Kaili Tado Ethnic Group.

Scientific Name	Indonesian Name	Local Name	Availability Status
Oryza sativa L.	Rice	Pae	Easy
Cocos nucifera L.	Coconut	Kaluku	Easy
Musa paradisiaca L.	Banana	Loka Dano	Easy
Kalanchae pinnata L.	Cocor bebek	Pomata	Easy
Areca catechu L.	Areca nut	Kalosu	Easy
Eleusine indica L.	Goosegrass	Kavoko	Easy
Hibiscus tiliaceus L.	Waru	Kalibau	Easy
Piper betle L.	Betel	Boulu	Difficult
Sida rhombifolia L.	Sidaguri	Sidagori	Easy
Bacopa sp.	Creeping weed	Languntale	Rare
Calamus sp.	Rattan	Bolago	Difficult

The majority of plant species used in the Kaili Tado life cycle rituals are easily accessible within the local environment, particularly in home gardens, village borders, and nearby forests. Of the 11 species recorded, eight are categorized as "easy to find," while three *Piper betle*, *Bacopa* sp., and *Calamus* sp. are classified as rare or difficult to obtain. This availability pattern reflects both ecological and cultural dynamics. Plants like rice, banana, coconut, and waru are commonly cultivated due to their daily economic and social importance (Arifin & Nakagoshi 2011). Their abundance facilitates continuous ritual use, ensuring cultural continuity. On the other hand, the decreasing abundance of *Piper betle* and *Calamus* sp. is mainly attributed to habitat alteration, limited replanting, and reduced traditional cultivation practices.

The rarity of these plants poses potential risks to the continuity of cultural practices, as certain rituals depend specifically on these species (Sangha et al. 2018). The betel plant (*Piper betle*), for instance, plays a crucial role in marriage ceremonies (*Adam Pocembola*), symbolizing unity and respect. Its scarcity could, therefore, affect ritual performance and meaning transmission. Ethnobotanical research in similar contexts (Arizona, 2011; Kasim et al., 2021) emphasizes that when traditional plants decline, communities often seek substitutes. However, substitution may dilute symbolic meaning, leading to cultural erosion (Hanazaki et al. 2013; Dean 2024). Thus, local awareness of plant conservation is vital. The Kaili Tado community demonstrates proactive ecological ethics by maintaining small-scale cultivation of sacred plants, illustrating how traditional knowledge contributes to biodiversity conservation (Ramavhunga 2025).

From an ecological anthropology perspective, the preservation of ritual plants can also be interpreted as an adaptive strategy to environmental changes. The persistence of certain species, despite modernization, reveals a selective conservation pattern driven by cultural necessity rather than mere utility. These practices highlight the reciprocal relationship between cultural resilience and ecological sustainability (Geng et al. 2017; Abas et al. 2022).

Utilization of Plant Parts and Functions in Ceremonies

The Kaili Tado people do not use entire plants indiscriminately in their rituals; instead, they selectively utilize specific plant parts that hold symbolic and practical significance. This selection is guided by

traditional knowledge, passed down orally through generations, regarding the inherent properties and ritual suitability of each plant. The parts used such as leaves, fruits, stems, and seeds serve different roles, including purification, protection, fertility, and unity (Table 3).

Table 3. Plant Parts Utilized and Their Functions in the Life Cycle Ceremonies of the Kaili Tado Ethnic Group.

Scientific Name	Local Name	Part Used	Function in Ceremony
Oryza sativa L.	Pae	Seeds	Symbol of prosperity and sustenance
Cocos nucifera L.	Kaluku	Fruit, Leaves	Symbol of purity and unity
Musa paradisiaca L.	Loka Dano	Fruit, Stem	Symbol of fertility and harmony
Kalanchae pinnata L.	Pomata	Leaves	Protection against disease and evil spirits
Areca catechu L.	Kalosu	Fruit	Symbol of strength and endurance
Eleusine indica L.	Kavoko	Leaves	Coloring and purification
Hibiscus tiliaceus L.	Kalibau	Leaves	Protection and blessing
Piper betle L.	Boulu	Leaves	Symbol of unity and respect
Sida rhombifolia L.	Sidagori	Leaves	Symbol of healing and protection
Bacopa sp.	Languntale	Whole Plant	Protection for infants
Calamus sp.	Bolago	Stem	Symbol of separation and boundary

