

# Density of Araceae in the Saluopa Waterfall Tourism Area, Wera Village, Poso Regency

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## Abstract

Araceae is a group of herbaceous plants that grow on land (terrestrial), in water (aquatic), and by climbing on trees (epiphytic). Araceae plants are widely known by the community as ornamental plants commonly found in home gardens; however, they can also be found growing wild in forests. Tropical regions such as Indonesia provide highly suitable habitats for these plants. Approximately 90% of Araceae genera and 95% of their species occur in tropical areas. This study aimed to describe and determine the species density of plants belonging to the Araceae family in Saluopa Waterfall area, Wera Village, Poso Regency. This research employed a quantitative descriptive design using a survey method, with sampling conducted through the belt transect method. The population in this study consisted of all Araceae species found in the Saluopa Waterfall area, Wera Village. The sample included all Araceae individuals recorded along the observation transects. Documentation and specimen collection were carried out for each Araceae species to enable identification based on morphological characteristics, followed by density analysis. The results revealed 10 species belonging to the Araceae family, distributed across nine genera: *Aglonema*, *Colocasia*, *Dieffenbachia*, *Xanthosoma*, *Homalomena*, *Schismatoglottis*, *Rhaphidophora*, *Scindapsus*, and *Syngonium*. The density values ranged from 0.02 to 0.24 individuals per meter, comprising ten species from nine different genera. The highest density species was *Colocasia esculenta* (0.24), followed by *Homalomena rubescens* (0.17) and *Dieffenbachia seguine* (0.13) while the lowest one was *Schismatoglottis calyptrata* (0.02).

**Keywords:** Araceae; Belt transect; Desa Wera Saluopa; Kerapatan; Spesies.

## INTRODUCTION

Sulawesi is the largest island in Indonesia and holds significant biogeographical importance as it is located within the Wallacea region. Wallacea is a unique transitional zone between the Asian and Australian continents, characterized by high biodiversity and endemism (Putra et al., 2023). This biological richness can be found in various natural habitats, including conservation areas such as wildlife reserves for animals and nature reserves for plants. In addition, substantial biodiversity is also present in the Saluopa Waterfall tourist area, located in Wera Village, Poso Regency.

Saluopa Waterfall in Wera Village is one of the well-known tourist attractions in Poso Regency, Central Sulawesi, due to its stunning natural beauty. The waterfall is considered one of the finest waterfalls in Indonesia. Around the waterfall area, visitors can encounter diverse fauna and enjoy the scenic view of pristine tropical forests with fresh air. The area is also surrounded by various plant species, particularly members of the Araceae family. The Araceae family has

long been recognized, consumed, and utilized by the people of Nias, especially in the Hilionaha community (Khalisa et al., 2017).

Araceae is a group of herbaceous plants with diverse habitats, including terrestrial, aquatic, and epiphytic environments where they climb or attach to trees. Members of Araceae can grow wild in forests and are also widely cultivated as ornamental plants. Beyond their aesthetic value, certain genera within the Araceae family, such as *Homalomena*, have potential applications in the health sector, while *Colocasia esculenta* has significant potential in the food sector (Novia, 2023). The substantial potential and ecological role of Araceae underline the importance of conservation efforts to maintain their natural populations. However, to date, there is limited information and research regarding Araceae species in this area, and many species have not been properly identified. The lack of public awareness and information has led to suboptimal utilization and management of these plants. Furthermore, the habitat of Araceae faces a relatively high risk of degradation due to natural factors, which may reduce population size and

affect plant density. Therefore, scientific research on the presence of Araceae in the Saluopa Waterfall area, Wera Village, Poso Regency, is necessary.

External factors such as pH and temperature influence the growth of Araceae. These plants require an optimal pH ranging from 6 to 7.7 and a relatively normal temperature between 25–30°C (Muslimin, 2019). Plant density is also an important ecological parameter because it reflects environmental conditions and the plant's ability to utilize growing space efficiently (Hutasuhut, 2020). Appropriate plant density within a given area is essential for achieving optimal plant growth.

