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Exploring the Potential of Araceae in Penggaron Forest for Traditional Medicine and Biodiversity Conservation

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ABSTRAK

Hutan Penggaron memiliki keanekaragaman hayati yang tinggi, namun informasi mengenai keterkaitan antara keanekaragaman Araceae, kandungan fitokimia, dan potensi pemanfaatannya sebagai sumber obat tradisional dalam kerangka konservasi ekosistem masih sangat terbatas. Penelitian ini bertujuan untuk mengisi celah tersebut dengan mendokumentasikan keanekaragaman Araceae, menganalisis kandungan fitokimia, dan mengevaluasi peran ekologis serta pemanfaatannya oleh masyarakat lokal. Langkah tersebut ditempuh melalui pendekatan terpadu yang menyatukan inventarisasi taksa, skrining laboratorium, dan eksplorasi pengetahuan tradisional guna memetakan potensi kelompok talas-talasan ini dalam program konservasi berbasis sumber daya hayati. Metode yang digunakan mencakup pengambilan sampel tanaman, identifikasi spesies, analisis fitokimia, serta wawancara dengan masyarakat setempat. Sebanyak sepuluh spesies Araceae berhasil diidentifikasi. Analisis laboratorium mengonfirmasi akumulasi universal senyawa bioaktif utama berupa alkaloid dan flavonoid pada seluruh sampel spesies yang diuji. Selain itu, terdeteksi pula variasi distribusi senyawa metabolit sekunder pendukung meliputi tanin, saponin, fenolik, dan terpenoid yang secara biokimia berpotensi kuat sebagai agen antiinflamasi, antimikroba, dan antioksidan alami. Beberapa spesies juga berkontribusi terhadap konservasi ekosistem melalui pengendalian erosi, penyediaan habitat mikro, serta pemeliharaan stabilitas tanah. Studi etnobotani menunjukkan adanya kesenjangan pengetahuan di masyarakat lokal yang pemanfaatannya masih timpang, didominasi oleh komoditas tanaman hias luar kawasan dan pengolahan pangan subsisten yang sangat sederhana tanpa menyadari nilai terapeutik taksa liar setempat. Temuan ini menunjukkan bahwa kelompok Araceae di Hutan Penggaron memiliki potensi strategis sebagai sumber biofarmaka alternatif sekaligus bertindak sebagai bioindikator sensitif untuk mendukung konservasi keanekaragaman hayati lantai hutan, sehingga sangat layak dikembangkan sebagai aset sumber daya hayati yang berkelanjutan.

Kata kunci: Araceae, konservasi sumber daya hayati, peran ekologis, Hutan Penggaron, profil fitokimia, obat tradisional.

ABSTRACT

Penggaron Forest possesses high biodiversity; however, information regarding the interconnectedness between Araceae diversity, phytochemical constituents, and their potential utilization as a source of traditional medicine within the framework of ecosystem conservation remains highly limited. This study aims to fill this gap by documenting Araceae diversity, analyzing phytochemical constituents, and evaluating their ecological roles along with their utilization by local communities. This objective was achieved through an integrated approach that synthesizes taxonomic inventory, laboratory screening, and the exploration of traditional knowledge to map the potential of this aroid group within bioresource-based conservation programs. The methods employed include plant sampling, species identification, phytochemical analysis, and interviews with the local community. A total of ten Araceae species were successfully identified. Laboratory analyses confirmed a universal accumulation of primary bioactive compounds, namely alkaloids and flavonoids, across all tested species specimens. Furthermore, variations in the distribution of supporting secondary metabolites—including tannins, saponins, phenolics, and terpenoids—were detected, which biochemically exhibit strong potentials as natural anti-inflammatory, antimicrobial, and antioxidant agents. Several species also contribute to ecosystem conservation through erosion control, microhabitat provisioning, and maintaining soil stability. Ethnobotanically, a distinct knowledge gap persists among the local community, whose utilization remains lopsidedly focused on external ornamental plant trading and rudimentary food preparation, completely leaving the therapeutic values of local wild aroids unrecognized. These findings demonstrate that the Araceae group in Penggaron Forest possesses strategic potential as a source of alternative biopharmaceuticals while simultaneously serving as a sensitive bioindicator to support understory biodiversity preservation, thereby warranting further development as a sustainable biological resource asset.

