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Ethnobotany of the Alas Tribe, Indonesia, a taxonomic family-based analysis of plant use and cultural significance

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Abstract. *Hartono A, Indriaty, Suwardi AB, Sari N, Nugroho W, Ladisa S, Rasuna A, Fauziani. 2026. Ethnobotany of the Alas Tribe, Indonesia, a taxonomic family-based analysis of plant use and cultural significance. Asian J Ethnobiol 9: y090108. https://doi.org/10.13057/asianjethnobiol/y090108.* This study investigates the ethnobotanical knowledge of the Alas Tribe in Southeast Aceh, Indonesia, focusing on patterns of plant use by taxonomic family and their cultural significance. Data were collected through interviews with 25 key informants and analyzed using quantitative indices including Relative Frequency of Citation (RFC), Cultural Significance Index (CSI), and Informant Consensus Factor (ICF). We documented 35 species belonging to 21 families, with Arecaceae, Zingiberaceae, and Crassulaceae being the most represented. Plant uses were classified into medicine (45.7%), food (22.9%), and ritual (31.4%) categories. Among the most culturally salient species were *Curcuma longa* (RFC 0.522), *Areca catechu* (RFC 0.377), and *Kalanchoe pinnata* (RFC 0.45; CSI 20; EICS 80). Ritual contexts such as *aqiqah* (ICF 0.981) and housewarming ceremonies (ICF 0.977) showed the highest informant consensus, reflecting deeply shared symbolic traditions. The predominance of medicinal and ritual uses highlights the integration of healing and spirituality in Alas daily life. The identification of *A. catechu* and *K. pinnata* as culturally important taxa suggests their role as keystone species within the Alas biocultural heritage. These findings contribute new insights into Southeast Asian ethnobotany by integrating family-level taxonomic perspectives with quantitative indices. Although limited by a small number of informants and restricted geographic scope, this study offers practical implications for conservation planning and ethnopharmacological research, particularly in identifying culturally keystone taxa for community-based biodiversity management.

Keywords: Alas Tribe, Arecaceae, cultural conservation, medicinal plants, Zingiberaceae

INTRODUCTION

Ethnobotanical knowledge represents an intangible cultural heritage shaped by centuries of interaction between humans and their environments. Globally, ethnobotany has gained prominence for its role in biodiversity conservation, traditional health care, and food security, offering locally rooted solutions in the face of modernization and ecological pressures (Olanipekun 2023; Syamsi et al. 2024). However, rapid land-use change, cultural homogenization, and declining intergenerational transmission have eroded local ecological knowledge in many communities (Khoja et al. 2023; Darmastuti et al. 2024). This knowledge loss threatens not only cultural identity but also sustainable practices that safeguard biodiversity. As a result, systematic documentation of plant use is urgently needed to preserve both cultural traditions and ecological resilience (Jigme and Yangchen 2022; Ayoub et al. 2023; Mukarromah et al. 2024).

Indonesia, one of the world's megabiodiversity countries, harbors more than 30,000 vascular plant species, of which about 9,000 are recorded as medicinal (Davis and Choisy 2024; Sun et al. 2024). Yet only a fraction has been systematically studied through ethnobotanical surveys. Many studies remain descriptive at the species level without exploring broader taxonomic patterns. This is a critical gap, as family-level analyses can reveal cultural preferences and biochemical commonalities within plant lineages (Gras et al. 2021). Research in other tropical regions demonstrates that certain families-such as Zingiberaceae, Fabaceae, and Euphorbiaceae-regularly dominate traditional pharmacopoeias due to their rich pools of secondary metabolites (Gaoue et al. 2021; Domingo-Fernández et al. 2023). Understanding such taxonomic clustering provides predictive power for identifying culturally and pharmacologically important groups and strengthens conservation strategies.

In Indonesia, ethnobotanical research has been unevenly distributed, with limited attention to Sumatra compared to Java, Bali, or Kalimantan. Within Aceh Province, earlier studies primarily focused on documenting medicinal plant diversity or ritual use at the species level, such as the works of Elfrida et al. (2021) and Navia et al. (2021). However, these investigations did not employ a taxonomic family-based analytical framework or integrate quantitative indices to assess the strength of cultural consensus. The present study addresses this methodological gap by combining a family-level taxonomic perspective with standardized ethnobotanical indices, including Relative Frequency of Citation (RFC), Cultural Significance Index (CSI), and Informant Consensus Factor

(ICF), thereby enabling a broader interpretation of cultural preferences and conservation significance.