Araceae plants possess two main leaf types, namely simple and compound leaves arranged in a basal rosette (Barwi, 2021). The leaves are alternately arranged and attached to the stem in a spiral pattern forming two rows. Leaf shapes vary widely, including sagittate (arrow-shaped), peltate (shield-shaped), lanceolate, and cordate forms, with margins that may be entire, sinuate, or

undulate. The leaf blades may be flat, convex, or concave and may orient upward or downward (Dinanti, 2023). This study aimed to describe and determine the species density of plants belonging to the Araceae family in Saluopa Waterfall area, Wera Village, Poso Regency.

## MATERIALS AND METHODS

### Study area

This study was conducted in November 2025 in Saluopa Waterfall Tourism Area, Wera Village, Poso Regency, Central Sulawesi, Indonesia (Figure 1). The study site is characterized by humid forest ecosystems, riparian habitats, and shaded microenvironments surrounding the waterfall. These environmental conditions, including high moisture levels, fertile soils, and dense canopy cover, provide suitable habitats for various species of Araceae (Figure 1).

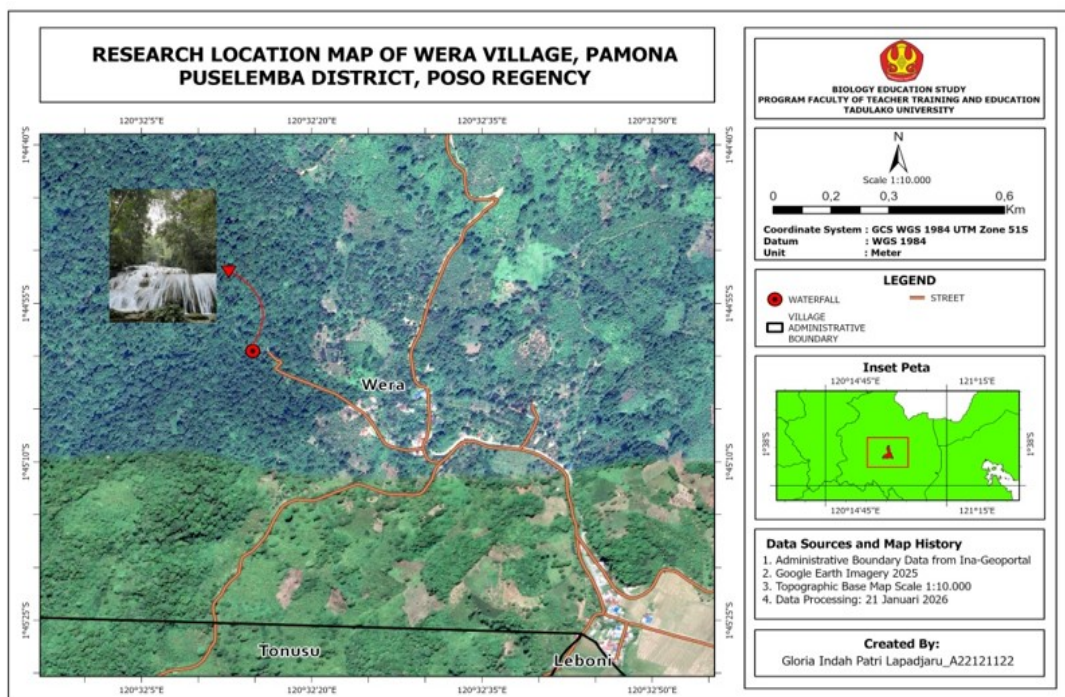


Figure 1. Map of the research location in Saluopa Waterfall Tourism Area, Wera Village, Poso Regency, Central Sulawesi, Indonesia.

## Procedures

### Determination of Study Site and Sampling Plots

This study site was selected using a purposive sampling approach, focusing on areas where Araceae species were present. To obtain representative data, the research area was divided into several observation stations based on differences in habitat characteristics, such as areas near water streams, densely shaded canopy zones, and relatively open areas. At each station, quadrat plots were established, with plot sizes adjusted to field conditions (e.g., 1 m × 1 m or 2 m × 2 m). The plots were arranged systematically or randomly to ensure adequate representation of the entire study area.