The use of specific plant parts in Kaili Tado ceremonies demonstrates a complex integration of symbolic, medicinal, and spiritual functions (Sirajuddin 2021). Among the 11 plant species identified, leaves are the most frequently utilized plant part, followed by fruits, stems, and seeds. The predominance of leaves highlights their accessibility, flexibility in ritual use, and association with life and renewal. Leaves often represent growth and vitality, qualities that align closely with the symbolic essence of life cycle ceremonies. In Kaili Tado tradition, each plant part is carefully chosen to match the intended symbolic and ritual function. For example, rice (*Oryza sativa*) seeds are used as offerings to symbolize prosperity and continuous sustenance, while coconut (*Cocos nucifera*) fruit and leaves represent purity and wholeness key values in both cleansing and marriage rituals. Coconut water is often sprinkled as a purifier, signifying the removal of misfortune. Similar ritual use of *Cocos nucifera* has been reported in various Indonesian ethnobotanical contexts, including Balinese and Bugis traditions, where it symbolizes unity between human and divine (Giambelli 2021).

Meanwhile, *Areca catechu* and *Piper betle* are used together in ceremonies involving social bonds such as marriage (*Adam Pocembola*). The act of sharing betel quid (a mixture of areca nut, betel leaf, and lime) represents respect, kinship, and alliance values deeply rooted in Austronesian cultural symbolism (Tusinski 2016). These plants are not chosen arbitrarily; they carry centuries of shared cultural meaning across Indonesia and Southeast Asia. Medicinally significant plants, such as *Kalanchoe pinnata*, *Sida rhombifolia*, and *Bacopa* sp., are used to safeguard physical and spiritual well-being. Their leaves and sap are believed to prevent disease or repel negative forces. Scientific studies have confirmed their pharmacological properties: *Kalanchoe pinnata* contains flavonoids and alkaloids with anti-inflammatory effects, *Sida rhombifolia* possesses antimicrobial compounds, and *Bacopa* sp. is known for its antioxidant and cognitive-enhancing properties. The convergence of symbolic and medicinal use highlights the empirical basis of traditional wisdom, showing how ritual practices also reflect indigenous pharmacology (Elendu 2024).

Furthermore, *Calamus* sp. (rattan) plays a distinctive role in the *Motapusi Posarara* ceremony, where it is physically cut to represent the severance of kinship. The rattan's fibrous strength and flexibility symbolize resilience and the emotional difficulty of separation, linking natural form with cultural metaphor (McHattie & Ting 2024). Similarly, *Eleusine indica* leaves are crushed to produce red pigment in the *Nokolontigi* ceremony, symbolizing sincerity and the blood bond between individuals a direct reflection of how physical properties of plants inform their symbolic function. The multifunctional use of plants in Kaili Tado culture thus bridges spiritual belief, ecological awareness, and empirical observation. Each plant part carries a layered meaning that embodies the community's cosmological perspective: humans are part of nature's cycle, not separate from it. The selection of plants for ritual use demonstrates both cultural continuity and biological adaptation, illustrating how ethnobotanical practices contribute to sustainable ecological relationships and cultural resilience (Kumar et al. 2021).

Ethnobotanical Meanings of Plants in Each Life Cycle Ceremony

Each traditional ceremony performed by the Kaili Tado ethnic group involves a distinct combination of plant species, each carrying a unique symbolic meaning aligned with the spiritual and moral purpose of the ritual. These meanings embody the community's worldview, in which plants are considered mediators between humans and nature. Through ethnobotanical interpretation, it becomes evident that every ritual from birth to death represents a continuous cycle of life sustained by plant symbolism (Tabel 4).

Table 4. Ethnobotanical Meanings of Plant Species Used in Each Life Cycle Ceremony of the Kaili Tado Ethnic Group.