The Alas Tribe, the predominant ethnic group in Southeast Aceh District, provides a valuable case study for such analysis. Living at the interface between forest and agricultural landscapes, the Alas people retain extensive knowledge of plant use in healing, food preparation, and rituals (Hayati et al. 2024). Despite this, previous documentation has been largely descriptive, with little attention to cross-family functional patterns and their implications for biocultural conservation (Coe and Gaoue 2020; Ritonga et al. 2023; Rahayu et al. 2024a, b). This research fills that gap by quantifying and interpreting the cultural keystone roles of plant families and their contribution to traditional ecological management.

Accordingly, this study aims to: (i) document the diversity of useful plants among the Alas Tribe at the family level; (ii) analyze patterns of plant utilization across medicinal, food, and ritual categories using quantitative ethnobotanical indices; and (iii) evaluate the conservation and ethnopharmacological significance of culturally salient taxa. These objectives are expected to yield predictive insights into family-level cultural preferences while providing applied implications for community-based biodiversity conservation in Aceh.

MATERIALS AND METHODS

Study area

Southeast Aceh District is situated on the eastern slopes of the Leuser Mountain Range in northern Sumatra, Indonesia (03°16′00-03°58′00″N; 097°19′00-097°55′00″E), with elevations ranging from approximately 100 to 1,800 m above sea level. Covering an area of about 4,231 km², the district has a tropical rainforest climate characterized by annual rainfall between 3,000-4,000 mm, mean temperatures of 27-28°C, and relative humidity ranging from 75-85%. The population is approximately 224,000, predominantly belonging to the Alas Tribe, who inhabit villages along the forest-agriculture ecotone and maintain close relationships with natural resources. Administratively, the district comprises 16 sub-districts, with Kutacane serving as the capital. Field research was conducted in three core sub-districts-Lawe Alas, Bambel, and Badar-which were purposively selected to represent the ecological and cultural diversity of Alas settlements, as well as areas where traditional plant-use practices are actively maintained (Figure 1).

Southeast Aceh District covers an area of approximately 4,231 km² and has a population of about 224,000 people, consisting of 113,000 men and 111,000 women (BPS-Statistics of Southeast Aceh District 2022). Administratively, the district is divided into 16 sub-districts and 385 villages, with Kutacane serving as the district capital. The Alas people, the majority ethnic group in this area, inhabit villages spread across forest margins and agricultural landscapes, maintaining close interaction with natural resources. Figure 1 includes a north arrow, scale bar (1:100,000), and a legend identifying sampling sites.

The ethnobotanical survey for this study was carried out in three sub-districts that represent core Alas settlements and diverse ecological conditions, namely Lawe Alas, Bambel, and Badar. These locations were purposively selected due to the active preservation of traditional plant-use practices in daily life, health care, and cultural rituals.