### Data Collection

Data collection was carried out using the quadrat method. Within each established plot, all Araceae individuals were counted and recorded. Preliminary identification was conducted directly in the field based on observable morphological characteristics. In addition to recording the number of individuals per species, environmental factors that could influence Araceae growth were also documented, including humidity levels, light intensity, and substrate type. Photographic documentation was conducted to support data validation and to facilitate further identification if necessary.

**Species Identification**

Species identification of Araceae was conducted based on morphological characteristics, including leaf shape and size, venation patterns, stem type, and reproductive structures such as the spadix and spathe, which are distinctive features of the Araceae family. Identification was carried out using taxonomic keys and relevant scientific references. If certain specimens could not be confidently identified in the field, further examination was conducted using photographic records and comparisons with scientific literature or herbarium collections to ensure accurate species determination.

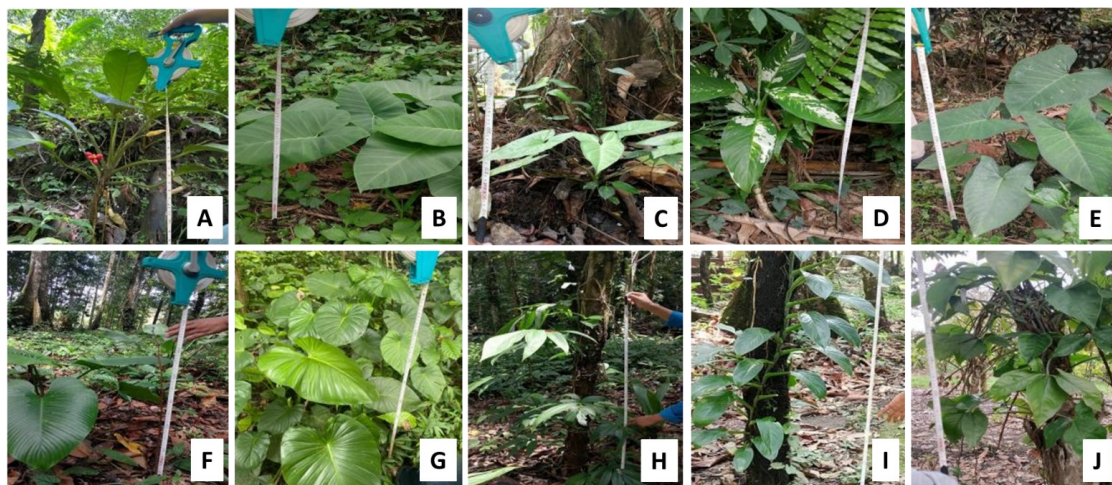
**Data analysis**

The collected data were analyzed to calculate the density of each Araceae species. Density was determined by dividing the number of individuals of a species by the total area of the sampling plots. Relative density was also calculated to determine the contribution of each species to the total Araceae population in the study area. The results were presented in tables and graphs to facilitate data interpretation and comparison among observation stations. This analysis provided an overview of the distribution and dominance patterns of Araceae species within the Saluopa Waterfall Tourism Area.

**RESULTS AND DISCUSSION**

**Composition of Araceae Species**

The study identified a total of 10 Araceae species belonging to nine genera: *Aglaonema*, *Colocasia*, *Syngonium*, *Dieffenbachia*, *Xanthosoma*, *Schismatoglottis*, *Homalomena*, *Rhaphidophora*, and *Scindapsus* (Table 1; Figure 2). This diversity indicates that the Saluopa Waterfall area provides suitable habitat conditions for various Araceae taxa with different morphological characteristics and ecological strategies. The species were distributed across diverse microhabitats, including moist soils near water streams, shaded forest floors, and areas with moderate canopy cover. Most of the recorded species are herbaceous plants characterized by large simple leaves, soft succulent stems, and reproductive structures consisting of a spadix and spathe, which are distinctive features of the Araceae family. The presence of ten species reflects a moderate level of species richness within the study area. However, although species richness was relatively notable, the abundance of each species varied considerably, indicating differences in ecological adaptation and growth performance among species.