Keywords: Araceae, bioresource conservation, ecological role, Penggaron Forest, phytochemical profiling, traditional medicine.

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1. INTRODUCTION

Traditional Indonesian medicine, which is still used today, is considered safer and more economical than modern medicine. Medicinal plants contain phytochemicals such as flavonoids, alkaloids, terpenoids, and saponins, which have the potential to be immunomodulatory, antioxidant, and antibacterial agents. Cultural modernization risks losing this knowledge, making documenting and utilizing local plant diversity important (Sianipar, 2021). Research in the Journal of Ethnopharmacology identified 554 phytochemicals from 33 plant species used by the Tengger community, with pharmacological activities such as anti-inflammatory and antimicrobial (Nugraha et al., 2022). In addition, a review in Frontiers in Pharmacology suggests medicinal plants' potential in managing metabolic syndrome, although further research is needed for clinical validation (Arozal et al., 2020). Therefore, it is important to preserve local plant diversity to maintain cultural heritage and public health (Adiyasa & Meiyanti, 2021).

Penggaron Forest, located in Semarang Regency, has promising biodiversity that needs to be studied. This forest, although known as a tourist forest, harbors naturally growing flora, such as shrubs and herbs including species from the Araceae tribe (Marsely et al., 2024).

Initial observations showed the presence of several wild Araceae species along the forest path, which are commonly known as ornamental plants. However, other potentials of these plants, such as their use as traditional medicinal ingredients, have not been widely studied. This indicates a research gap that needs to be bridged in order to comprehensively understand the ecological, pharmacological, and cultural values of Araceae in Penggaron Forest.

The Araceae family is a highly diverse group of monocotyledonous plants, comprising about 2,500-3,700 species distributed across tropical regions including the Americas, Africa, and Southeast Asia (Mayo et al., 1997). More than 800 species of Araceae have economic value, serving as ornamental plants, food sources, and traditional medicines. For example, taro (*Colocasia esculenta* (L.) Schott) is the most widely cultivated Araceae species and an important food source for approximately 10% of the world's population (Boampong et al., 2020; Kaushal et al., 2015). In addition to being consumed by humans, taro tubers are also used as animal feed.

The characteristic broad leaves of Araceae with various shapes and beautiful patterns, make them popular as ornamental plants. Some species, such as Aglonema and other cultivars, have high economic value due to their aesthetic appeal. On the other hand, this plant group also has significant pharmacological potential. For example, the *Acorus calamus* and *Typhonium flagelliforme* have long been used to treat diarrhea and malaria, and for their chemopreventive properties. The medicinal use of Araceae has been documented since ancient times, such as using Acorus calamus in Egypt, China, and India. *Amorphophallus konjac* has been utilized in China since 210 BC for the treatment of wounds, tumors, and skin diseases (Arbain et al., 2022).

In Indonesia, various species of Araceae, comprising 43 records from 36 species and 23 genera, are known to be used in traditional medicine, particularly for treating malaria and other diseases. Neotropical *Philodendron* Schott and *Anthurium* Schott are used to treat malaria, fever, liver problems, and headaches, while leaf extracts of as chemopreventive and anti-allergic agents for bowel cancer (Frausin et al., 2015; Korinek et al., 2016).

Although several documented cases of the medicinal use of Araceae exist, scientific information on their clinical, toxicological, and pharmacological properties is still limited. Through an integrated approach, this study offers scientific novelty in uncovering the correlation between Araceae species richness, phytochemical profiles, and their ecological significance in Penggaron Forest. The primary focus of this study is to map the pharmacological potential of these local taxa as traditional medicine candidates while simultaneously identifying their environmental-saving functions. The outcomes of this exploration are expected to strengthen the database for plant-based biopharmaceutical development and reinforce the urgency of protecting understory vegetation in the region.

2. METHODOLOGY

2.1. Study Area

This study was conducted in Penggaron Forest, located in Ungaran District, Semarang Regency, Central Java (Figure 1). This site was selected due to its rich biodiversity, particularly within the Araceae family, which remains underrepresented in scientific research. Although Penggaron Forest serves as a tourist area, it still preserves wild flora with significant potential as sources of traditional medicine.

2.2. Sampling

Sampling was conducted purposively and systematically along designated forest trails. Each encountered Araceae species was recorded and morphologically documented, while unidentified specimens were collected for further laboratory analysis. Sample sizes were determined based on individual plant availability at the site and the representativeness of each species across various observation points.