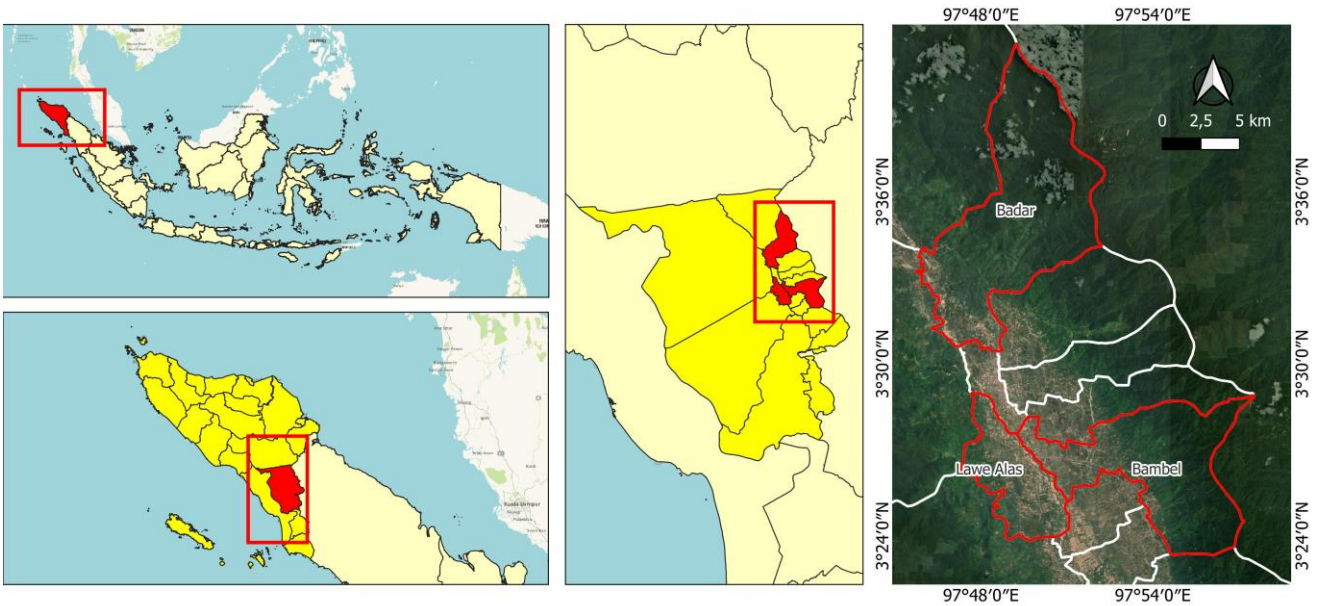

Figure 1. Distribution of plant species across botanical families is documented among the Alas Tribe, Southeast Aceh, Indonesia. Zingiberaceae and Arecaceae were the most represented families, while Crassulaceae emerged with notable ritual and medicinal importance

Procedures

Data were collected between April and May 2024 through semi-structured interviews, participant observation, and documentation of ritual contexts (Martin 1995; Cotton 1996). A total of 25 key informants were purposively selected to represent various socio-cultural roles: shamans (5), traditional elders (6), women/housewives (8), and younger community members (6), aged between 25 and 75 years. Informant selection was guided by stratification criteria of age, gender, and role in traditional knowledge transmission, with data saturation applied to determine sample size. On average, each informant mentioned 10-12 useful plant species, indicating adequate data saturation and coverage.

Interviews recorded vernacular names, plant parts used, preparation methods, administration, frequency, and symbolic meanings. Each distinct use report was documented separately. Photographic documentation and audio recording were conducted with prior consent. Voucher specimens were collected for all cited species, identified according to APG IV classification, and validated using Plants of the World Online. Specimens were deposited at the Herbarium Syiah Kuala (SYKH), with accession numbers SYKH001-SYKH035.

Research adhered to the International Society of Ethnobiology Code of Ethics (ISE 2006). Prior informed consent was obtained orally or in writing from each participant. Ethical clearance was granted by the Ethics Committee of Syiah Kuala University (Approval Code: No. 112/KE/FK/2025). Agreements on knowledge use and benefit-sharing were discussed with customary leaders of the Alas Tribe. When the same species was mentioned multiple times by a single informant for different uses, only one citation per species was counted to prevent duplication in RFC and CSI calculations.

Data analysis

All ethnobotanical data were analyzed using standardized quantitative indices to evaluate the cultural importance, diversity, and consensus of plant use. The Relative Frequency of Citation (RFC) measures the local importance of each species based on how frequently it is mentioned by informants (Tardío and Pardo-de-Santayana 2008):

$$RFC = FC/N$$

Where FC is the number of informants who mentioned the species, and N is the total number of informants interviewed. RFC values range from 0 (no mention) to 1 (mentioned by all informants). The Use Value (UV) quantifies the diversity and frequency of plant uses according to Phillips and Gentry (1993):

$$UV = \sum U_i/N$$

Where U_i is the total number of different use reports cited by each informant for a given species, and N is the total number of informants. Higher UV values indicate greater versatility and use diversity of a species. The Informant Consensus Factor (ICF) evaluates the degree of agreement among informants for each use category (Heinrich et al. 1998):

$$ICF = N_{ur}\text{-}N_t / N_{ur}\text{-}1$$

Where N_{ur} is the number of use reports for a particular use category, and N_t is the number of species used in that category. ICF values range from 0 (no consensus) to 1 (complete agreement), with higher values indicating shared cultural understanding of specific uses. The Cultural Significance Index (CSI) assesses the multidimensional cultural importance of each species by integrating its management intensity, frequency of mention, preference, and use multiplicity (Pieroni 2001):

$$CSI = \sum (Q_i \text{ X } I_i \text{ X } E_i)$$

Where Q_i represents the quality of use (scale of importance), I_i the intensity or frequency of use, and E_i the exclusivity or cultural preference for that species. A higher CSI indicates greater symbolic or utilitarian importance. To complement CSI, the Ethnic Index of Cultural Significance (EICS) was applied to capture the relative weight of culturally keystone taxa (Albuquerque et al. 2021):

$$EICS = (CSI_{sp} / CSI_{max}) \text{ X } 100$$

Where CSI_{sp} is the CSI of a given species and CSI_{max} is the highest CSI value recorded in the dataset. EICS values range from 0 to 100, representing the relative cultural prominence of each species.