**Figure 2.** The Araceae species identified in the Air Terjun Saluopa area include A. *Aglaonema densinervium*, B. *Colocasia esculenta*, C. *Syngonium* sp., D. *Dieffenbachia seguine*, E. *Xanthosoma sagittifolium*, F. *Schismatoglottis inculata*, G. *Homalomena rubescens*, H. *Rhaphidophora decursiva*, I. *Scindapsus simplex*, and J. *Syngonium podophyllum*.

**Table 1.** Composition of Araceae species.

Genus	Species	Habitat Type
Aglaonema	<i>Aglaonema densinervium</i>	Terrestrial (Mesophyte)
Colocasia	<i>Colocasia esculenta</i>	Geophyte
Syngonium	<i>Syngonium</i> sp.	Hemiepiphyte
Dieffenbachia	<i>Dieffenbachia seguine</i>	Terrestrial (Mesophyte)
Xanthosoma	<i>Xanthosoma sagittifolium</i>	Geophyte
Schismatoglottis	<i>Schismatoglottis inculata</i>	Terrestrial
Homalomena	<i>Homalomena rubescens</i>	Terrestrial (Mesophyte)
Rhaphidophora	<i>Rhaphidophora decursiva</i>	Hemiepiphyte
Scindapsus	<i>Scindapsus simplex</i>	Hemiepiphyte
Syngonium	<i>Syngonium podophyllum</i>	Hemiepiphyte

### Habitat Structure and Life Forms

Based on their growth forms, the recorded Araceae species can be classified into three main life-form categories: geophytes, terrestrial mesophytes, and hemiepiphytes. Geophytes such as *Colocasia esculenta* and *Xanthosoma sagittifolium* possess underground storage organs, including corms or rhizomes, which enable them to survive under fluctuating environmental conditions. Terrestrial mesophytes such as *Aglaonema densinervium*, *Dieffenbachia seguine*, and *Homalomena rubescens* grow directly in moist soil under moderate to

dense canopy cover. In contrast, hemiepiphytic species such as *Rhaphidophora decursiva*, *Scindapsus simplex*, and *Syngonium podophyllum* exhibit climbing growth habits, attaching themselves to tree trunks or moist rocks while maintaining contact with the soil. These species utilize vertical forest structures to access light more efficiently (Table 2). The presence of these different life forms demonstrates ecological niche differentiation within the Araceae community, allowing multiple species to coexist within the same general habitat through varying adaptive strategies.

**Table 2.** Classification based on life form.

Life Form	Species Included	Ecological Characteristics
Geophyte	<i>Colocasia esculenta</i> , <i>Xanthosoma sagittifolium</i>	Possess underground storage organs (corm/rhizome); adapted to moist soils.
Terrestrial (Mesophyte)	<i>Aglaonema densinervium</i> , <i>Dieffenbachia seguine</i> , <i>Homalomena rubescens</i> , <i>Schismatoglottis inculata</i>	Grow on moist forest floor under canopy shade.
Hemiepiphyte	<i>Rhaphidophora decursiva</i> , <i>Scindapsus simplex</i> , <i>Syngonium podophyllum</i> , <i>Syngonium sp.</i>	Climbing plants attached to host trees; utilize vertical forest structure.

### Habitat Density Values of Araceae Species

The density analysis revealed that all recorded Araceae species fell within the low-density category based on vegetation classification standards. Density values ranged from 0.02 to 0.24 individuals per square meter. *Colocasia esculenta* exhibited the highest density value (0.24), followed by *Homalomena rubescens* (0.17) and *Dieffenbachia seguine* (0.13). The relatively high density of *Colocasia esculenta* may be attributed to its strong adaptability to moist, organic-rich soils commonly found

near flowing water. Conversely, *Schismatoglottis inculata* showed the lowest density value (0.02) (Table 3). The low density observed in several species may be influenced by limited growing space, interspecific competition, and uneven microhabitat distribution. Although all species were categorized as having low density, the variation in density values reflects differences in ecological tolerance, reproductive capacity, and competitive ability among species within the study area.

