

Species Inventory of Araceae In West Block of Batang Toru Forest, North Tapanuli Regency, North Sumatra

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Abstract. Araceae is a family plant that generally inhabits the tropical region with relatively high humidity such as The Batang Toru Forest Area. Environmental conditions such as humid or wet, watery, shady and high rainfall support the growth of Araceae species. Araceae have an unique spadix inflorescence characteristic that protected by spatha. A study on Araceae in Batang Toru Forest Area has never been conducted, leaving the unknown status of the species diversity and distribuion. The aims of this study was to invent Araceae in The Batang Toru Forest West Block area. The study was carried out from July to September 2018. The exploration method were used to invent the Araceae along the existing track path. There were 34 species of Araceae belonging to 8 genera found in the study side. All of species, 25 of them were lived as terrestrial and 9 of them were as epiphytes. The genera with the most species are Homalomena (12 species) and the least are Pothos (1 species). Araceae can lived on the soil, stones, trees, riparian and pond. Araceae can be found at various altitude with high air humidity (73-99 %) and warm temperature (17-27 °C). Araceae also like acid soil (4-7), warm (19-27 °C) with various humidity (1.5-8).

Keyword: Araceae, Batang Toru Forest, Inventory

Received 1th November 2020 | Revised 20th December 2020 | Accepted 22th January 2021

1 Introduction

Sumatra is one of the largest islands in Indonesia that has tropical rainforests with more than 10,000 types of plants. The number of types of plants is high due to warm forest conditions and sufficient humidity with various environments. Large trees provide a variety of niches for smaller trees, climbing plants, shrubs, herbs and epiphytes. The richness of plant species on the island of Sumatra is comparable to the island of Kalimantan and the island of Papua New Guinea. Sumatra has 17 endemic plant genera, with some unique plants such as Amorphophallus of the Araceae group. The araceae plant group is the fourth largest monocot after orchids, grasses and puzzles and is an important plant in Tropical Asia. Araceae can be found in various regions of Indonesia with several centers of diversity especially in Kalimantan, Sumatra and Papua New Guinea [1,2] The relatively high diversity of araceae species in Indonesia prompted experts to conduct araceae

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research in various regions including Kalimantan [3,4], in Bali [5,6], in Java [7,8,9]. Araceae research in Sumatra has also been conducted in several regions namely Bangka Belitung, Riau Islands and West Sumatra [10,11,12,13,14].

One of the forests in North Sumatra is Batang Toru Forest which is divided into two areas, namely Batang Toru Forest West Block and Batang Toru East Block Forest (Sarulla). This area has various types of vegetation that make up three main ecosystems, namely lower mountain forests, peat forests at an altitude of 900 to 1,200 meters and dipterocarpaceae forests. Batang Toru Forest is a tropical forest that has a wealth of types of animals and plants [15,16]. One of the many plant tribes found in tropical forests is the Tribe of Araceae. Information about Araceae in North Sumatra is not widely known because of the limited research conducted. Therefore, research was conducted to obtain and add data from the Araceae tribe in North Sumatra. From the results of the survey conducted, Batang Toru Forest has environmental conditions that are quite humid and very suitable as a habitat of Araceae. The research of the Araceae group in the Batang Toru Forest area of West Block, North Tapanuli Regency, North Sumatra Province has never been reported before. Based on this, the study was conducted on an inventory of araceae species in this region. The purpose of this study was to inventory the type of Araceae in the West Block Batang Toru Forest area, North Tapanuli Regency, North Sumatra Province.

2. Research Methods

2.1. Time and Place of Research

The initial survey was conducted in 2017 and the study was conducted from July to September 2018 at the Research Station of Yayasan Ekosistem Lestari Sumatran Orangutan Conservation Programme (YEL-SOCP) Batang Toru Forest Area West Block, North Tapanuli Regency, North Sumatra Province and continued at the Medanense and Herbarium Plant Systematic Laboratory, University of North Sumatra.

2.2. Area Description

2.2.1 Location and area

Batang Toru Forest (HBT) has an area of 136,000 ha and is divided into two blocks, namely the Eastern Block and the Western Block. Administratively batang toru forest area is located in North Tapanuli Regency, Central Tapanuli, and South Tapanuli. It is geographically located between 98° 53' to 99° 26' BT and 02°03' to 01°27' LU. The area of The West Toru Batang Block Forest area of 76,000 ha is between 98 °04'48" to 99°017'24" BT and 10°27'00" to 10°59'24" LU. The research site is a 12,000 ha flora and fauna monitoring station area located between 49° 93'31' BT and 18°63'20" LU [16].