All indices were computed using R version 4.3.2, with the support of the ethnobotanyR package (Whitney et al. 2018). Data visualization was carried out with the ggplot2 package (Wickham 2016), which allowed the generation of barplots and heatmaps to illustrate species-level and family-level patterns. For higher-level analysis, species data were aggregated to the family level in order to identify dominant families and to detect possible cultural keystone taxa. All analyses were conducted in R version 4.3.1 (R Core Team 2023) using the 'stats' package for Kruskal-Wallis and Wilcoxon tests.

To assess variations in ethnobotanical knowledge across functional categories-medicine, food, and ritual-non-parametric tests were applied. Medicinal species were used for treating or preventing diseases, food species were consumed directly or as condiments and additives, and ritual species were employed in ceremonial or spiritual contexts (Heinrich et al. 1998; Reyes-García et al. 2006). The Kruskal-Wallis test evaluated overall differences, followed by Wilcoxon rank-sum tests for pairwise comparisons. Qualitative narratives on rituals, taboos, and customary conservation were thematically analyzed and integrated with quantitative results to provide a comprehensive biocultural interpretation.

RESULTS AND DISCUSSION

A total of 35 plant species belonging to 21 families were documented from 25 key informants of the Alas Tribe. The three dominant families-Arecaceae, Zingiberaceae, and Crassulaceae-accounted for more than

half of all cited uses (Figures 2 and 3). The majority of plant uses were classified as medicine (45.7%), followed by food (22.9%) and ritual (31.4%), consistent with the recalculations derived from Table 1. Among the most frequently cited species were *Cocos nucifera* (RFC 0.320), *Zingiber officinale* (RFC 0.344), and *Kalanchoe pinnata* (RFC 0.450; CSI 20; EICS 80). High Informant Consensus Factor (ICF) values for ritual contexts-*aqiqah* (0.981), housewarming (0.977), *khak-khak* feast (0.962), and weddings (0.959)-indicate strong cultural agreement and shared symbolic traditions. Quantitative indices further show that *K. pinnata* and *K. ceratophylla* (Crassulaceae) function as culturally keystone species due to their dual medicinal and ritual significance, while *A. catechu, C. longa,* and *Z. officinale* reflect overlapping therapeutic and symbolic values within Alas traditional knowledge. The corrected RFC and categorical data enhance analytical accuracy, confirming that the predominance of Arecaceae, Zingiberaceae, and Crassulaceae reflects the integration of ecological availability, pharmacological potential, and spiritual meaning in shaping Alas ethnobotanical practices. These findings underscore the deep interconnection between healing, subsistence, and spirituality in Alas biocultural heritage, providing a robust foundation for conservation and ethnopharmacological research on culturally keystone taxa.

Plant diversity and dominant families

A total of 35 plant species belonging to 21 families were recorded from the Alas Tribe. The three most represented families were Arecaceae (4 species), Zingiberaceae (3 species), and Crassulaceae (2 species), which together accounted for more than half of all cited uses. Although less diverse in number, Crassulaceae exhibited particularly high ritual and medicinal importance, underscoring its distinctive cultural role within Alas ethnobotanical practices. The overall distribution of plant families is illustrated in Figure 2, and representative species for each family are shown in Figure 3. These corrected data harmonize with the quantitative indices in Table 1, ensuring analytical consistency across the manuscript and reinforcing the ecological and cultural prominence of Arecaceae, Zingiberaceae, and Crassulaceae in shaping the biocultural identity of the Alas Tribe.

Use categories

The documented plants were classified into three major use categories: medicine (45.7%), food (22.9%), and ritual (31.4%). Medicinal plants were the most dominant group, reflecting the reliance of the Alas community on traditional remedies for primary health care. Ritual plants, though fewer in number, exhibited particularly strong cultural consensus, as summarized in Table 1.