2.3. Species Identification

Species identification was performed at the Plant Structure Laboratory, Faculty of Science and Technology, UIN Walisongo Semarang. The specimens were identified utilizing determination keys and taxonomic literature, as well as through comparisons with established herbarium specimens. Successfully identified taxa were subsequently classified to the genus and species levels.

Figure 1. Research Location in Penggaron Forest, Ungaran District, Semarang Regency, Central Java

2.4. Phytochemical Analysis

Phytochemical analysis was carried out at the STIFAR Laboratory, Semarang, to determine the bioactive compound profiles. The procedure comprised the following steps:

1. Extraction: Plant samples were macerated using standardized solvents.
2. Evaporation and Drying: The resulting extracts were evaporated and dried to isolate the targeted compounds.
3. Phytochemical Screening: The presence of alkaloids, flavonoids, tannins, saponins, and terpenoids was assessed using validated qualitative and quantitative methods, including spectrophotometry. The screening outcomes were then analyzed to evaluate their pharmacological potentials.

2.5. Interview Methods

Interviews were conducted with 10 local informants who were selected purposively based on their expertise in medicinal plants. A semi-structured interview guide was utilized to gather data regarding the utilization of Araceae in traditional medicine, cultural practices, and local rituals.

2.6. Data Analysis

1. Phytochemical Data: Screening outcomes were descriptively analyzed to determine the types of bioactive compounds and their corresponding pharmacological potentials.
2. Morphological Data: Plant morphological characteristics were analyzed descriptively and compiled for each identified species.
3. Interview Data: Information gathered from the interviews was evaluated using thematic analysis. The data were coded, categorized, and synthesized to identify patterns of plant utilization and community traditional practices.

3. RESULT AND DISCUSSION

3.1. The Diversity of Araceae in Penggaron Forest

Based on the research findings, Penggaron Forest exhibits a relatively high diversity of Araceae, with 10 species recorded (Table 1). These species comprise *Dieffenbachia seguine*, *Dieffenbachia oerstedii*, *Homalomena cordata*, *Colocasia esculenta*, *Colocasia esculenta* var. *antiquorum*, *Colocasia gigantea*, *Philodendron hederaceum*, *Syngonium auritum*, *Syngonium podophyllum*, and *Caladium bicolor*. The presence of these taxa indicates that the forest area still provides a highly suitable habitat for the growth of various members of the aroid family. Furthermore, the variations in leaf morphology observed—ranging from elliptic, ovate, and peltate to palmate and lobed forms—reflect a high degree of morphological diversity within the family. This structural variation serves not only as a functional adaptation to diverse environmental conditions but also contributes to their substantial value as sought-after ornamental plants (Croat & Ortiz, 2020; Wilyasari et al., 2020).

Table 1. Araceae species in Penggaron Forest

No	General Name	Scientific Name
1	Dumb Cane	*Dieffenbachia seguine* (Jacq.) Schott
2	Oersted's Dumb Cane	*Dieffenbachia oerstedii*
3	Heart Leaf Homalomena	*Homalomena cordata* Schott
4	Taro	*Colocasia esculenta* (L.) Schott
5	Taro	*Colocasia esculenta* (L.) Schott var. antiquorum
6	Giant Elephant Ear (Giant Taro)	*Colocasia gigantea*
7	Heartleaf Philodendron	*Philodendron hederaceum* (Jacq.) Schott
8	Arrowhead Vine	*Syngonium auritum* (L.) Schott
9	Arrowhead Plant	*Syngonium podophyllum* Schott
10	Heart of Jesus (Angel Wings)	*Caladium bicolor* (Ait.) Vent.

Although species richness is high, the spatial distribution pattern of each species is not uniformly spread across all observation sites. *Homalomena cordata* was the most frequently encountered species during the study. This plant is widely distributed throughout various forest zones, particularly dominating areas characterized by high moisture, deep shade, sufficient water availability, and protection from direct sunlight exposure. The defining characteristics of this species lie in its heart-shaped leaf morphology and a distinctive aroma emitted from both the stem and leaf blades. The high abundance of *H. cordata* is strongly suggested to be linked to its superior physiological capacity to adapt to variations in soil conditions and moisture gradients (Hong et al., 2015; Irsyam et al., 2023).