2.2.2 Climate

The climate in the toru stem forest includes a tropical climate with high rainfall ranging from 4,500 to 5,000 mm per year. This forest is in a mountainous region, so the temperature at night can drop to 14°C, the most extreme temperature during the day 31°C and has humidity ranging from 33% to 95% [16].

2.2.3 Topography

Batang Toru Forest area in the western block is a low and high altitude mountain area that has a height of 50 to 1,875 meters above sea level (MDPL) with the lowest point being on the Sipan Sihaporas River (near Sibolga City) and the highest point is in Dolok Lubuk Raya. Marbles between 16 to 60%, with landscapes with hilly and undulating topography [16].

2.2.4 Vegetation

Batang Toru forest has various types of vegetation and typical peat forests at an altitude of 900 to 1,000 meters above sea level, limestone forests and there are several swamps located at an altitude of 800 meters above sea level. The dominance of vegetation in the Batang Toru Forest consists of the type of mountain fir (*Casuarina* sp.), Tali Sampinur (*Dacrydium* spp.) and the type of mayang (*Palaquium* spp.). In general, this forest area has high vegetation, but the diameter of the tree is relatively small. Other types of plants that can be found are from the type of epiphyte, moss and some types of orchids and semar bags (*Nepenthes* spp.) [16].

2.2.5 Field exploration

The survey (exploration) in the field was conducted in the Batang Toru Forest Area of the West Block along the main line, namely lanes A (3000 meters), B (3,500 meters), C (4000 meters), H (2,600 meters), G (3,300 meters), JMK (2,400 meters) and Cave (2600 meters) (Appendix 2). Observation and collection are carried out along a predetermined path of track according to the habitat of Araceae. The Araceae species was found photographed, recording important characters in detail and collected. Collection of specimens is carried out in wet or dry form. Measurements of physical and environmental chemistry factors, namely air humidity with hygrometer, air temperature with thermometer, soil temperature with soil thermometer, soil pH, light intensity with lux meter, altitude of place with altimeter and coordinate point with GPS (Global Positioning System) respectively Araceae found.

Specimens from the field are opened, replaced with new ones, flanked with sasak, then in the laboratory dried in a dryer oven with a temperature of $\pm 60^{\circ}\text{C}$ until the specimen is dry and the weight of the specimen becomes constant. Dried specimens identified in Herbarium Medanense (MEDA), for non-identifiable samples will be sent to Herbarium Andalas (ANDA) and Herbarium Bogoriense. The way to send a sample to be identified is to use a specimen that has been dried, for a wet collection the sample is put in a glass jar then soaked in 70% alcohol. Identification based on vegetative and generative morphological properties.

Reference books used for identification include:

- Araceae [17].
- Araceae kalimantan-Genera [18].
- Araceae from Peninsular Malaysia [19].
- Genera Araceae [20].

2.6. Data analysis

Data on araceae species presented in morphological description form are complemented by photographs, images of common habitats of each type of Araceae found and key determinations.

3. RESULTS AND DISCUSSIONS

3.1 Diversity of Araceae Species

Based on research that has been conducted in the Batang Toru Forest Area of West Block, North Tapanuli Regency, North Sumatra obtained 34 types consisting of 8 clans as mandated in Table 1