Ceremony Name	Plant Species	Symbolic Meaning
Mosaviraka Ngana (Baby Swing Ceremony)	*Kalanchoe pinnata*, *Bacopa* sp.	Protection and vitality
Membua Soibou (House Moving Ceremony)	*Oryza sativa*, *Musa paradisiaca*	Prosperity and harmony
Adat Kalabu' (Marriage Among Relatives)	Sida rhombifolia	Purification and protection
Nokolontigi (Pre-Marital Purification)	Eleusine indica	Sincerity and spiritual cleansing
Adam Pocembola (Marriage Ceremony)	*Cocos nucifera*, *Piper betle*, *Areca catechu*, *Hibiscus tiliaceus*	Unity, respect, strength, and peace
Motapusi Posarara (Severing Kinship Ceremony)	*Calamus* sp.	Separation and independence
Kamaté (Funeral Ceremony)	*Jatropha curcas*	Protection and purification

The symbolic meanings of plants used in the life cycle ceremonies of the Kaili Tado ethnic group reveal a sophisticated cultural system where natural elements express moral, spiritual, and social principles (Sirajuddin 2020; Sirajuddin 2021). Each plant is not merely a ritual object but serves as a metaphor of life, linking human existence to nature's rhythm and divine balance (Septiwiharti et al. 2020). In *Mosaviraka Ngana*, the baby swing ceremony, *Kalanchoe pinnata* and *Bacopa* sp. embody protection and vitality qualities essential to newborn life. The use of these species underscores the Kaili Tado belief that plants can act as mediators between the spiritual and physical worlds. This belief reflects animistic cosmology, where every living organism possesses spiritual essence (*pue*). Scientifically, these plants have medicinal functions that align with their symbolic use; *Kalanchoe pinnata* is known to treat inflammation and fever, supporting the concept of protection and health (Rahman et al. 2019).

In *Membua Soibou*, when a family moves into a new house, *Oryza sativa* and *Musa paradisiaca* signify prosperity and harmony core values in domestic life (Permanasari 2017). Rice, the staple food and life symbol in most Indonesian cultures, represents sustenance and gratitude, while banana conveys sweetness and unity (Mualimin et al. 2025). The offering of these plants reflects the principle of *gotong royong* (mutual cooperation), emphasizing balance and community welfare. The *Adat Kalabu'* ritual, involving *Sida rhombifolia*, expresses purification and protection for couples marrying within kinship lines (Marasabessy 2025). This aligns with the broader Austronesian principle of ritual cleansing before social transitions. Similarly, *Nokolontigi* employs *Eleusine indica* to symbolize sincerity through its red pigment interpreted as the essence of life and devotion (Kasim et al. 2021).

The *Adam Pocembola* marriage ceremony is the most elaborate, using *Cocos nucifera*, *Areca catechu*, *Piper betle*, and *Hibiscus tiliaceus*. Each species plays a role in symbolizing purity, respect, endurance, and peace. Coconut represents divine connection and purity, betel leaf embodies communication and respect, areca nut signifies courage, and waru leaves represent reconciliation (Giambelli 2021). The combination of these plants expresses the holistic unity of physical, emotional, and spiritual dimensions in marital life. In contrast, *Motapusi Posarara* involves *Calamus* sp., a plant physically cut to symbolize separation of kinship. Its durability and elasticity mirror human bonds strong yet severable when required by social ethics (Mane 2023). Finally, in the *Kamaté* funeral ceremony, *Jatropha curcas* is planted at the grave as protection against malevolent spirits, representing both closure and purification (Lautenschläger 2020).

These meanings show how Kaili Tado ethnobotany integrates symbolic thought, ecological knowledge, and moral philosophy. Plants serve as media through which humans express gratitude, request blessings, and maintain harmony with the universe (Ozdemir 2003). This integration of cultural symbolism with biological function demonstrates that ethnobotany is not simply about plant use but also about the continuity of worldview and identity (Dean 2024; Luo 2024). Preserving these practices thus contributes not only to cultural heritage but also to biocultural conservation, reinforcing the unity of nature and culture that defines indigenous ecological wisdom (Asrawijaya 2024).

Conservation Status and Cultural Continuity

Understanding the conservation status of ritual plants is essential to evaluating how traditional ecological knowledge supports biodiversity preservation in indigenous communities. The Kaili Tado people rely on locally available plants, yet several species are now facing scarcity due to habitat loss and declining ritual frequency. Assessing the conservation status of each species helps to identify which plants require cultivation efforts or protection initiatives to maintain both ecological and cultural sustainability (Table 5).

Table 5. Conservation Status and Cultural Continuity of Plant Species Used in the Life Cycle Ceremonies of the Kaili Tado Ethnic Group.