Conversely, *Caladium bicolor* exhibits a contrasting temporal response, characterized by a significant population decline during the dry season. This phenomenon underscores the high dependency of this species—distinguished by its light green leaves with striking white patterns—on moist environments. Such a response confirms that water availability acts as a primary limiting factor regulating the abundance of the Araceae family in Penggaron Forest (dos Santos et al., 2022; Fleta-Soriano and Munné-Bosch, 2016). Distinct adaptation patterns are also observed in other species within this area. For instance, the populations of *Dieffenbachia seguine* and *Dieffenbachia oerstedii* remain stable, sustained by a habitat that provides year-round shade. Beyond their ecological adaptations, both species possess high aesthetic value; *D. seguine* features light green leaves with white blotches, whereas *D. oerstedii* is characterized by dark green leaves with distinctive white midribs (Croat, 2004). These exquisite leaf morphological characteristics are precisely what render both species highly popular as ornamental plants (Henny, 1985).

Colocasia esculenta and *Colocasia esculenta* var. antiquorum are found in quite large numbers, especially in areas close to water sources. Its large shield-shaped leaves and stems with high water content allow this species to survive in relatively wet environmental conditions (Ezeabara et al., 2015). The tubers are commonly consumed by local people, as in many other regions of Indonesia (Oktavianingsih et al., 2017). The antiquorum variety has a difference in the color of the leaf stalks which tend to be darker with purple leaf veins (Maretta et al., 2020; Netam et al., 2022).

The synthesis of these mapping results indicates that the local distribution of the Araceae family in Penggaron Forest is governed more by microhabitat fluctuations than by the total area of the forest itself. Ecological factors such as soil moisture, light penetration intensity, and the canopy cover percentage of dominant trees serve as the primary determinants for the presence of each species on the forest floor. Although the total area of Penggaron Forest is relatively limited compared to other conservation forests or national parks, the well-preserved integrity of the understory habitat has proven capable of sustaining the survival of various Araceae species, each exhibiting its respective ecophysiological characteristics. Consequently, strategies aimed at maintaining forest floor microhabitat conditions—particularly canopy shade availability and soil moisture—constitute a crucial aspect of biodiversity conservation programs in this region.

3.2. Phytochemical Profiling and Ethnopharmacological Potential of the Araceae in Penggaron Forest

In Indonesia, the aroid family (Araceae) has long been integrated into the daily lives of local communities, serving as alternative food sources, ornamental plants, and essential elements in traditional rituals. Species such as *Colocasia esculenta*, *Amorphophallus paeoniifolius*, and *Xanthosoma sagittifolium* exemplify taxa frequently consumed as rice substitutes. In Bali, certain Araceae species even serve as critical components in religious ceremonies (Asih & Kurniawan, 2019b; Mutaqin et al., 2020b). Furthermore, ancient medical records from Egypt, China, and India document that plants from this family have long been utilized to treat wounds and dermatological diseases(Asih & Kurniawan, 2019b; Sakti, 2021). In its development, active compounds from the genus *Amorphophallus* have been extensively researched, as they are proven to exhibit anticancer and antidiabetic activities, as well as the potential to alleviate gastric inflammation (Suyoko et al., 2024; Wahidah et al., 2021). Similarly, the *Alocasia* spp. group possesses a well-established track record in traditional medicine, long recognized for its capacity to treat various health disorders (Rahman et al., 2011).

To evaluate this potential at a local scale, laboratory testing was conducted on the ten Araceae species documented in Penggaron Forest (Table 1). Based on the phytochemical screening presented in Table 2, all tested species turned positive for alkaloid and flavonoid compounds. The ubiquitous presence of these two primary secondary metabolites across all samples serves as a robust baseline indication that the aroids in this region hold significant potential for development as herbal medicine raw materials. Biomedically, alkaloids are widely recognized for their active properties as anti-inflammatory, antimicrobial, and anticancer agents (Adamski et al., 2020), while flavonoids play a critical role as antioxidants in neutralizing free radicals (Agati et al., 2020; Arbain et al., 2022). This potential is notably evident in the genus *Dieffenbachia*. The laboratory outcomes indicate that *Dieffenbachia seguine* and *Dieffenbachia oerstedii* share an identical profile of alkaloids, flavonoids, and terpenoids. The distinction lies strictly in their minor compounds, where *D. seguine* contains tannins, whereas *D. oerstedii* tests positive for saponins. These biochemical characteristics render both *Dieffenbachia* species compelling candidates for deeper investigation, particularly regarding their toxicity safety thresholds and specific pharmacological effects (Ajuru et al., 2018).