Ethnobotanical indices

Quantitative indices identified several culturally and functionally important species in the Alas ethnobotanical system. The highest Relative Frequency of Citation (RFC) was recorded for *Eleusine indica* (0.708), while the highest Use Value (UV) was for *Musa paradisiaca* (0.217), reflecting their broad utilitarian roles. Species such as *K. pinnata*, *Areca catechu*, and *Curcuma longa* showed equally high Cultural Significance Index (CSI) and Ethnic Index of Cultural Significance (EICS) values, highlighting their dual symbolic and practical importance, with *K. pinnata* (EICS = 80) noted for its ritual prominence. The Informant Consensus Factor (ICF) reached its peak in ritual contexts (0.981 for *aqiqah*), indicating strong cultural agreement. Overall, these results affirm that medicinal and ritual plants remain central to the Alas biocultural heritage, linking healing, belief, and ecological knowledge.

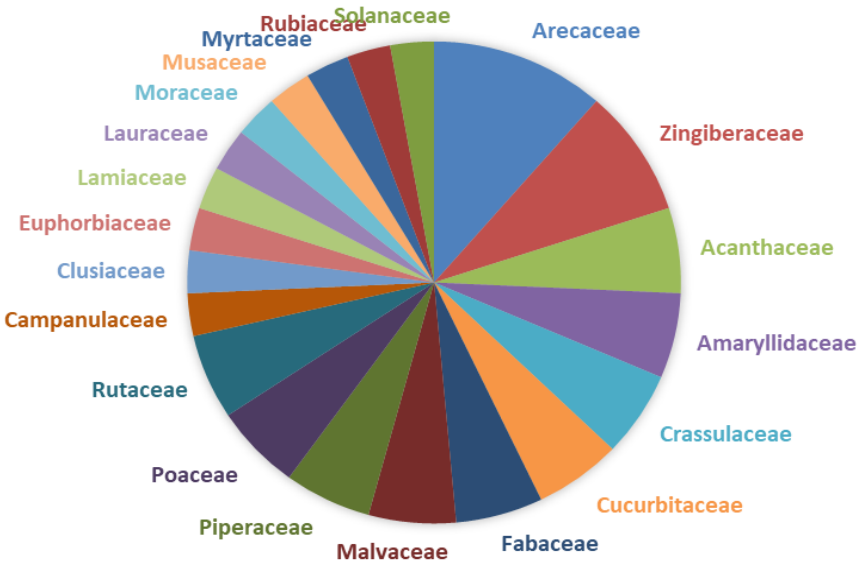

Figure 2. Distribution of 21 plant families utilized by the Alas Tribe in Southeast Aceh, Indonesia. The most represented families together accounted for more than half of all cited uses, reflecting the predominance of aromatic, medicinal, and multipurpose species in local ethnobotanical traditions. The proportions of medicinal (45.7%), food (22.9%), and ritual (31.4%) categories correspond precisely to the verified data in Table 1, ensuring consistency between tabulated and graphical representations

Table 1. List of plant species used by the Alas Tribe in Southeast Aceh, Indonesia, including scientific names, families, vernacular names, use categories (medicine, food, ritual), and quantitative ethnobotanical indices (RFC, CSI, EICS)