Table 1 Types of Araceae in the Western Block of Batang Toru Forest Area

No.	Family	Species	Habitat	
			Terrestrial	Epif
1.	<i>Aglaonema</i>	<i>Aglaonema nitidum</i>	+	-
2.		<i>Aglaonema simplex</i>	+	-
3.	<i>Alocasia</i>	<i>Alocasia longiloba</i>	+	-
4.		<i>Alocasia arifolia</i>	+	-
5.	<i>Amorphophallus</i>	<i>Amorphophallus gigas</i>	+	-
6.		<i>Amorphophallus</i>	+	-
7.	<i>Homalomena</i>	<i>Homalomena argenta</i>	+	-
8.		<i>Homalomena humilis</i>	+	-
9.		<i>Homalomena rostrata</i>	+	-
10.		<i>Homalomena rubescens</i>	+	-
11.		<i>Homalomena vagans</i>	+	-
12.		<i>Homalomena</i> sp.1	+	-
13.		<i>Homalomena</i> sp.2	+	-
14.		<i>Homalomena</i> sp.3	+	-
15.		<i>Homalomena</i> sp.4	+	-
16.		<i>Homalomena</i> sp.5	+	-
17.		<i>Homalomena</i> sp.6	+	-
18.		<i>Homalomena</i> sp.7	+	-
19.	<i>Pothos</i>	<i>Pothos scandens</i> L.	-	+
20.	<i>Rhaphidophora</i>	<i>Rhaphidophora</i>	-	+
21.		<i>Rhaphidophora</i>	-	+
22.		<i>Rhaphidophora</i>	-	+
23.		<i>Rhaphidophora</i>	-	+
24.		<i>Rhaphidophora</i> sp.1	-	+
25.		<i>Rhaphidophora</i> sp.2	-	+
26.	<i>Schismatoglottis</i>	<i>Schismatoglottis</i>	+	-
27.		<i>Schismatoglottis</i>	+	-
28.		<i>Schismatoglottis</i> sp.	+	-
29.	<i>Scindapsus</i>	<i>Scindapsus hederaceus</i>	-	+
30.		<i>Scindapsus pictus</i>	+	-
31.		<i>Scindapsus</i> sp.1	+	-
32.		<i>Scindapsus</i> sp.2	+	-
33.		<i>Scindapsus</i> sp.3	-	+
34.		<i>Scindapsus</i> sp.4	+	-

Description : + = Found, - = Not found

From Table 1, the Homalomena clan has the most common species, including 12 species, followed by *Rhaphidophora* and *Scindapsus*, each of 6 species, and the *Schismatoglottis* clan of three types. The other genera *aglaonema*, *Alocasia* and *Amorphophallus* are each found in two types, while *Pothos* is only one type. [20] states that the Homalomena clan lives in the tropics with distribution centers located in Southeast Asia and the Malesia region so it is found in many parts of Indonesia. In this study obtained 34 types of Araceae 25 types that grow terrestrial and 9 types grow as epiphytes. The number of species found at the research site is equal to the number of species reported by [21] in the Anai Valley Nature Reserve, but has more genera than the research site, namely 14 clans with 7 different clans namely *Amydrium*, *Anadendrum*, *Apobalis*, *Arisaema*, *Caladium*, *Colocasia* and *Dieffenbachia*. The number of araceae species that are smaller than the research site was reported by [4] in the Subah Village Forest of West Kalimantan, which is 9 species consisting of 8 genera.

The high type of Araceae in the Batang Toru Forest is influenced by suitable environmental conditions as araceae habitat because it has high rainfall and humidity and diverse vegetation. This environment supports the growth of *Araceae* which lives in moist and shady places but some types of *Araceae* can grow in the open and warm. [22] states that *Araceae* grows in low to moderate plains, mostly on forest floors or on steep cliffs/areas. The availability of water also affects the presence of Araceae. This tribe grows a lot on the banks of rivers, ponds and swamps that have abundant water. [20] states that the growth of Araceae is highly dependent on water availability and supports moist areas.

3.2. Morphology of Araceae

3.2.1 Habitat

In this study, the araceae species grew in several habitats, namely terrestrial and epiphytic, mostly terrestrial life. The epiphytes of Araceae are *Pothos*, *Rhaphidophora* and *Scindapsus*. Figure 1A is a type of *Rhaphidophora angustata* that grows epiphytically. According to [9], *Rhaphidophora angustata* is a very characteristic climbing plant with climbing stems that reach 20 meters high. In addition, the genus Araceae that grows terrestrial is *Homalomena*, *Alocasia*, *Aglaonema*, *Amorphophallus* and *Schismatoglottis*. *Alocasia longiloba* is a type of Araceae that grows terrestrial (Figure 1B). Menurut [23], *Alocasia longiloba* is an herbaceous plant that has rhizomes or stolons with the direction of growing upright stems. The tribe Araceae can be found on the banks of rivers, ponds, damp places and shades, some types are found in the open, namely clans.

3.2.2. *Alocasia* and *Amorphophallus*.