Beyond the aforementioned primary compounds, the presence of tannins, saponins, phenolics, and terpenoids in several species further enhances the functional value of these plants. Tannins and saponins themselves are commonly utilized as natural antiseptics, and saponins are additionally documented to stimulate the immune system. This comprehensive chemical profile is prominently observed within the genus *Colocasia*. The species *Colocasia esculenta* and its *antiquorum* variety share an identical composition consisting of alkaloids, flavonoids, tannins, saponins, and phenolics. Conversely, *Colocasia gigantea* lacks phenolic content, which is replaced by terpenoids. The co-occurrence of saponins and flavonoids within the genus *Colocasia* is strongly suggested to reinforce why these tubers are safe and health-promoting when consumed regularly by local residents. A similarly rich combination of compounds is encountered in *Homalomena cordata*. Based on the data in Table 2, this taxon stands as the only species to turn concurrently positive for phenolics, terpenoids, and tannins. In modern industrial sectors, the synergy of these three active substances is highly sought after as raw materials for both the cosmetic and pharmaceutical industries (Parham et al., 2020; Silletta et al., 2024; Sun & Shahrajabian, 2023).

From a plant ecology perspective, these phytochemical substances are fundamentally produced as a survival strategy in the wild (Al-Khayri et al., 2023). In the case of *H. cordata*, which dominates wet areas, its phenolic and terpenoid content functions to maintain cellular stability against environmental stress. Conversely, in other species, the production of these secondary metabolites typically surges when confronting climatic pressures, such as the dry season in Penggaron Forest, while simultaneously serving as a natural shield against herbivore attacks or pathogens(Divekar et al., 2023; War et al., 2012).

Crucially, the phytochemical profiling of the ten Araceae species in Penggaron Forest demonstrates a close interconnectedness between environmental adaptation functions and their pharmacological potential. These data serve as an important baseline for future pharmaceutical research based on local biodiversity, while simultaneously enhancing the conservation value of the Penggaron Forest area itself.

3.3. Ecological Significance and Conservation Implications of Araceae in Penggaron Forest

The occurrence of 10 Araceae species in Penggaron Forest reflects not only the taxonomic richness of the area but also the spatial adaptation of these species to heterogeneous forest microhabitats. Based on species abundance, *Homalomena cordata* was the dominant species, occurring predominantly in the forest understory. Its high abundance is likely associated with its heart-shaped leaves and preference for moist forest-floor habitats, which is consistent with the general ecological characteristics and life-form diversity of understory Araceae in tropical forests (Boyce, 1995; Croat, 1988). This capability contrasts sharply with *Caladium bicolor*, which exhibits pronounced temporal fluctuations. The drastic population decline of *C. bicolor* during the dry season indicates that surface water availability in Penggaron Forest acts as a primary limiting factor for the survival of specific species within this family. Such characteristics reinforce that the distribution patterns and functional contributions of the Araceae family are heavily influenced by local environmental gradients and the presence of climate-sensitive species (Croat & Ortiz, 2020; Jain et al., 2014).

Functionally, this variation in interspecific tolerance forms a complementary ecosystem defense system throughout the year. When sensitive species like *Caladium bicolor* enter a temporal dormancy phase during dry spells to minimize water loss, populations of *Dieffenbachia seguine* and *Dieffenbachia oerstedii* remain stable, acting as an ecological buffer. These two *Dieffenbachia* species sustain the microclimate moisture of the forest floor due to their long-term adaptation to year-round shaded locations (Croat, 2004). Through high water-use efficiency mechanisms within their succulent stem tissues, these stable understory taxa simultaneously suppress extreme soil evapotranspiration rates on the forest floor during hot weather. This phenomenon underscores a functional division of labor among local Araceae taxa, where the populational decline of one species is compensated for by the resilience of another to maintain the hydrological functions and microclimatic stability of Penggaron Forest (Croat, 2004).