Scientific Name	Local Name	Availability Status	Conservation Notes
Oryza sativa L.	Pae	Easy	Cultivated widely as staple food; readily available.
Cocos nucifera L.	Kaluku	Easy	Commonly planted near households; maintained for daily and ritual use.
Musa paradisiaca L.	Loka Dano	Easy	Planted in home gardens; high regeneration rate.
Kalanchae pinnata L.	Pomata	Easy	Grows naturally in shaded areas; self-propagating species.
Areca catechu L.	Kalosu	Easy	Cultivated in small plantations; socio-cultural and economic value.
Eleusine indica L.	Kavoko	Easy	Wild grass species; regenerates naturally in open areas.
Hibiscus tiliaceus L.	Kalibau	Easy	Common along riverbanks and forest edges; traditionally maintained.
Piper betle L.	Boulu	Difficult	Cultivation declining due to reduced traditional use.
Sida rhombifolia L.	Sidagori	Easy	Grows naturally in village surroundings; resilient to disturbance.
Bacopa sp.	Languntale	Rare	Habitat decreasing; found only near streams.
Calamus sp.	Bolago	Difficult	Harvested from natural forests; regeneration limited.

The conservation status of ritual plants in the Kaili Tado community reveals the dynamic interplay between cultural practice, ecological adaptation, and modernization pressures (Sirajuddin 2021). Among the 11 plant species identified, eight are still categorized as easily available, while three *Piper betle*, *Bacopa* sp., and *Calamus* sp. are considered rare or difficult to find. These findings indicate that while traditional rituals continue to sustain certain species, ecological changes and declining ritual frequency threaten the availability of others (Tusinski 2016).

The persistence of widely available species such as *Oryza sativa*, *Cocos nucifera*, *Musa paradisiaca*, and *Areca catechu* is largely due to their dual role in daily life and ritual use. These plants are cultivated extensively for food, economic value, and cultural functions (Rahman et al. 2019; Marasabessy 2025). For example, rice cultivation remains central to Kaili Tado livelihood and spirituality, reinforcing its presence in multiple ceremonial contexts. Similarly, coconut and banana trees are integral to both subsistence and symbolic life, ensuring their continuous propagation around homesteads. This indicates that integration of ritual and livelihood functions serves as a natural conservation mechanism within traditional societies (Mualimin et al. 2025).

In contrast, species that are exclusively used for specific rituals such as *Piper betle*, *Bacopa* sp., and *Calamus* sp. are becoming scarce. Informants noted that younger generations rarely cultivate *Piper betle* since its social function (chewing as a symbol of respect) has diminished. The *Bacopa* sp., associated with infant protection rituals (*Mosaviraka Ngana*), is rarely used today as modern medical practices replace traditional protection ceremonies. Meanwhile, *Calamus* sp., obtained from forest habitats, is vulnerable due to deforestation and limited regeneration. This reflects a broader issue observed in many indigenous communities, where erosion of traditional knowledge leads to loss of culturally significant species (Sirajuddin 2020).

Nevertheless, the Kaili Tado people exhibit strong awareness of their cultural and ecological heritage. Community elders continue to preserve ritual knowledge through oral transmission and direct participation of younger members in ceremonies (Manan et al. 2024). This form of intergenerational education acts as a cultural conservation strategy, ensuring that the symbolic meanings and ecological roles of plants are not forgotten. The maintenance of sacred plants near homes such as *Kalanchoe pinnata*, *Areca catechu*, and *Hibiscus tiliaceus* demonstrates how cultural values translate into everyday conservation actions.

The interdependence between cultural preservation and biodiversity conservation is evident. Ethnobotanical studies, including those by Kasim et al. (2021), have shown that traditional ceremonies often promote sustainable plant management because sacred values restrict overexploitation. The Kaili Tado practice of using minimal plant quantities during rituals reflects ethical use rooted in reverence, not consumption. Plants are viewed as living beings possessing spiritual essence (*pue*), reinforcing attitudes of respect and restraint in their collection. Moreover, traditional knowledge provides adaptive strategies for environmental management. The use of easily renewable plant species in most ceremonies indicates that the community consciously avoids overharvesting forest-dependent plants (Lautenschläger et al. 2020). This adaptation illustrates the principle of biocultural resilience the ability of cultural systems to adjust to ecological changes while maintaining their symbolic and moral integrity (Ozdemir 2003).