**Table 3.** Density values of Araceae species

Species	Density (Ind/m <sup>2</sup> )	Density Category
<i>Aglaonema densinervium</i>	0.09	Low
<i>Colocasia esculenta</i>	0.24	Low
<i>Syngonium sp.</i>	0.08	Low
<i>Dieffenbachia seguine</i>	0.13	Low
<i>Xanthosoma sagittifolium</i>	0.04	Low
<i>Schismatoglottis inculata</i>	0.02	Low
<i>Homalomena rubescens</i>	0.17	Low
<i>Rhaphidophora decursiva</i>	0.04	Low
<i>Scindapsus simplex</i>	0.03	Low
<i>Syngonium podophyllum</i>	0.03	Low

### Habitat Dominance Patterns of Araceae Species

The dominance index (C) indicated that no species reached a value exceeding 0.25, meaning that no single species overwhelmingly dominated the Araceae community. However, *Colocasia esculenta* showed the highest dominance value (0.24), suggesting that it exerts a relatively greater ecological influence compared to other species. Its broad leaves and rapid vegetative growth allow it to efficiently capture light and occupy available space, thereby influencing resource distribution

within the community. Species with intermediate dominance values, such as *Homalomena rubescens* (0.17) and *Dieffenbachia seguine* (0.13), can be considered sub-dominant. Hemiepiphytic species generally exhibited low dominance values (0.03–0.04), likely due to their dependence on suitable host trees and more restricted spatial distribution. Overall, the dominance pattern suggests a relatively balanced community structure without extreme species monopolization (Table 4).

**Table 4.** Dominance index (C) of Araceae species

Species	Dominance Index (C)	Dominance Level
<i>Aglaonema densinervium</i>	0.09	Low
<i>Colocasia esculenta</i>	0.24	Highest (Sub-dominant)
<i>Syngonium</i> sp.	0.08	Low
<i>Dieffenbachia seguine</i>	0.13	Moderate
<i>Xanthosoma sagittifolium</i>	0.04	Low
<i>Schismatoglottis inculata</i>	0.02	Lowest
<i>Homalomena rubescens</i>	0.17	Moderate
<i>Rhaphidophora decursiva</i>	0.04	Low
<i>Scindapsus simplex</i>	0.03	Low
<i>Syngonium podophyllum</i>	0.03	Low

**Environmental Factors and Their Relationship to Density**

The measured environmental conditions indicate that the Saluopa Waterfall area provides a suitable habitat for Araceae growth. The moderate temperature (25.7°C), high humidity (76%), and relatively low light intensity (127 cd) create a favorable microclimate for understory tropical plants. The recorded soil pH of 7.8, although slightly alkaline, remains within the tolerance range of many Araceae species (Table 5). The relationship

between environmental factors and species density suggests that species with higher density values tend to occur in areas with stable moisture conditions and loose, organic-rich soils. In contrast, species with lower densities were frequently found in areas with very dense canopy cover or less favorable substrate conditions. Overall, the microclimatic conditions of the Saluopa Waterfall area play a crucial role in shaping the distribution, density, and dominance patterns of Araceae species within the study site.

**Table 5.** Relationship between environmental factors and species density

Environmental Factor	Measured Value	Ecological Influence on Araceae
Temperature (°C)	25.7	Optimal for tropical understory growth
Humidity (%)	76	Supports moisture-dependent species
Soil pH	7.8	Within tolerance range for most species
Light Intensity (cd)	127	Suitable for shade-adapted plants
Soil Condition	Moist, organic-rich	Favors geophytes and mesophytes

**Discussion**

The Araceae species found in the Saluopa Waterfall area exhibit diverse morphological characteristics and habitat preferences. Based on their growth form, these plants can be grouped into three main habitat types: mesophytes, geophytes, and hemiepiphytes. These habitat differences reflect each species’ adaptive capacity to the humid and shaded environmental conditions typical of tropical waterfall ecosystems (Rahman, 2018). The geophytic species recorded include *Aglaonema densinervium*, *Colocasia esculenta*, *Dieffenbachia seguine*, *Xanthosoma sagittifolium*, *Schismatoglottis inculata*, and *Homalomena rubescens*.