In addition to these hydro-physical adaptations, the resilience of the Araceae family in Penggaron Forest is heavily reinforced by a biochemical defense system. The production of phytochemical compounds such as alkaloids, flavonoids, and terpenoids detected across all species in this area (Table 2) functions actively as a plant chemical defense machinery to confront natural environmental pressures (Al-Khayri et al., 2023). The accumulation of these bioactive compounds, particularly alkaloids and saponins, is commonly synthesized by the aroid group to serve as natural pest controllers while simultaneously providing protection against opportunistic herbivores in the wild.(Adamski et al., 2020; Bouabdallah et al., 2023; Maatalah et al., 2012). Furthermore, the diversity of phytochemical compounds within fine root tissues plays a critical role in upscaling the tolerance of aroid communities against both abiotic and biotic stresses under various extreme weather conditions (Zhang et al., 2024).

Beyond physiological adaptations, the physical contribution of local Araceae is highly crucial to the mechanical stability of terrains in Penggaron Forest, which features sloping topographies vulnerable to landslides. Massive species like *Colocasia gigantea* and dense vegetation covers like *H. cordata* possess fibrous root architectures that intensively bind topsoil aggregates. Furthermore, the broad leaf canopy of *C. gigantea* serves to intercept the kinetic energy of rainfall before reaching the ground, effectively mitigating soil erosion rates on slopes (Cao et al., 2023). These dense plant structures simultaneously provide sheltered microhabitats and critical food sources—in the form of fruits or seeds—for birds, insects, and small mammals, which in turn sustains the continuity of the local food web (Boyce, 1995; Croat, 1988; Fernandez Barrancos et al., 2019). The presence of this understory herb community also serves as a vital indicator for habitat conservation; the loss of Araceae components or the absence of local cultivation and utilization in Central Java frequently signals severe habitat degradation and risks of local population extinction that demand rigorous conservation interventions (Fernandez Barrancos et al., 2019; Krömer et al., 2019; Wahidah et al., 2022).

Given its complex role in maintaining soil stability, sustaining the microclimate, and offering extensive pharmacological potential, the population fluctuations of the Araceae family can be proposed as a sensitive bioindicator to monitor ecosystem health in Penggaron Forest (Chen et al., 2007). Conservation efforts in this area can no longer focus exclusively on the overstory tree vegetation; instead, they must actively integrate the protection of understory plant communities, such as Araceae, as a key component in securing long-term forest floor ecological stability to sustain tropical biodiversity sustainably (Fernandez Barrancos et al., 2019; Jain et al., 2014).

Table 2. Phytochemical Content of 10 Araceae Species in Penggaron Forest

No	Species	Alkaloid	Flavonoid	Tannin	Saponin	Phenolic	Terpenoid
1	*Dieffenbachia squine* (Jacq.) Schott	+	+	+	-	-	+
2	*Dieffenbachia oerstedii*	+	+	-	+	-	+
3	*Homalomena cordata* Schott	+	+	+	-	+	+
4	*Colocasia esculenta (*L.) Schott	+	+	+	+	+	-
5	*Colocasia esculenta* (L.) Schott var. antiquorum	+	+	+	+	+	-
6	*Colocasia gigantea*	+	+	+	+	-	+
7	*Philodendron hederaceum* (Jacq.) Schott	+	+	-	+	-	+
8	*Syngonium auritum* (L.) Schott	+	+	+	+	-	-
9	*Syngonium podophyllum* Schott	+	+	-	-	-	+
10	*Caladium bicolor* (Ait.) Vent.	+	+	+	+	+	-