In the context of cultural continuity, the Kaili Tado rituals represent more than symbolic acts; they are mechanisms for sustaining ecological wisdom and social cohesion. Each ceremony reinforces community identity, moral values, and awareness of environmental balance (Septiwiharti et al. 2020). Documenting these practices through ethnobotanical research contributes to both cultural revitalization and biodiversity protection, bridging indigenous knowledge with scientific understanding (Arifin & Nakagoshi 2011). However, modernization and diminishing ritual participation pose challenges for the transmission of this knowledge. Therefore, integrating ethnobotanical values into educational materials, such as local wisdom-based

teaching resources, can ensure continuity of cultural and ecological awareness among younger generations. Such integration aligns with the goals of education for sustainable development (ESD), emphasizing harmony between humans and nature (Sangha et al. 2018; Levis et al. 2024).

CONCLUSIONS

The ethnobotanical practices of the Kaili Tado ethnic group reveal that plants play multidimensional roles in sustaining both cultural and ecological systems. Each species used in life cycle ceremonies carries symbolic meanings associated with human values such as purity, strength, harmony, and protection. The presence of 11 identified plant species most of which remain accessible in local environments demonstrates the community's enduring connection to nature. However, several species are becoming less common, indicating a need for community-based conservation initiatives. The findings highlight that ritual plant use among the Kaili Tado people is not merely ceremonial but represents a form of traditional ecological knowledge that supports sustainable resource management. Therefore, preserving this ethnobotanical wisdom is crucial for maintaining cultural identity, ecological balance, and intergenerational transmission of indigenous knowledge.

Acknowledgements: The authors would like to express their sincere gratitude to the Faculty of Teacher Training and Education, Tadulako University, for providing research approval and academic guidance throughout the study. Special appreciation is extended to the traditional leaders and residents of Langko Village, Lindu District, for their hospitality, cooperation, and invaluable knowledge of Kaili Tado cultural practices. Their openness and participation made it possible to document and interpret the rich ethnobotanical heritage of their community

Authors' Contributions: Conceptualization, Syech Zainal, Supriatman, and Amalia Buntu; methodology, Pahriadi, Muh. Syarif Abd Syukur, Raya Agni, and Aan Febriawan; analysis, Muh. Syarif Abd Syukur and Raya Agni; writing original draft preparation, Syech Zainal, Supriatman, and Amalia Buntu; writing, review and editing, All authors.

Competing Interests: The authors declare that there are no competing interests.

Funding: This research was funded by Tadulako University, grant number 4621/UN28/HK.02/2025.

REFERENCES

Abas, A., Aziz, A., & Awang, A. (2022). A systematic review on the local wisdom of indigenous people in nature conservation. *Sustainability*, *14*(6), 3415.

Arifin, H. S., & Nakagoshi, N. (2011). Landscape ecology and urban biodiversity in tropical Indonesian cities. *Landscape and ecological engineering*, *7*(1), 33-43.

Asrawijaya, E. (2024). Traditional Ecological Wisdom for the Resilience of Indigenous Peoples in Indonesia. *Besari: Journal of Social and Cultural Studies*, *1*(2), 59-77.

Baydoun, S. A., Kanj, D., Raafat, K., Aboul Ela, M., Chalak, L., & Arnold-Apostolides, N. (2017). Ethnobotanical and economic importance of wild plant species of Jabal Moussa Bioreserve, Lebanon. *J. Ecosyst. Ecography*, *7*(3), 1-10.

Cariño, J., & Ferrari, M. F. (2021). Negotiating the futures of nature and cultures: Perspectives from Indigenous peoples and local communities about the post-2020 global biodiversity framework. *Journal of Ethnobiology*, *41*(2), 192-208.

Dean, M. (2024). Exploring ethnobotanical knowledge: Qualitative insights into the therapeutic potential of medicinal plants. *Golden Ratio of Data in Summary*, *4*(2), 154-166.

Elendu, C. (2024). The evolution of ancient healing practices: From shamanism to Hippocratic medicine: A review. *Medicine*, *103*(28), e39005.

