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Ethnobotanical Study of *Zingiberaceae* to Reinforce Plant Taxonomy Concepts through Field Practice

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ABSTRACT

Botany plays a crucial role in shaping students' understanding of biodiversity and its relevance to daily life. However, theoretical approaches often create a disconnect between scientific knowledge and its real-world application. This study aimed to assess the effectiveness of practice-based ethnobotany learning in enhancing students' biological understanding, cultural awareness, and critical thinking skills. Using a qualitative descriptive approach combined with experiential learning methods, data were collected through direct observation of Zingiberaceae species, semi-structured interviews with local communities on plant uses, scientific literature reviews on pharmacological benefits, and visual documentation. The findings revealed that this approach strengthened students' grasp of plant taxonomy, conservation values, and local wisdom. Students successfully identified various species such as Curcuma domestica, Zingiber officinale, and others, along with their traditional health and environmental benefits. Additionally, the learning process significantly improved students' critical thinking and self-efficacy in applying acquired knowledge. The results emphasize that real-world experiences enhance theoretical understanding and foster ecological awareness. This study suggests that ethnobotany education grounded in field practice should be more widely implemented in higher education, especially in biology and environmental science. Integrating this approach supports not only academic achievement but also character development, cultural preservation, and sustainable development in response to 21st-century educational challenges.

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INTRODUCTION

Plant diversity has played a significant role in the development of human culture Since the earliest stages of civilization (Kalita et al., 2024; Megersa et al., 2023). Botany plays a fundamental role in introducing students to the world of plants, which are rich in biodiversity and have practical benefits for human life. As a branch of biology, botany not only focuses on the structural and physiological aspects of plants, but also encompasses ecological relationships and the ethnobotanical value inherent in certain species (Astuti, 2015; Detia et al., 2024; Rahayu, 2023). Strengthening botany in higher education is important as it serves as a foundation for sustainable understanding of natural resources and their applications in health, food, and the environment (Jannah & Fathir, 2024).

Although botany is widely taught, the pedagogical approach tends to be theoretical and does not provide much room for exploration of local contexts and cultural practices. This creates a gap between scientific knowledge and practical applications that are relevant to students' everyday lives. In fact, the connection between theory and practice is essential to help students internalize a comprehensive understanding of the functions of plants, including in the context of traditionalmedicine and conservation (Sunariyati et al., 2020).

Ethnobotany, as a branch of botany, presents an interdisciplinary approach that bridges modern science with local wisdom, making it an essential tool in closing the gap between theory and practice. This field examines the relationship between humans and plants in cultural, social, and medicinal contexts, making it highly relevant amidst the growing interest in natural medicine (Nanuayo et al., 2023). Through ethnobotany education, students can understand the functions of plants not only from a biological perspective but also from the viewpoint of tradition and sustainability. Nevertheless, research on the integration of ethnobotany and indigenous knowledge into higher education remains limited, despite the considerable potential of this field for further development (Marsandi et al., 2025).

Ethnobotany education that integrates hands-on practices such as field exploration, plant identification, and herbal material processing has proven more effective in fostering a holistic understanding. This method provides real-life experiences that not only enrich knowledge but also sharpen students' skills in utilizing plants. Direct interaction with plants in their natural habitats strengthens taxonomy knowledge and instills a deeper ecological awareness (Wulan et al., 2023).

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Ethnobotany also introduces values related to the preservation of culture and local biodiversity. Students who study ethnobotany become more aware of the importance of preserving rare plant species and traditional healing practices as part of cultural heritage. Thus, ethnobotany education not only provides academic benefits but also social and ecological advantages, making it a strategic tool in character education and sustainability (Putri et al., 2022; Trisnawati et al., 2023).