'+' indicates presence, '-' indicates absence

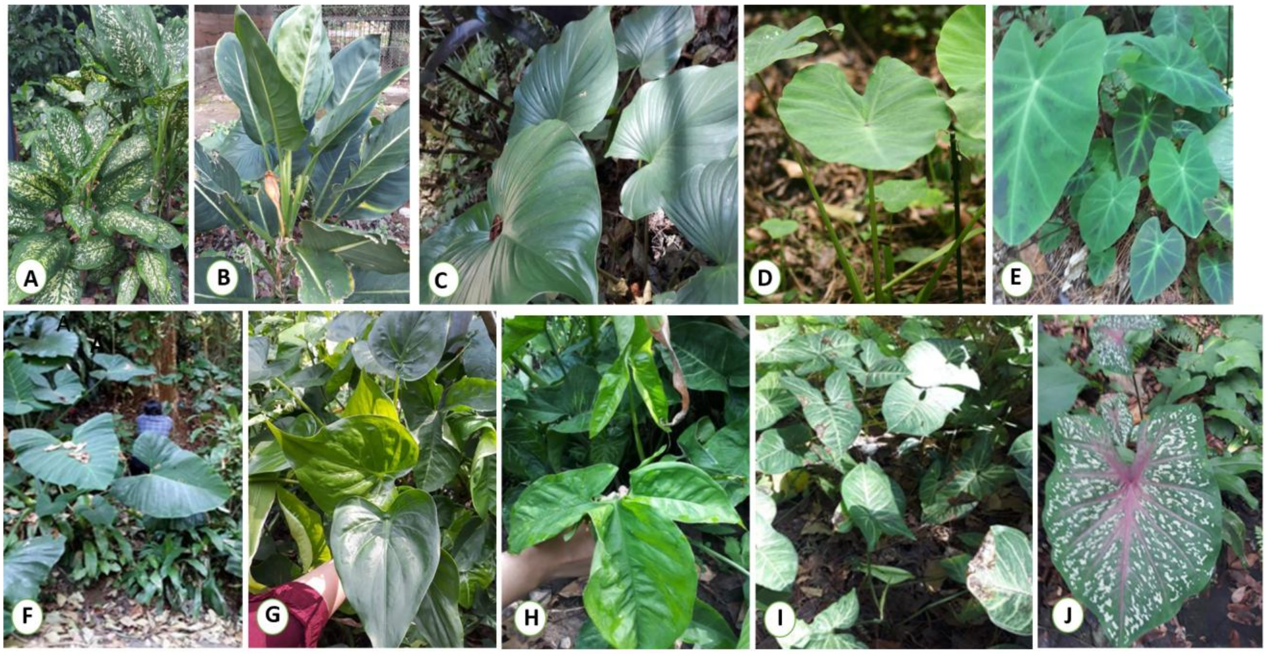

Figure 2. Araceae Species in Penggaron Forest*:* (A) *Dieffenbachia seguine* (Jacq.) Schott, (B) *Dieffenbachia oerstedii,* (C) *Homalomena cordata* Schott, (D) *Colocasia esculenta* (L.) Schott, (E) *Colocasia esculenta* (L.) Schott var. antiquorum, (F) *Colocasia gigantea*, (G) *Philodendron hederaceum* (Jacq.) Schott, (H) *Syngonium auritum* (L.) Schott, (I) *Syngonium podophyllum* Schott, (J) *Caladium bicolor* (Ait.) Vent

3.4. The Potential and Utilization of Araceae by the Communities Surrounding Penggaron Forest

The utilization patterns of the Araceae family among local communities surrounding Penggaron Forest display highly utilitarian characteristics, focusing predominantly on the commercial ornamental plant sector and the procurement of alternative food sources from specific species. The visual appeal of their leaf morphology and the diversity of their growth habits render several local species in this region highly viable for domestic yard cultivation. Based on the documented species (Table 1), taxa such as *Philodendron hederaceum*, *Syngonium auritum*, *Syngonium podophyllum*, and *Caladium bicolor* possess exceptional aesthetic qualities in their foliage. The presence of these plants extends beyond a mere decorative function to beautify residential yards; rather, they hold strategic economic value as high-demand market commodities. This trend aligns with current market realities, where exotic Araceae varieties and foliage plants demonstrate immense economic potential as promising commodities with substantial commercial value across both local and international trade networks (Rahmadani & Santoso, 2025).

Closer analysis, however, reveals an ethnobotanical disconnect between the wild potential inside the forest and the actual cultivation preferences of the community. Only a negligible fraction of the indigenous Araceae species native to Penggaron Forest has been intensively adopted as domestic ornamental plants by local residents. The vast majority of the community prefers to cultivate or purchase hybrid cultivars imported from outside the region, which are already firmly established in the commercial nursery market. This phenomenon indicates an underutilized domestication potential. The ten indigenous Araceae species documented within Penggaron Forest—including the taxa *Dieffenbachia seguine* and *Dieffenbachia oerstedii*—actually possess substantial prospects for further development through independent domestication or strategic promotion as alternative ornamental plants with competitive commercial value, without overexploiting their natural habitats.