Geng, Y., Hu, G., Ranjitkar, S., Shi, Y., Zhang, Y., & Wang, Y. (2017). The implications of ritual practices and ritual plant uses on nature conservation: a case study among the Naxi in Yunnan Province, Southwest China. *Journal of Ethnobiology and Ethnomedicine*, *13*(1), 58.

Giambelli, R. A. (2021). The coconut, the body and the human being. Metaphors of life and growth in Nusa Penida and Bali. In *The social life of trees* (pp. 133-157). Routledge.

Hanazaki, N., Herbst, D. F., Marques, M. S., & Vandebroek, I. (2013). Evidence of the shifting baseline syndrome in ethnobotanical research. *Journal of ethnobiology and ethnomedicine*, *9*(1), 75.

Hariyanto, P., Nardiati, S., Endardi, J., Sukesti, R., & Heryana, N. (2024). Linguistic and symbolic meanings in ethnic communities: A case study of Tedhak Siten traditional ceremony. *International Journal of Society, Culture & Language*, *12*(1), 293-311.

Huberman, M., & Miles, M. (1994). Manejo de datos y métodos de análisis. *The Sage handbook of qualitative research*, 428-444.

Kakoty, S. (2018). Ecology, sustainability and traditional wisdom. *Journal of cleaner production*, *172*, 3215-3224.

Kasim, A., Nurdin, M., Tellu, A. T., & Zainal, S. (2021). Identifikasi Pemanfaatan Tumbuhan Pada Upacara Siklus Hidup Suku Kaili Da'a di Desa Uwemanje Kecamatan Kinovaro Kabupaten Sigi. *Biocelebes*, *15*(2), 125-138.

Kumar, A., Kumar, S., Komal, Ramchiary, N., & Singh, P. (2021). Role of traditional ethnobotanical knowledge and indigenous communities in achieving sustainable development goals. *Sustainability*, *13*(6), 3062.

Lautenschläger, T., Mandombe, J. L., Mawunu, M., & Neinhuis, C. (2020). Stories told by plants on graveyards in Northern Angola. PloS one, 15(8), e0236941.

Levis, C., Flores, B. M., Campos-Silva, J. V., Peroni, N., Staal, A., Padgurschi, M. C., ... & Clement, C. R. (2024). Contributions of human cultures to biodiversity and ecosystem conservation. *Nature Ecology & Evolution*, *8*(5), 866-879.

Liu, C., Wang, Y., Ma, X., Cui, D., Han, B., Xue, D., & Han, L. (2022). Traditional agricultural management of kam sweet rice

(Oryza sativa L.) in southeast Guizhou Province, China. Journal of Ethnobiology and Ethnomedicine, 18(1), 30.

Luo, B., Tong, Y., Liu, Y., Zhang, Y., Qin, Y., & Hu, R. (2024). Ethnobotanical insights into the traditional food plants of the Baiku Yao community: a study of cultural significance, utilization, and conservation. *Journal of ethnobiology and ethnomedicine*, *20*(1), 52.

Malone, N., Wade, A. H., Fuentes, A., Riley, E. P., Remis, M., & Robinson, C. J. (2014). Ethnoprimatology: Critical interdisciplinarity and multispecies approaches in anthropology. *Critique of Anthropology*, *34*(1), 8-29.

Manan, A., Lianda, R., & Nur, A. (2024). The Tradition of Seeing Hari Bulan in Starting A Life Cycle Ritual in The North Kluet Community, South Aceh, Indonesia. *Islamika Inside: Jurnal Keislaman dan Humaniora*, *10*(2), 155-176.

Mane, G. M. (2023). Indian cultural value system based on ancient indian knowledge based on in the pursuit of pillars of values for human life. *The Wisdom of Bharat: An Exploration of the Indian Knowledge System*, 69.

Marasabessy, A. C. (2025). The Meaning and Value of Kia Lahi Traditional Rituals in the Tidore Community. *Jurnal Pemberdayaan Masyarakat*, *4*(1), 34-47.

McGonigle, I. V. (2017). Spirits and molecules: Ethnopharmacology and symmetrical epistemological pluralism. *ethnos*, *82*(1), 139-164.

McHattie, L. S., & Ting, T. B. W. (2024). Indigenous relations: craft, vernacular materials and cultural assets in Borneo. *CoDesign*, *20*(1), 194-217.