Studies in botanical education have introduced the concept of plant awareness, while ethnobotany has long explored related dimensions independently, such as the relationship between humans and plants in cultural, social, and medicinal contexts. However, integration or interaction between educational research and ethnobotanical studies remains very limited (Corbacho-Cuello et al., 2025; Schunko et al., 2025). Integrating ethnobotany into higher education curricula represents a strategic initiative aligned with the holistic and contextual demands of 21st-century education. Given the significant global reliance on medicinal plants, traditional medicine constitutes a vital component of contemporary healthcare systems (Nyirenda & Chipuwa, 2024). Through this approach, students can develop scientific skills, social empathy, and resilience in facing complex challenges in health and environmental fields. Therefore, it is crucial for educational institutions to develop ethnobotany-based learning models as part of relevant and transformative pedagogical innovation (Ismail et al., 2024; Suryani, 2024)

One of the significant contributions of ethnobotany education is the development of students' critical thinking skills to evaluate various alternative solutions to health or environmental problems based on the use of plants. This evaluation process involves examining scientific evidence, assessing the validity of information sources, and integrating local wisdom values. Thus, students not only learn about plant species but also enhance their ability to synthesize various information into practical solutions that are relevant to the local socio-cultural context through fieldwork (Suryani, 2024; Yani et al., 2024). Thus, incorporating ethnobotany into education has the potential to strengthen students' ecological consciousness and their comprehension of the intricate relationships between plant life, human society, and cultural practices (Suja, 2022). To ensure meaningful and lasting learning experiences in science, it is essential to structure both in-school and out-of-school learning environments around inquiry-based and investigative learning strategies (Ozkan & Topsakal, 2019).

Hands-on experience in the field boosts students' self-confidence as they are able to solve field challenges and conduct experiments independently. Through direct interaction in the field,

students undergo active learning that is both challenging and provides opportunities to build self-confidence in facing practical problems. This self-efficacy is important because it impacts motivation to learn, persistence, and overall academic success (Amin, 2022; Nurrindar & Wahjudi, 2021).

Therefore, the importance of research on the ethnobotany of *Zingiberaceae* and their utilization as a reinforcement of plant taxonomy concepts through fieldwork cannot be overlooked. Ethnobotany can be briefly explained as the knowledge possessed by residents of a region to be used to benefit from the plants around them. By integrating this research into higher education curricula, institutions not only produce graduates who are competent in scientific fields but also individuals who are critical, confident, and adaptable to face complex future challenges. This research provides a foundation for pedagogical innovation that is more relevant to the demands of the global world and local needs. Experiences in nature help students gain confidence and build relationships with the environment. This informations and skills they get, their perception of both themselves and nature, guide them through the rest of their lives for protecting the environment (Güler, 2009).

RESEARCH METHODS

This study uses a qualitative descriptive approach with an experiential learning method based on fieldwork. This approach was chosen because it provides students with direct experience in understanding biodiversity and the cultural values associated with plants, particularly the Zingiberaceae family (Ismail et al., 2024). The learning activities were conducted through field observations, species identification, ethnobotanical information collection from local communities, and literature reviews related to the pharmacological aspects and traditional values of plants.

Data collection techniques involved several methods: (1) direct observation to document the morphology of plants and the plant parts used; (2) semi-structured interviews with community leaders to obtain local knowledge about plant usage (Creswell & Creswell, 2017); and (3) literature studies from journals and academic books to confirm reported pharmacological benefits (Detia et al., 2024; Nanuayo et al., 2023). Additionally, visual documentation through field photographs was used to strengthen the validity of the data.

The data were analyzed descriptively-qualitatively by classifying plant species based on their biological functions and cultural values. The results of observations and interviews were compared with literature sources to enhance the validity of the findings (Miles et al., 2014). The analysis aimed

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to not only map the benefits of species but also link them to the importance of biodiversity conservation and local cultural preservation, in line with the goals of character education and sustainability in the modern era (Suryani, 2024).

RESEARCH RESULT

The research phase included observation, identification, and documentation of Zingiberaceae plants, along with interviews with community leaders. The results obtained were grouped based on plant names, benefits, and the parts of the plants used as medicinal plants, and classified according to their taxonomic order. These findings were then validated using available literature sources, including books, journals, and online media. The results obtained from this study are presented in Table 1 below.

Table 1. Benefits of Zingiberaceae Plants

Plant Name	Benefits	Figure of the Used Plant Part
***Alpinia galanga* Sw. (Lengkuas,Lengkueh,Laos)**	Has antimicrobial, anti-inflammatory, antioxidant, and anticancer properties, making it effective in treating various health issues, including digestive tract infections, rheumatism, skin inflammation, and also serves as a potential chemopreventive agent against certain cancers (Chudiwal et al., 2010; Ifandi & Alfiza, 2023).	
***Costus speciosus* (Koen.) J. E. Smith (Sitawa)**	Contains diosgenin, which has potential as an anti-diabetes, anticancer, and kidney disease treatment (Bauri et al., 2024; Sohrab et al., 2021).	
***Curcuma domestica* Val. (Kunyit)**	Contains curcumin, which has antioxidant, antibacterial, anticarcinogenic, and anti-inflammatory properties (Fadhilah et al., 2021; Shan & Iskandar, 2018).	