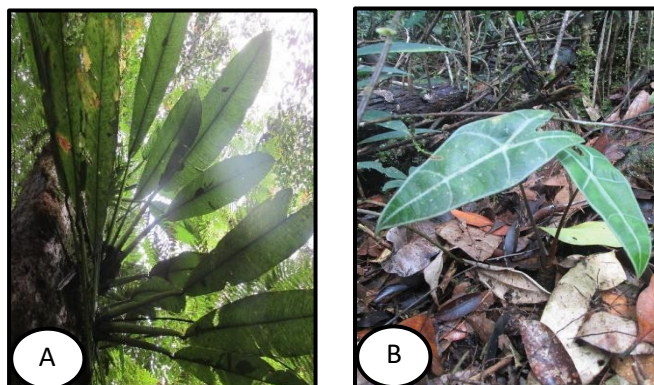


Figure 1. Places to grow, A. Growing epiphyte on *Rhaphidophora angustata*, B. Grow terrestrial on *Alocasia longiloba*

3.3. Trunk

The stem shape of the araceae species found is generally round as in the genera *Alocasia*, *Aglaonema*, *Amarphophallus*, *Homalomena*, *Pothos*, *Schismatoglottis* and *Scindapsus* and square stems are found only in the *Rhaphidophora* clan. The direction of growth of araceae stems also varies greatly, namely upright in *Aglaonema simplex*, spread on *Scindapsus pictus* and climb *Rhaphidophora angustata*. The surface of the *Araceae* stem is book-ordered and slippery. The types that have book-made stems are *Rhaphidophora sylvestris* and *Aglaonema simplex* and slippery rods on *pothos scanden*.

3.4. Leaf

In the study it is known that araceae has a varied leaf shape (Figure 2). Building araceae leaves include waking a shield in *Alocasia longiloba*, waking the heart in *Scindapsus pictus*, waking up oblong at *Rhaphidophora angustata*, waking a round egg in *Rhaphidophora korthalsii*, waking up delta at *Homalomena sp.2*, waking up elliptical in *Homalomena argentea*, waking arrows in *Schismatoglottis calyptrata*, and waking spears in *Alocasia arifolia*. *Homalomena* has a more varied leaf shape compared to other genera. The surface of the beruly leaves found on *Scindapsus pictus* and other types has a slippery leaf surface. Some types of *Araceae* have a pattern at the top of the leaves such as *Scindapsus pictus*,

Schismatoglottis scortechinii and *Schismatoglottis calyptrata*.

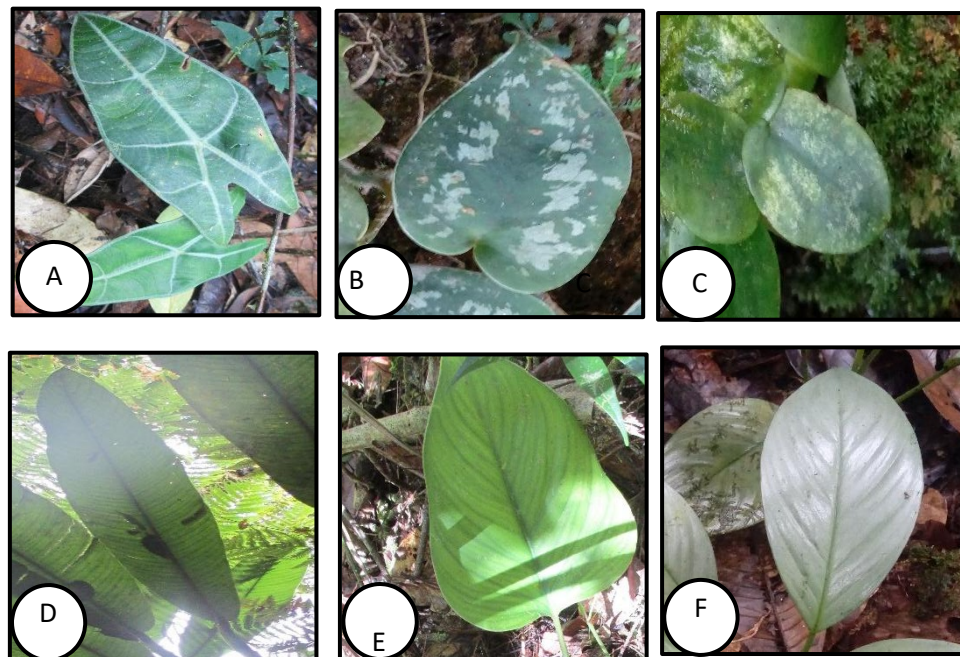


Figure 2 Leaf-wake variation, A. Build a shield at *Alocasia longiloba*, B. Wake up heart in *Scindapsus pictus*, C. Build an egg round at *Rhaphidophora korthalsii*, D. Build an oblong at *Rhaphidophora angustata*, E. Build delta at *Homalomena sp.2*, F. Build an ellipse at *Argentea homalomena*.