Mualimin, M., Pamungkas, R., Khoirunnisa, N., Nareswari, A., & Febriyantiningrum, K. (2025). Ethnobotanical Knowledge in Javanese Rituals as Contextual Resources for Biology Education. *Journal of Biological Education Indonesia (Jurnal Pendidikan Biologi Indonesia)*, *11*(2), 797-810.

Nguyen, T. T., Grote, U., Neubacher, F., Do, M. H., & Paudel, G. P. (2023). Security risks from climate change and environmental degradation: implications for sustainable land use transformation in the Global South. *Current Opinion in Environmental Sustainability*, *63*, 101322.

Ozdemir, I. (2003). Toward an understanding of environmental ethics from a Qur'anic perspective. Islam and ecology: A bestowed trust, 3-37.

Permanasari, M. D. (2017). Banana plants as a cultural resource in Javanese culture. *Journal of the International Center for Cultural Resource Studies 3*.

Phillips, O., & Gentry, A. H. (1993). The useful plants of Tambopata, Peru: I. Statistical hypotheses tests with a new quantitative technique. *Economic Botany*, *47*(1), 15-32.

Prasetyo, S. F. (2023). Harmony of nature and culture: Symbolism and environmental education in ritual. *Journal of Contemporary Rituals and Traditions*, *1*(2), 67-76.

Prawiradilaga, D. M., & Soedjito, H. (2013). Conservation challenges in Indonesia. *Conservation biology: Voices from the tropics*, 134-141.

Rahman, R., Al-Sabahi, J. N., Ghaffar, A., Nadeem, F., & Umar, A. (2019). Phytochemical, morphological, botanical, and pharmacological aspects of a medicinal plant: Kalanchoe pinnata–A review article. *International Journal of Chemical and Biochemical Sciences*, *16*, 5-10.

Ramavhunga, N. (2025). How urbanisation impacts the transmission of cultural knowledge and practices from one generation to the next within Vhavenda communities. *International Journal of Research in Business & Social Science*, *14*(5).

Sangha, K. K., Preece, L., Villarreal-Rosas, J., Kegamba, J. J., Paudyal, K., Warmenhoven, T., & RamaKrishnan, P. S. (2018). An ecosystem services framework to evaluate indigenous and local peoples' connections with nature. *Ecosystem services*, *31*, 111-125.

Sapkota, P. P. (2013). Religious culture and medicinal plants: an anthropological study. *Dhaulagiri Journal of Sociology and Anthropology*, *7*, 197-224.

Septiwiharti, D., Maharani, S. D., & Mustansyir, R. (2020). Concept and development of Sintuvu Culture in Kaili Central Sulawesi Community. *Research, Society and Development*, *9*(2), e99922495-e99922495.

Sinthumule, N. I. (2023). Traditional ecological knowledge and its role in biodiversity conservation: a systematic review. *Frontiers in Environmental Science*, *11*, 1164900.

Siradjuddin, Z. (2021). Evolution Of Tokaili Settlement Process In Central Sulawesi, Indonesia. *Advances in Social Sciences Research Journal*, *8*(4), 543-59.

Sirajuddin, Z. (2020). Local Wisdom as a Planning Strategy and Sustainable Settlement Development in ToKaili Traditional Settlement, Central Sulawesi, Indonesia. *Rev. Eur. Stud.*, *12*, 107.

Turner, N. J., Cuerrier, A., & Joseph, L. (2022). Well grounded: Indigenous Peoples' knowledge, ethnobiology and sustainability. *People and Nature*, *4*(3), 627-651.

Tusinski, G. (2016). Fates worse than death: Destruction and social attachment in Timor-Leste. *Social Analysis*, *60*(2), 13-30.

Uchôa, R. (2024). "Savage Knowledge," Ethnosciences, and the Colonial Ways of Producing Reservoirs of Indigenous Epistemologies in the Amazon. *Journal of Social Ontology*, *10*(2).

Wahyuningtyas, B. P., Asteria, D., & Sunarto, S. (2022). The Ultimate Traditional Wedding Ceremony: Accommodating Generation Gap of Javanese Familyin Celebrating Nostalgic Moment. *Jurnal Komunikasi Indonesia*, *11*(1), 3.