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***Curcuma mangga* Val. (Kunyit Temu)**	Used as an antipyretic, detoxifier, antimicrobial, laxative, and antioxidant (Novinovrita & Irawan, 2020; Susanti & Mahmudah, 2017).	
***Curcuma xanthorrhiza* Roxb. (Temulawak)**	Used in the treatment of digestive disorders, jaundice, leucorrhea, boosts immunity, and maintains health (Dewi et al., 2021; Syamsudin et al., 2019).	
***Etlingera elatior* (Jack) R.M. Sm (Sambung, Sabung)**	Has high antioxidant activity and is used in the treatment of skin diseases and as an anti-hyperglycemic agent for diabetes (Jabbar et al., 2019; H. S. Putri, 2021)	
***Hedychium coronarium* Koen. (Suli)**	Its compounds have anticancer, antioxidant, antihypertensive, diuretic, and antimalarial activities (Pachurekar & Dixit, 2017). Also has antioxidant and antimicrobial properties (Ray et al., 2018)	
***Kaempferia galanga* L. (Kencur)**	Used for treating diabetes, hypertension, cough, asthma, joint fractures, rheumatism, urticaria, vertigo, and intestinal injuries (Khairullah et al., 2021). Also serves as an anti-inflammatory and analgesic (Andriyono, 2019).	
***Zingiber cassumnar* Roxb (Kunyit Melai)**	Contains strong anti-inflammatory compounds, used in the treatment of muscle and joint pain (Alshiekheid et al., 2022). Also used as an analgesic, antimicrobial, anti-inflammatory, anticancer, free radical scavenger, and antimalarial (Han et al., 2021; Singh et al., 2015)	

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Zingiber officinale **Rosc. (Jahe, Sepdeh, padi-padi)**	Used for gastrointestinal protection, anticancer, and obesity prevention (Zhang et al., 2021), as well as preventing bacterial infections that cause gum inflammation and respiratory tract problems (Adjeng et al., 2024).	

Alpinia galanga (Lengkuas)

Alpinia galanga is a Zingiberaceae plant rich in bioactive compounds such as flavonoids, saponins, and essential oils. Recent studies show that galangal has antimicrobial, anti-inflammatory, antioxidant properties and has potential as a chemopreventive agent against cancer (Ifandi & Alfiza, 2023). Additionally, galangal extract plays an important role in accelerating wound healing and strengthening the immune system, making it a crucial herbal ingredient in both traditional and modern medicine formulations.

Costus speciosus (Sitawa)

Costus speciosus contains diosgenin compounds that have potential as anti-diabetes, anticancer, and kidney-protective agents. Bauri et al. (2024), showed that this compound can reduce blood glucose levels and prevent kidney damage progression. Furthermore, the use of sitawa in traditional herbal medicine has shown that this plant has adaptogenic properties that support the body's resistance to physiological stress.

Curcuma domestica (Kunyit)

Curcuma domestica has long been used both as a spice and a herbal medicine. Its main active compound, curcumin, has powerful antioxidant, anti-inflammatory, antibacterial, and anticarcinogenic effects (Fadhilah et al., 2021). Furthermore, research by ,Shan & Iskandar (2018) showed that curcumin also functions as a natural immunomodulator that enhances the body's immune response to infections and degenerative diseases.

Curcuma mangga (Kunyit Temu)

Curcuma mangga is widely known in Indonesian ethnomedicine as an antipyretic and detoxifier. According to Novinovrita & Irawan (2020), this plant contains bioactive compounds like curcuminoids and flavonoids that help combat pathogenic microorganisms. In addition, the use

of turmeric temu in traditional therapies has been proven to accelerate detoxification by improving liver function.

***Curcuma xanthorrhiza* (Temulawak)**

Curcuma xanthorrhiza is primarily used in the treatment of digestive disorders and has hepatoprotective properties. Dewi et al. (2021) mentioned that regular consumption of temulawak extract can stimulate bile secretion, assist in fat metabolism, and improve liver function. Additionally, its immunomodulatory activity supports its use in boosting the immune system in the face of modern conditions prone to infection.