3.5. Flower

The type of flower in Araceae is a cob that is protected by separate cell points as in arifolia Alocasia. Araceae has different flower and seludang colors, both bright and dark in color. Figure 4.3A is a simplex Aglaonema flower with brightly colored seludang even in a budding state. Furthermore, the alocasia arifolia flower is an example of a flower that has dark colored cells (Figure 4.3B). Some flowers have a fragrant aroma and some have a good smell.

The rot that stings a lot.

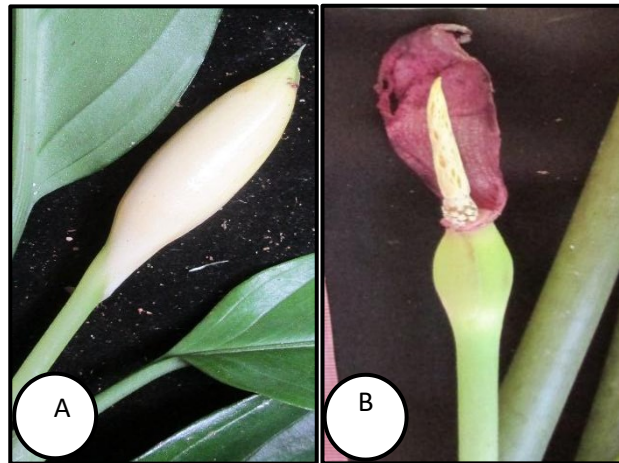


Figure 3 Separate flower seludang, A. Celery is yellowish white in *Aglaonema simplex*, B. Purple celery in *Alocasia arifolia*.

3.6. Fruit

Araceae has a type of berri fruit with a round arrangement as in Alocasia arifolia and Aglaonema simplex. One fruit stem has different numbers and has different colors. Figure 4A is a type of arifolia Alocasia that has 34 oranges. Furthermore, Aglaonema simplex is one example of a type that has a yellow fruit consisting of 8 pieces in one stalk (Figure 4.B).

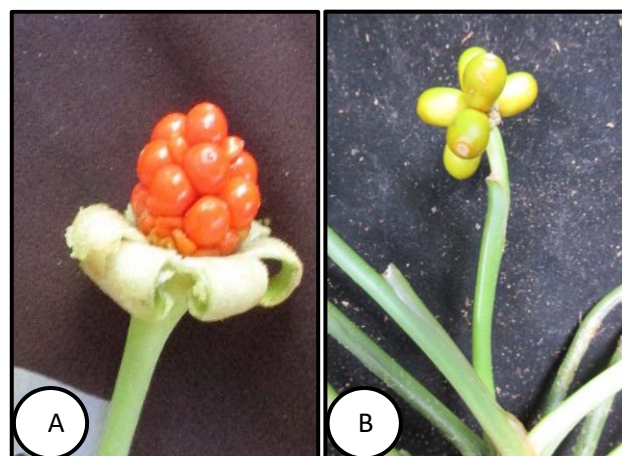


Figure 4. Type of fruit, A. Berri fruit is orange in *Alocasia arifolia*, B. Berri fruit is yellow in *Aglaonema simplex*.

3.7. Ecology of Araceae

Araceae species are found in a variety of habitats with altitudes ranging from 800 to 1005 mL, air humidity of 73 to 99%, air temperatures of 17 to 27 °C, soil temperatures of 19 to 24 °C, soil pH of 4 to 7, and mild intensity of 103 to 982 Cd. According to [24], the lower diversity of plant species is strongly influenced by environmental factors such as light, relatively high humidity, air temperatures ranging from 25 to 30 °C, and soil pH of 5 to 7.5. [25] states that Araceae grows in lowland areas to mountainous areas 1 to 2000 meters above sea level. Araceae can be found in wet/humid, watery and shady places such as riverbanks, ponds, waterfalls and areas with high humidity. According to [20] The most diverse and abundant araceae are in humid tropical regions with abundant water that produces many species variations. This type of Araceae will be difficult to grow in dry conditions.