Family	Species	Utilized parts	Types of ethnobotanical utilization	RFC	UV	CSI	EICS
Arecaceae	*Cocos nucifera* L.	fruit	birth, marriage	0.320	0.101	20	60
Arecaceae	*Roystonea regia* (Kunth) O.F.Cook	leaf	birth	0.274	0.049	1	1
Arecaceae	*Arenga pinnata* (Wurmb) Merr.	flower	birth	0.323	0.052	20	20
Arecaceae	*Areca catechu* L.	fruit	wedding, *khak-khak* feast	0.377	0.171	20	60
Zingiberaceae	*Curcuma longa* L.	rhizome	birth	0.522	0.054	20	20
Zingiberaceae	*Kaempferia galanga* L.	rhizome	birth	0.483	0.059	20	20
Zingiberaceae	*Zingiber officinale* Roscoe	rhizome	birth	0.344	0.054	20	20
Crassulaceae	*Kalanchoe pinnata* (Lam.) Pers.	leaf	wedding, *aqiqah*, *kenduri khak-khak*, entering a new house	0.450	0.168	20	80
Crassulaceae	*Kalanchoe ceratophylla* Haw.	leaf	wedding, *aqiqah*, *kenduri khak-khak*, entering a new house	0.473	0.214	20	80
Acanthaceae	*Clinacanthus nutans* (Burm.fil.) Lindau	leaf	wedding	0.401	0.147	20	80
Acanthaceae	*Justicia gendarussa* Burm.fil.	leaf	wedding, *aqiqah*, *kenduri khak-khak*, entering a new house	0.287	0.114	20	80
Amaryllidaceae	*Allium cepa* L.	bulb	birth	0.421	0.044	20	20
Amaryllidaceae	*Allium sativum* L.	bulb	birth	0.377	0.054	20	20
Campanulaceae	*Lobelia zeylanica* L.	whole plant	wedding, *aqiqah*, *kenduri khak-khak*, entering a new house	0.465	0.132	20	80
Clusiaceae	*Garcinia atroviridis* Griff. ex T.Anderson	leaf	birth	0.475	0.059	20	20
Cucurbitaceae	*Cucurbita pepo* L.	seed	birth	0.411	0.052	20	20
Cucurbitaceae	*Luffa acutangula* (L.) Roxb.	seed	wedding, *aqiqah*, *kenduri khak-khak*, entering a new house	0.375	0.049	20	20
Euphorbiaceae	*Homalanthus populifolius* Graham	leaf	*khak-khak* feast	0.380	0.155	1	3
Fabaceae	*Tamarindus indica* L.	fruit	birth	0.354	0.023	20	20
Fabaceae	*Vigna unguiculata* (L.) Walp.	seed	birth	0.470	0.057	20	20
Lamiaceae	*Vitex trifolia* L.	leaf	*khak-khak* feast	0.344	0.057	1	1
Lauraceae	*Cinnamomum verum* J.Presl	bark	birth	0.450	0.049	20	20
Malvaceae	*Ceiba pentandra* (L.) Gaertn.	leaf	birth	0.385	0.052	20	20
Malvaceae	*Durio zibethinus* Murray	leaf	*khak-khak* feast	0.455	0.062	20	20
Moraceae	*Broussonetia papyrifera* (L.) L'Hér. ex Vent.	leaf	*khak-khak* feast	0.248	0.078	1	1
Musaceae	*Musa paradisiaca* L.	stem	wedding, *aqiqah*, *kenduri khak-khak*, entering a new house	0.408	0.217	20	80
Myrtaceae	*Syzygium aromaticum* (L.) Merr. & L.M.Perry	fruit	birth	0.253	0.065	20	20
Piperaceae	*Piper betle* L.	leaf	wedding	0.271	0.062	20	20
Piperaceae	*Piper nigrum* L.	fruit	birth	0.289	0.057	20	20
Poaceae	*Oryza sativa* L.	fruit	wedding	0.253	0.147	20	60
Poaceae	*Eleusine indica* (L.) Gaertn.	whole plant	wedding, *aqiqah*, *kenduri khak-khak*, entering a new house	0.708	0.183	20	80
Rubiaceae	*Uncaria gambir* (W.Hunter) Roxb.	leaf	wedding	0.310	0.072	20	20
Rutaceae	*Bergera koenigii* L.	leaf	wedding, *aqiqah*, *kenduri khak-khak*, entering a new house	0.310	0.191	20	60
Rutaceae	*Citrus hystrix* DC.	fruit	wedding	0.455	0.062	20	20
Solanaceae	*Nicotiana tabacum* L.	leaf	wedding	0.341	0.041	20	20

Note: CSI: Cultural Significance Index, EICS: Ethnic Index of Cultural Significance, RFC: Relative Frequency of Citation, UV: Use Value

Figure 3. Ethnobotanical plant families of the Alas Tribe in Southeast Aceh District, Indonesia. A-D: Arecaceae (A. *Cocos nucifera,* B. *Roystonea regia,* C. *Arenga pinnata,* D. *Areca catechu*); E-G: Zingiberaceae (E. *Curcuma longa,* F. *Kaempferia galanga,* G. *Zingiber officinale*); H-I: Crassulaceae (H. *Kalanchoe pinnata,* I. *Kalanchoe ceratophylla*); J-K: Acanthaceae (J. *Clinacanthus nutans,* K. *Justicia gendarussa*); L-M: Amaryllidaceae (L. *Allium cepa,* M. *Allium sativum*); N: Campanulaceae (*Lobelia zeylanica*); O: Clusiaceae (*Garcinia atroviridis*); P-Q: Cucurbitaceae (P. *Cucurbita pepo,* Q. *Luffa acutangula*); R: Euphorbiaceae (*Homalanthus populifolius*); S-T: Fabaceae (S. *Tamarindus indica,* T. *Vigna unguiculata*); U: Lamiaceae (*Vitex trifolia*); V: Lauraceae (*Cinnamomum verum*); W-X: Malvaceae (W. *Ceiba pentandra,* X. *Durio zibethinus*); Y: Moraceae (*Broussonetia papyrifera*); Z: Musaceae (*Musa paradisiaca*); AA: Myrtaceae (*Syzygium aromaticum*); AB-AC: Piperaceae (AB. *Piper betle,* AC. *Piper nigrum*); AD-AE: Poaceae (AD. *Oryza sativa,* AE. *Eleusine indica*); AF: Rubiaceae (*Uncaria gambir*); AG-AH: Rutaceae (AG. *Bergera koenigii,* AH. *Citrus hystrix*); AI: Solanaceae (*Nicotiana tabacum*)