***Etlingera elatior* (Kecombrang)**

Etlingera elatior has high antioxidant content, including phenols and flavonoids. Jabbar et al. (2019),found that its extract can lower blood sugar levels and protect tissues from oxidative stress. Besides being used as a food ingredient, kecombrang is also processed into topical formulations to accelerate the healing of skin wounds caused by infection.

***Hedychium coronarium* (Suli)**

Hedychium coronarium is a member of the *Zingiberaceae* family that shows a wide range of pharmacological activities. Pachurekar & Dixit (2017)revealed that the active compounds in this plant act as anticancer, antioxidant, antihypertensive, diuretic, and antimalarial agents. Additionally, the flowers of *Suli* are used in traditional medicine to reduce inflammation, accelerate tissue recovery, and improve overall vitality.

***Kaempferia galanga* (Kencur)**

Kaempferia galanga contains compounds such as ethyl p-methoxycinnamate that have anti-inflammatory and analgesic properties. Khairullah et al. (2021) demonstrated that *kaemferia galanga* can be used to treat various inflammatory conditions, from joint inflammation to bronchitis. Additionally, aromatherapy using kencur has been shown to be effective in relieving stress and improving sleep quality.

***Zingiber cassumnar* (Kunyit Melai)**

Zingiber cassumnar is a plant with the main compound cassumunarin A, which has strong anti-inflammatory properties. Alshiekheid et al. (2022) reported that the extract of this plant is effective in reducing pain in cases of osteoarthritis. Moreover, its use as a natural analgesic shows great potential for the development of modern phytopharmaceutical products.

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***Zingiber officinale* (Jahe)**

Zingiber officinale is a plant with extensive pharmacological benefits. Zhang et al. (2021) found that ginger not only protects the stomach from ulcers but also functions as an anticancer, anti-obesity, and antimicrobial agent. Interestingly, the gingerol compounds in ginger also contribute to preventing systemic inflammation, which is at the root of many degenerative diseases.

Field activities also teach the importance of medicinal plant conservation. Many species are endangered due to over-exploitation and environmental changes. By participating in fieldwork, students not only learn species identification but also develop ecological awareness about the importance of preserving natural resources for future generations (Juwita et al., 2024).

Direct interaction with local communities during field lectures enriches students' understanding of traditional knowledge related to the use of medicinal plants. This ethnobotanical knowledge is often not documented in scientific literature but is highly valuable in the development of new drug research. Therefore, field lectures serve as an important tool for documenting and appreciating local wisdom (Martin, 2010)

Overall, field lectures are an effective method that connects taxonomy theory with real-world practice, strengthens understanding of the ecological and social value of medicinal plants, and fosters a conservation mindset towards natural resources. Through this experience, students not only gain scientific knowledge but also practical competencies that will be useful in various professional fields in the future. This is illustrated in Figure 1 below.