3.8. Identification Key

Key to Clan Identification

1. a. Square Trunk..... Rhaphidopora
b. Bulat stems..... 2
2. a. Grow upright..... 3 b.
Growing up climbing and creeping..... 7
3. a. Round round..... Amorphophallus
b. Cylindrical light bulbs..... 4
4. a. Wide leaves..... Alocasia
b. The leaves are narrow and wide..... 5
5. a. The tip of the leaves varies..... Homalomena
b. The tip of the leaf tapered..... 6
6. a. Plain leaves..... Aglaonema
b. Plain leaves, sometimes silver patterned..... Schismatoglottis
7. a. The leaf bone children can be distinguished..... Pothos
b. Leaf bone children are difficult to distinguish..... Scindapsus

3.9. Type of Identification Key

1. a. a. The potion is an epiphyte..... 2 b. Terrestrial
Herbs..... 10
2. a. Round stems..... 3 b. Square
trunks..... 5
3. a. Oblong leaves..... *Scindapsus* sp.3
b. Lanset left..... 4
4. a. a. Basic leaf rounding..... *Pothos scandens*
b. The bottom of the blunt leaf..... *Scindapsus hederaceus*
- 5 a. Pelepah free leaves..... 6 b. Leaves with
smelt..... 7
- 6 a. The bones of the leaves are curved..... *Rhaphidophora korthalsii*
b. The leaf bones narrowed their eyes..... *Rhaphidophora crassifolia*
- 7 a. The flesh of the leaves is thick and stiff..... 8
b. The leaves are thin like paper..... 9
- 8 a. Elliptical leaves, pointed base..... *Rhaphidophora sylvestris*
b. Egg round leaves, round base..... *Rhaphidophora* sp.2
- 9 a. Oblong leaves, the ends tapered off..... *Rhaphidophora angustata*
b. Lanset leaves, pointing at the tip..... *Rhaphidophora* sp.1
- 10 a. The direction is creeping up..... 11 b.
Directions grew upright..... 15
- 11 a. The smelter leaves widened..... *Scindapsus* sp.4

b. The leaf pelepah docked.....	12	
12 a. The surface of the leaf gauze.....		<i>Scindapsus pictus</i>
b. The surface of the leaves is slippery.....	13	
13 a. Elliptical leaves, tapered ends.....		<i>Homalomena vagans</i>
b. Lanset left, the tip tapered off.....	14	
14 a. Lanset leaves, tapered ends, thick and stiff leaves.....		<i>Scindapsus sp.1</i>
b. Lanset leaves, tapered ends, thin leaves.....		<i>Scindapsus sp.2</i>
15 a. Rosette root.....		<i>Homalomena humilis</i>
b. The real stem.....	16	
16 a. The stems formed rhizomes.....	17	
b. Rhizome-free stems.....	28	
17 a. Round rhizome.....	18	
b. The rhizome was extended.....	19	
18 a. White patterned leaf stalks.....		<i>Amorphophallus gigas</i>
b. Stalks of brown patterned leaves.....		<i>Amorphophallus beccarii</i>
19 a. The pink rhizome.....	20	
b. The orange rhizome.....	22	
20 a. The flat leaf base.....		<i>Homalomena sp.2</i>
b. The base of the leaves notched.....	21	
21 a. The base of the leaves is notched, both ends are pointed.....		<i>Aglaonema nitidum</i>
b. The base of the leaves is notched, both ends widen.....		<i>Homalomena sp.1</i>
22 a. Wide leaves.....	23	
b. Narrow leaves.....	25	
23 a. Arrow leaves.....		<i>Homalomena rostrata</i>
b. The leaves awaken the heart.....	24	
24 a. The base of the leaves notched, both ended round.....		<i>Homalomena rubescens</i>
b. The base of the leaves is notched, both ends are dull.....		<i>Homalomena sp.4</i>
25 a. Leaf set, green smelt.....	26	
b. Elliptical leaves, reddish smelter.....	27	
26 a. The base of the leaves is round, the ends tapered.....		<i>Homalomena sp.6</i>
b. Bottom of the pointed leaves, the ends tapered off.....		<i>Homalomena sp.5</i>
27 a. Silver left.....		<i>Homalomena argentea</i>
b. Green leaves.....		<i>Homalomena sp.3</i>
28 a. The leaves are wavy.....		<i>Schismatoglottis sp.</i>
b. Flat leaves.....	29	
29 a. The leaves are plain.....	30	
b. The leaves are patterned.....	32	
30 a. Stalks of leaves from under the leaves.....		<i>Alocasia longiloba</i>
b. The stalk of leaves from the base of the leaf.....	31	
31 a. Spear leaves, stalks of blackish leaves.....		<i>Alocasia arifolia</i>
b. Lanset leaves, green leaf stalks.....		<i>Aglaonema simplex</i>
32 a. Yellow patterned leaves.....		<i>Homalomena sp.7</i>
b. Silver-patterned leaves.....	33	
33 a. Arrows go, silver patterns.....		<i>Schismatoglottis calyptrata</i>
b. Lanset left, silver pattern.....		