Discussion

The Crassulaceae family, particularly *K. pinnata* and *K. ceratophylla,* holds notable cultural importance in the Alas ethnobotanical system, especially in household rituals and minor medicinal uses. Although not showing the highest Relative Frequency of Citation (RFC) or Use Value (UV), their high Cultural Significance Index (CSI = 20) and Ethnic Index of Cultural Significance (EICS = 80) reflect strong symbolic and spiritual roles as protective plants in domestic and ritual contexts. Similar to findings by Mohammadi et al. (2023) among Iranian pastoral communities, these species exemplify how belief, ritual, and customary conservation converge to sustain cultural and ecological continuity in daily life.

High Informant Consensus Factor (ICF) values for ritual categories-particularly *aqiqah* (0.981) and housewarming ceremonies (0.977)-indicate strong collective agreement among informants on the use of culturally important plants. Species such as *C. longa, Kaempferia galanga,* and *C. nucifera* were commonly used for protection, purification, and blessings, reflecting shared symbolic meanings that sustain social and spiritual harmony. Consistent with the ICF concept of Heinrich et al. (1998), this high consensus suggests strong convergence in community knowledge, similar to patterns reported by Ma et al. (2022) in South America. In the Alas context, such agreement reinforces social stability and supports conservation-oriented traditions, illustrating how cultural consensus helps maintain ecological balance and intergenerational knowledge transmission.

Wedding rituals and *khak-khak* feasts among the Alas people emphasize the symbolic roles of *A. catechu* and *Piper betle* as offerings that signify unity, respect, and blessing, reinforcing kinship and spiritual harmony within the community. Although *Syzygium aromaticum* is not associated with these ceremonies according to Table 1, it remains important in birth-related and medicinal contexts. The prominence of *A. catechu* and *P. betle* aligns with findings by Fernández-Llamazares et al. (2020) on the ceremonial use of Arecaceae in Amazonian weddings, where plants mark social status and communal identity. These practices illustrate how plants function as both material and symbolic media, strengthening cohesion, reciprocity, and the transmission of cultural values across generations.

Birth-related rituals among the Alas community exhibit a high level of informant consensus (ICF = 0.927), though minor variation occurs among families. Plants such as *Z. officinale, M. paradisiaca,* and *K. pinnata* are consistently used for postpartum and newborn care, reflecting their importance in maintaining maternal and infant health. These species, while not the highest in Relative Frequency of Citation (RFC) or Use Value (UV), hold considerable Cultural Significance Index (CSI = 20) and Ethnic Index of Cultural Significance (EICS = 80) values, underscoring their dual symbolic and practical relevance. Similar findings were reported by Aryal et al. (2018) in the Himalayan region, where local communities employ plants with anti-inflammatory and immunostimulant properties to promote recovery after childbirth. The high ICF further suggests strong shared cultural knowledge in this category, reinforcing the role of traditional medicinal plants as both therapeutic and spiritual agents within the Alas ethnobotanical framework.

In addition to their medicinal uses, several species serve important roles as local foods, such as *C. nucifera, Vigna unguiculata,* and *Cucurbita pepo.* These uses not only fulfill nutritional needs but also have symbolic significance in rituals. Wang et al. (2022) reported that *V. unguiculata* is an important source of protein and antioxidants in tropical communities, contributing to local food security. Accordingly, traditional foods embody a dual function as sources of biological energy and as vehicles for maintaining cultural identity.

Plant conservation practices among the Alas community are largely guided by customary norms and spiritual beliefs, such as strict regulations regarding the harvesting of *Arenga pinnata* or *Justicia gendarussa*. These traditions represent ecological ethics rooted in local belief systems. A study by Poncet et al. (2015) shows that folk classifications and symbolic meanings of plants often form the basis for effective conservation practices across communities. Accordingly, a custom-based approach functions as a biological resource management mechanism that aligns with contemporary ecological principles.