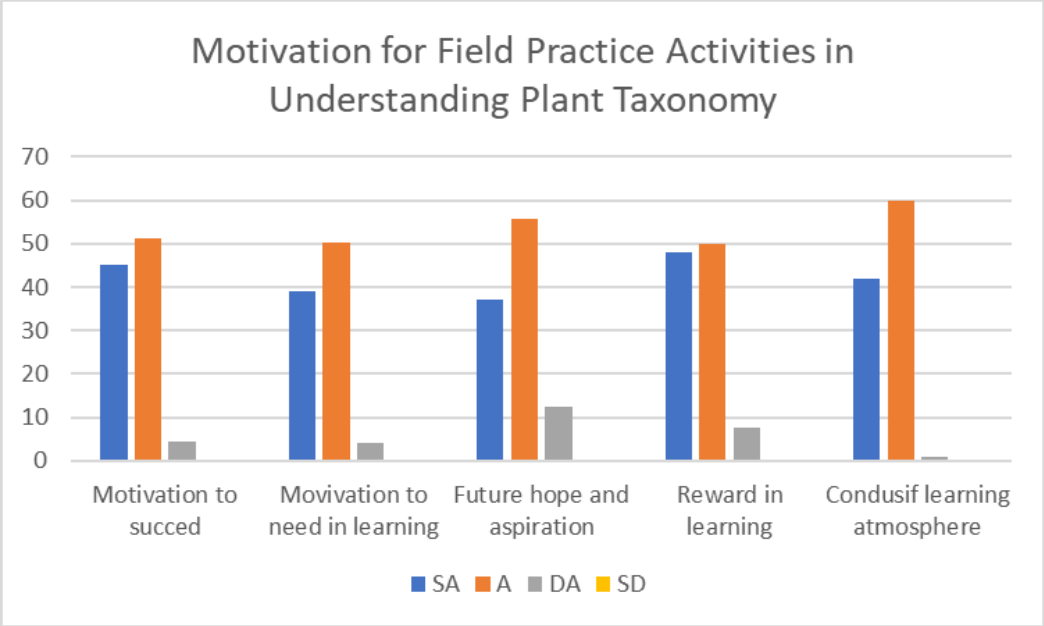

Figure 1. Motivation for Field Practice Activities in Understanding Plant Taxonomy

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In general, the medicinal plants found in the yards and gardens of the people in Kerinci Regency are from the Zingiberaceae family, particularly ginger, which is known by the local community as Sipedeh or padi-padi. Each plant in the Zingiberaceae family has its own unique characteristics and benefits in its utilization. This depends on the compounds found in the plant. The combination of taxonomic data and bioactivity test results strengthens the understanding of which plant parts are used for specific medicinal applications. The ethnobotanical study of Zingiberaceae plants and their utilization as a reinforcement of plant taxonomy concepts through fieldwork helps produce graduates who are competent in scientific fields, as well as critical, confident, and adaptable to facing complex challenges in the future.

DISCUSSION

The grouping of plants based on taxonomic hierarchy (family, genus, species) facilitates the analysis of their properties and benefits. For example, Munawaroh (2020) states that the *Zingiberaceae* family (ginger family) consists of 53 genera and 1,500 species worldwide, with the highest diversity found in tropical forests. This family is widely known as a source of medicinal plants, culinary spices, herbs, ornamental plants, and cosmetics; According to Chudiwal et al., 2010; Phumthum & Balslev, 2020, species belonging to the Zingiberaceae family have a long history of use in traditional medicine. Grouping these species within a single taxonomic family allows researchers to predict shared characteristics, particularly in terms of phytochemical composition and therapeutic potential. For example, many ginger species are known to contain essential oils and curcumin, compounds recognized for their anti-inflammatory and antioxidant activities (Chattopadhyay et al., 2004). Furthermore, certain Zingiberaceae members possess bioactive compounds that have contributed to the development of new pharmaceuticals, including gingerol from *Zingiber officinale* Roscoe (Wang et al., 2014) and a range of secondary metabolites from *Alpinia* species (Ghosh & Rangan, 2013).

Each medicinal species has its own distinct properties and plant parts that are used. For example, ginger rhizomes (*Zingiber officinale*) are generally used to relieve nausea and pain, while *Curcuma longa* is used as an anti-inflammatory agent through the compound curcumin. In the *Zingiberaceae* family, vegetative parts such as rhizomes, stems, roots, and leaves are commonly used in herbal formulations. Rahmawati & Sriyati, (2024)emphasize that the use of outdated instructional materials may hinder students from accessing current knowledge. In the context of

ethnobotany, recent discoveries related to plant utilization and environmental conservation should be incorporated into educational content to ensure its relevance and accuracy.

Using similar plants for the same or similar purposes as those of people living in different areas implies the efficacy of the plants. Research by Ifandi & Alfiza (2023) showed that the rhizome of *Alpinia galanga* is rich in alkaloids, phenols, flavonoids, and saponins, making its extract highly effective as an antibacterial agent against *Klebsiella pneumonia*. Adjeng et al. (2024) also revealed that all ginger species' extracts contain active phenolic and flavonoid compounds, with significant antioxidant, anti-inflammatory, cytotoxic, and even antiviral activities (including antidendangue properties). In the context of an Ethnobotany course, a comprehensive discussion of the benefits of Zingiberaceae plants should begin with an introduction to the diversity of species within this family and their roles in local cultures. The Zingiberaceae family, which includes plants such as ginger (*Zingiber officinale*), turmeric (*Curcuma longa*), and Javanese ginger or "temulawak" (*Curcuma xanthorrhiza*), holds significant value in traditional medicine, culinary practices, and cultural rituals across various regions in Indonesia (Handayani et al., 2022). For instance, in Lampung, communities use the rhizomes of Zingiberaceae plants to treat digestive issues and as essential ingredients in traditional dishes.