Plants such as *Aglaonema* and *Dieffenbachia* have soft, succulent stems and broad leaves capable of effectively absorbing and retaining water. These characteristics represent adaptations to humid environments with low light intensity. According to Amelia (2017), mesophytic plants possess well-developed spongy tissue that helps retain water within their leaves, enabling them to survive in moderately moist environments. Research conducted by Supriadi (2019) in tropical forests of Kalimantan demonstrated that *Aglaonema densinervium* and *Dieffenbachia seguine*

grow optimally in areas with high humidity (70–90%) and neutral soil pH. These conditions are consistent with the microclimatic characteristics of the Saluopa Waterfall area. *Homalomena rubescens* is also categorized as a mesophyte growing on moist soil surfaces. Fauziah (2025) reported that species of *Homalomena* play an important role in covering the forest floor and maintaining ecosystem moisture.

The geophytic species identified was *Colocasia esculenta* (taro). This tuberous plant thrives in moist environments such as riverbanks or small swamps. Its tuber functions as an energy reserve during dry seasons or periods of limited light availability. According to Titin (2018), *Colocasia esculenta* grows well in moist, fertile soils rich in organic matter, with a pH range of 5.5–7.0. Previous research by Septiawan et al. (2017) states that taro is a tropical geophyte tolerant of high humidity and low light intensity, making it well suited to grow around waterfalls that remain humid throughout the year. The presence of *Colocasia esculenta* in the Saluopa Waterfall area indicates that the soil is loose, fertile, and well-drained, which is favorable for tuberous plants.

The hemiepiphytic species found include *Rhaphidophora decursiva*, *Scindapsus simplex*, and

*Syngonium podophyllum*. These species possess strong climbing roots that allow them to attach to large tree trunks. According to Croat (2020), most members of the Araceae family inhabiting tropical rainforests exhibit hemiepiphytic characteristics to access canopy light without losing contact with the soil. Research by Kendari (2020) also showed that *Syngonium podophyllum* can grow in environments with low light intensity (20–40%) and high humidity (>80%) due to its flexible root structure and ability to absorb moisture from the surrounding air. The presence of these hemiepiphytic species in the Saluopa Waterfall area reflects highly humid and shaded microhabitat conditions that support climbing plants.

The presence of various Araceae species indicates that the Saluopa Waterfall area provides a suitable microhabitat for the growth of tropical herbaceous plants requiring high humidity. Environmental measurements at the study site recorded an air temperature of 25.7°C, relative humidity of 76%, soil pH of 7.8, and light intensity of 127 cd. These conditions are considered ideal for the growth of tropical mesophytic and hygrophytic Araceae. Croat (2020) states that members of the Araceae family generally grow in shaded areas with low light intensity and high humidity beneath tropical forest canopies.

According to Sari et al. (2021), plant density values above 5,000 are categorized as high, values between 1,000–5,000 as moderate, and values below 1,000 as low. The results of this study indicate that the density of Araceae species in the Saluopa Waterfall area is categorized as low for all recorded species. Density values ranged from 0.02 to 0.24 individuals per square meter, comprising ten species from nine different genera (Asih, 2019). The species with the highest density value was *Colocasia esculenta* (0.24), followed by *Homalomena rubescens* (0.17) and *Dieffenbachia seguine* (0.13). The species with the lowest density value was *Schismatoglottis inculata* (0.02).