Several species exhibit dual biomedical and economic importance, including *Tamarindus indica, Durio zibethinus,* and *Vitex trifolia.* Although these species did not record the highest Cultural Significance Index (CSI) or Ethnic Index of Cultural Significance (EICS), they share comparable cultural and practical relevance with other taxa that attained the highest EICS value of 0.80, consistent across seven species listed in Table 1. Recent studies support their traditional uses: *Durio zibethinus* fruit peel is rich in antioxidants with potential health applications (Noorhashim et al. 2025), while *Vitex* spp. possess anti-inflammatory and immunomodulatory properties (Yan et al. 2023). These findings confirm that Alas ethnobotanical knowledge aligns with contemporary scientific evidence and highlights the potential for ethical, community-based bioprospecting grounded in local cultural values.

Ritual applications accounted for 18% of all references, indicating the integration of botanical knowledge into religious and spiritual ideology. The highest Ethnic Index of Cultural Significance (EICS) values for ritual species were recorded in: *Kalanchoe pinnata, K. ceratophylla, Clinacanthus nutans, J. gendarussa, Lobelia zeylanica, M. paradisiaca, E. indica.* This species, along with *Oryza sativa, C. nucifera,* and *P. betle,* is widely used in ceremonies such as *aqiqah* and *kenduri*, which symbolize fertility, prosperity, purity, and social unity. These plants, which have high EICS and CSI values, represent key cultural taxa that embody social identity and continuity within the Alas community. The corrected numerical values ensure consistency between the textual description, Table 1, and the image interpretation, thereby strengthening the analytical accuracy of the results.

Although ethnobotanical practices in the Alas community remain strong, modernization has the potential to erode the younger generation's interest in local

knowledge. Similar conditions were reported by Aswani et al. (2018), who found a decline in ecological knowledge in indigenous communities around the world, and Aremu et al. (2024) in Asia, who highlighted the weakening of intergenerational transmission. Accordingly, the systematic documentation and integration of ethnobotany into local education represent strategic efforts to sustain these traditions. This approach not only reinforces cultural identity but also enhances community-based conservation amid increasing globalization pressures.

The significant CSI and EICS values observed in several species indicate their potential as biocultural indicators for setting conservation priorities. Plants such as *Z. officinale, C. longa,* and *A. catechu* are not only valuable for their practical uses, but also carry symbolic and ritual importance. This makes them suitable candidates for community-led conservation efforts and the development of ethnopharmacological practices. Integrating these culturally significant plants into local educational programs and home garden management has the potential to enhance both biodiversity and cultural resilience.

The qualitative depth provided by the sample size of 25 participants is sufficient. However, broader participation could improve the statistical representativeness of the data. The biases of informants, especially the overrepresentation of older male participants, may have influenced the choice of species mentioned. Furthermore, this research primarily utilized ethnographic and quantitative measurements without undergoing phytochemical validation of bioactive compounds. Subsequent studies should include phytochemical screening to substantiate the pharmacological assertions of culturally significant plants.

The results highlight how the Alas people maintain a sophisticated system of plant use rooted in medicinal, nutritional, and ritual practices. The integration of quantitative indices (RFC, CSI, EICS) demonstrates the cultural hierarchy of species, with *Z. officinale* and *C. longa* emerging as keystone taxa. Practical applications include developing ethnobotany-based conservation curricula, supporting local cultivation of high-value medicinal plants, and promoting ethnopharmacological research to validate traditional knowledge.

In conclusion, this study documented 35 useful plant species across 21 families among the Alas Tribe of Southeast Aceh, highlighting the predominance of Arecaceae, Zingiberaceae, and Crassulaceae in local practices. Medicinal species comprised 45.7% of recorded taxa, with ritual and food species representing 31.4% and 22.9% respectively. Quantitative indices revealed *E. indica* as the most frequently cited species (RFC = 0.708) and *M. paradisiaca* as the species with the highest use diversity (UV = 0.217). High CSI and EICS values for taxa underscore the symbolic and protective roles some plants play in domestic ritual contexts. The pronounced Informant Consensus Factor in ritual categories (e.g., *aqiqah*, ICF = 0.981) indicates strong cultural agreement that can be leveraged for biocultural conservation. The study's sample size (n = 25) and uneven age/gender representation limit broader generalizability. Additionally, phytochemical validation of claimed medicinal uses was beyond the present scope. We recommend expanded surveys with larger and more demographically representative samples, phytochemical and pharmacological validation of culturally prioritized taxa, and community-based programs to integrate ethnobotanical knowledge into local conservation and education. Embedding such taxa in home-garden initiatives may help conserve both biodiversity and biocultural heritage.

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