Subsequently, it is crucial to examine the pharmacological benefits of Zingiberaceae plants based on recent scientific research. Studies have shown that bioactive compounds found in these rhizomes exhibit antimicrobial, anti-inflammatory, and antioxidant properties. For example, gingerol in ginger and curcumin in turmeric have demonstrated effectiveness in treating inflammation and mild infections (Diah et al., 2024; Yit & Zainal-Abidin, 2024). Ginger has also shown potential as an antioxidant and antidiabetic agent (Alolga et al., 2022). These findings reinforce traditional uses of Zingiberaceae plants and highlight their potential for the development of herbal-based products.

In the context of an Ethnobotany course, a comprehensive discussion of the benefits of Zingiberaceae plants should begin with an introduction to the diversity of species within this family and their roles in local cultures. The Zingiberaceae family, which includes plants such as ginger (*Zingiber officinale*), turmeric (Curcuma longa), and Javanese ginger or "temulawak" (*Curcuma xanthorrhiza*), holds significant value in traditional medicine, culinary practices, and cultural rituals across various regions in Indonesia (Handayani et al., 2022). For instance, in Lampung,

communities use the rhizomes of Zingiberaceae plants to treat digestive issues and as essential ingredients in traditional dishes.

Field lectures play an important role in supporting students' understanding of plant taxonomy, especially in the context of medicinal plant utilization. Taxonomy learning in the classroom is often theoretical, making it difficult for students to connect scientific concepts with real-world examples in nature. Through field lectures, students can directly observe plant morphology, compare species, and understand biodiversity in natural ecosystems (Prance, 2001).

Moreover, it is considered that students will love and protect nature provided that they develop a positive attitude towards the plan

In addition to reinforcing theory, field lectures provide practical experience in recognizing medicinal plants commonly used in everyday life. Plants like *Curcuma longa* (turmeric) and *Andrographis paniculata* (sambiloto) hold significant value in both traditional and modern health practices. By observing their natural habitats and morphological characteristics directly, students gain a deeper understanding of the relationship between plant structure and its pharmacological benefits (Balick & Cox, 1996). The results of this research may serve as valuable input for the development of university level science curricula that incorporate local wisdom (Fathir et al., 2021; Helmina & Hidayah, 2021; Wahdina et al., 2021) Additionally, the research has the potential to inspire further investigations in the biological sciences particularly in ethnobotany by encouraging the documentation of Indonesia's rich biodiversity as a reflection of its abundant natural resources.

Fieldwork plays a critical role in bridging theoretical knowledge with practical application in Ethnobotany education. Through visits to local gardens or traditional markets, students can directly identify Zingiberaceae species, observe traditional processing methods, and engage with local communities regarding their uses. Such experiential learning deepens students' understanding of the relationships between people and plants within ecological and cultural contexts (Pitopang et al., 2019). Furthermore, field studies provide students with opportunities to observe the conservation status and sustainability of Zingiberaceae species.

Finally, integrating traditional knowledge with scientific research in the Ethnobotany curriculum can significantly enrich student insight. Understanding the pharmacological benefits of Zingiberaceae supported by scientific evidence not only fosters appreciation for indigenous wisdom but also promotes the sustainable development of herbal products. Thus, ethnobotanical

education provides not only academic enrichment but also contributes to cultural preservation and environmental stewardship.

CONCLUSION

This study demonstrates that ethnobotanical research implemented through fieldwork has a positive impact on strengthening plant taxonomy concepts, understanding conservation values, and internalizing local wisdom. Several species findings, such as *Alpinia galanga*, *Costus speciosus*, *Curcuma domestica*, *Curcuma mangga*, *Curcuma xanthorrhiza*, *Etlingera elatior*, *Hedychium coronarium*, *Kaempferia galanga*, *Zingiber cassumunar*, and *Zingiber officinale*, along with their benefits in the context of traditional health and environmental sustainability, were identified. Additionally, real-life field experiences enrich theoretical understanding and build deeper ecological awareness. The implications of this research suggest that ethnobotany-based learning through practice should be more widely adopted in higher education curricula, particularly in biology and environmental science fields.

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