Regarding dietary needs, the community surrounding Penggaron Forest displays a consumption pattern that remains predominantly subsistent and restricted to a few corm-bearing species. This utilization relies on species such as *Colocasia esculenta*, and *Colocasia esculenta* var. *antiquorum* (Table 1), which are typically processed into simple household dishes. The limitations in culinary innovation are evident from their monotonous processing methods, where the corms are merely boiled or fried into traditional chips. Conversely, in terms of nutritional profiles, the corms of *C. esculenta* and its varieties represent the most prominent root crops within the Araceae family due to their robust chemical composition and verified nutritional benefits, making them highly valid choices for enhancing nutritional value and diversifying modern food product technologies (Calle et al., 2021). By way of comparison, the utilization of corms from the genus *Amorphophallus*—which has long served as an alternative carbohydrate source in several other regions of Central Java—mirrors this limited local pattern, as its broader utilization remains locked within traditional seasonal cycles and has yet to be optimized into innovative, high-value processed food derivatives (Mutaqin et al., 2020a; Dinalhaq et al., 2023;Wahidah et al., 2021).

A distinct divergence in ethnobotanical interactions is also evident within the dimensions of custom, culture, and religious rituals, where the potential for spiritual utilization has not been explored by the communities surrounding Penggaron Forest using the existing local species. This condition contrasts sharply with cultural patterns observed in other regions, such as Bali. In Hindu-Balinese traditions, several species identical to the findings at this research site—such as *Colocasia esculenta*, *Colocasia gigantea*, *Homalomena cordata*, and *Caladium bicolor*—have long been integrated into various customary rituals as symbols of fertility, spirituality, and cosmic protection in the form of ceremonial offerings (Asih & Kurniawan, 2019a; Sujarwo et al., 2020). The absence of this magico-religious dimension in Penggaron indicates that the local community maintains a secular and purely functional relationship with the forest floor flora. This cultural divergence actually opens substantial opportunities for culture-based education and public awareness campaigns, enabling the Penggaron community to elevate the eco-functional narratives of this aroid group into the contexts of educational tourism and sustainable cultural attractions.

Beyond their utility as ornamental and food plants, the Araceae family harbors extensive pharmacological potential as traditional medicine, a health dimension that remains unrecognized by the communities surrounding Penggaron Forest. In various countries with rich histories of ancient medicine, such as Egypt, China, and India, plants from the Araceae family have been applied for centuries in traditional healing systems to treat open wounds, tumors, and various dermatological diseases (Chen et al., 2007). This local knowledge gap represents a missed ethnopharmacological opportunity. When linked to the local phytochemical screening results in Penggaron Forest—which demonstrate a stable presence of alkaloids and flavonoids across all samples, including the dominant species *H. cordata*—these laboratory data provide a valid scientific baseline for the community to initiate the development of local wisdom-based herbal medicine.

Taken together, the current utilization patterns of Araceae surrounding Penggaron Forest remain heavily lopsided, dominated by external ornamental plant trading and rudimentary food preparation. Ample room remains to optimize the cultural, economic, and therapeutic values of these ten species. Community education programs focusing on post-harvest detoxification techniques to remove calcium oxalate (acridity) from wild corms, publicizing medicinal efficacy based on the current phytochemical data, and implementing community-based cultivation training will unlock novel economic streams while simultaneously supporting the success of biodiversity conservation strategies for the forest floor ecosystem.

4. CONCLUSION

This study concludes that Penggaron Forest harbors a significant diversity of the Araceae family, with ten indigenous species identified across the forest floor structure. Ecologically, this diversity shapes dynamic microhabitat adaptation patterns throughout the year; stress-tolerant taxa like *Homalomena cordata* maintains the stability of the understory microclimate, whereas sensitive species like *Caladium bicolor* undergo temporal population fluctuations driven by dry season constraints. Furthermore, the physical-functional traits of *Colocasia gigantea* and *H. cordata* prove crucial in mitigating topsoil erosion on sloping terrains. On a laboratory scale, phytochemical screening confirms a universal presence of bioactive alkaloids and flavonoids across all species, with the distribution of secondary metabolites (tannins, saponins, phenolics, and terpenoids) varying among taxa as a natural chemical defense machinery. Ethnobotanically, a distinct usage gap persists among the local community, whose practices remain focused on trading introduced ornamental plants and rudimentarily processing subsistent food sources, leaving the extensive therapeutic values of these ten local species unrecognized. Consequently, these findings not only unlock novel avenues for local wisdom-based herbal medicine development but also serve as a robust scientific baseline to shift conservation priorities in Penggaron Forest toward the active, sustainable preservation of understory plant communities.

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