Plant density is strongly influenced by environmental physicochemical factors such as light intensity, soil pH, air temperature, and humidity. Measurements at the study site showed a light intensity of 127 cd, soil pH of 7.8 (neutral to slightly alkaline), air temperature of 25.7°C, and relative humidity of 76%. These values indicate that the Saluopa Waterfall area is humid, shaded, and cool conditions typical of Araceae habitats. Hadi (2022) states that Araceae species generally grow optimally in tropical regions characterized by high humidity and low to moderate light intensity. Their broad leaves and soft stems represent adaptations to such moist and shaded environments. Research by Supriadi et al. (2016) in tropical forests of Kalimantan also found that the highest Araceae density occurred in locations with humidity levels of 70–90% and temperatures of 25–27°C, conditions very similar to those of the Saluopa Waterfall area.

*Colocasia esculenta* exhibited the highest density (0.24), reflecting its strong adaptation to moist, organic-rich soils. Hadi (2022) notes that *Colocasia esculenta* grows rapidly in areas with flowing or consistently moist water, resulting in denser populations compared to other species. *Homalomena rubescens* showed moderate density (0.17), indicating stable and shaded microhabitat conditions. *Dieffenbachia seguine* was frequently found along stream edges with loose soil. The low density observed in several species may be influenced by dense canopy cover and limited light penetration. Hemiepiphytic species such as *Rhaphidophora decursiva*, *Scindapsus simplex*, and *Syngonium podophyllum* exhibited low densities (0.03–0.04). Croat (2020) explains that hemiepiphytic Araceae typically have low densities because their growth depends on the availability of suitable host trees.

Dominance levels are strongly influenced by abiotic factors such as light, temperature, humidity, and soil nutrient availability. Dominance within a plant community reflects the extent to which a species influences ecosystem structure and function. Higher dominance values indicate a greater influence on light availability, water, and nutrients within the habitat. The environmental conditions at Saluopa Waterfall temperature 25.7°C, soil pH 7.8, humidity 76%, and light intensity 127 cd (Novia et al., 2023) support the growth of understory vegetation such as Araceae. However, these relatively balanced conditions also create even competition among species, preventing any single species from fully dominating the community.

Data analysis showed that no species reached a dominance value greater than 0.25. The highest value was recorded for *Colocasia esculenta* (0.24), slightly below the threshold for primary dominance. This indicates that *Colocasia esculenta* is the species closest to being dominant within the community. Its broad leaves effectively cover surrounding areas, influencing light penetration for other species. Hadi (2022) states that *Colocasia esculenta* often becomes dominant in moist and fertile environments due to its adaptability to waterlogged and fine-textured soils.

Species with intermediate dominance values included *Homalomena rubescens* (0.17), which demonstrates its ability to maintain populations under closed canopy conditions. Barwi (2021) reported that *Homalomena rubescens* often dominates riparian zones due to its strong root system and tolerance of extremely moist conditions. *Dieffenbachia seguine* can be categorized as sub-dominant, as it remains relatively abundant without controlling the community. Other species, including *Aglaonema densinervium*, *Syngonium podophyllum*, and *Scindapsus simplex*, had dominance values below 0.10, indicating low dominance. Hemiepiphytic species such as *Rhaphidophora decursiva*, *Scindapsus simplex*, and *Syngonium podophyllum* exhibited very low dominance values (0.03–0.04). Their growth depends on suitable

host trees, and their distribution is influenced by the vertical forest structure and density of large trees (Croat, 2020).

## CONCLUSIONS

A total of ten plant species belonging to the family Araceae were recorded, all of which exhibit distinctive morphological characteristics such as large simple leaves, a spathe, and a spadix. All identified species are herbaceous plants that grow under humid and shaded environmental conditions. The density index of Araceae at the study site was categorized as low, with values ranging from 0.02 to 0.24 individuals per square meter, representing nine different genera. The species with the highest density was *Colocasia esculenta* (0.24), followed by *Homalomena rubescens* (0.17) and *Dieffenbachia seguine* (0.13), while the lowest density was recorded for *Schismatoglottis inculata* (0.02). No species reached a dominance value greater than 0.25; however, *Colocasia esculenta* was the species that most closely approached dominance within the community.

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

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