4. Conclusion

The conclusions of this study are as follows:

1. Found 34 types of Araceae with 25 types of terrestrial growth and 9 types growing as epiphytes. The clan with the most types is Homalomena as many as 12 types and at least pothos as many as 1 type.
2. Araceae has a varied living habitat i.e. soil, rocks, trees, riverbanks and ponds.
3. Araceae can be found at various altitudes with high air humidity (73 to 99%) and low to warm air temperatures (17 to 27 °C). Araceae also supports acidic (4 to 7) and warm soils (19 to 27 °C) with varying soil moisture (1.5 to 8).

Reference

- [1] Whitten T, Damanik SJ, Anwar J, Hisyam N, 2000. *The Ecology of Sumatera*. Singapore: Periplus.
- [2] Boyce PC, Wong, SY, 2012. Studies on Homalomena (Araceae) of Sumatera I: Homalomena hypsiantha, A Distinctive New Species of The Chamaecladon Supergroup. *Webbia*. 67 (1): 147-150
- [3] Boyce PC, Wong SY, Ting APJ, Low SE, Ng KK, Ooi IH, 2010. The Araceae of Borneo-The Genera. *Aroideana*. 33: 3-73
- [4] Widiyanti DN, Mukarlina, Masnur T, 2017. Inventarisasi Tumbuhan Araceae Di Hutan Desa Subah Kecamatan Tayan Hilir Kabupaten Sanggau Kalimantan Barat. 6 (3): 207-214.
- [5] Kurniawan A, Asih NPS, 2012. *Araceae Di Pulau Bali*. Jakarta: LIPI Press.
- [6] Asih NPS, Warseno T, Kurniawan A, 2015. Studi inventarisasi Araceae di Gunung Seraya (Lempuyang), Karangasem, Bali. *Pros Sem Nas Masy Biodiv Indon*. 1 (3): 521-527.
- [7] Kusumo H, 2014. Jenis-Jenis Araceae Di Hutan Wisata Dan Cagar Alam Plawangan-Turgo Yogyakarta. *Seminar Nasional XI Pendidikan Biologi*. 11 (1): 290-300.
- [8] Purnama AL, Nurmilawati M, Solikin N, 2016. Keragaman Jenis Dan Pola Sebaran Araceae Di Kawasan Wana Wisata Ubalan Kabupaten Kediri. *Prosiding Seminar Nasional Biologi*
- [9] Yuzammi, 2018. The Diversity Of Aroids (Araceae) In Bogor Botanic Gardens, Indonesia: Collection, Conservation And Utilization. *Biodiversitas*. 1 (19): 140-152.
- [10] Boyce PC, Wong, SY, 2012. Studies on Homalomena (Araceae) of Sumatera I: Homalomena hypsiantha, A Distinctive New Species of The Chamaecladon Supergroup. *Webbia*. 67 (1): 147-150.
- [11] Boyce PC, Wong SY, 2013. Studies on Homalomena (Araceae) of Sumatera II: Homalomena limnogenia, A Novel Species from Pulau Belitung, and The First Record of Colonial Helophytism In The Homalomena Chamaecladon Supergroup. *Journal of Plant Taxonomy and Geography*. 68 (2) : 77-79
- [12] Boyce PC, Wong SY, 2015. *Compendium Genera Aracearum Malesianum*. *Aroideana*. 38: 40-43.
- [13] Boyce PC, Wong SY, 2015. Studies on Homalomena (Araceae) of Sumatera III– A New Species of Furtadoa – Furtadoa indrae. *Aroidema*. 39 (1).

- [14]Boyce PC, Wong SY, 2016. Studies on Homalomena (Araceae) of Sumatera IV: Three New Ornamental Homalomena (Chamaecladon clade) Species. Botanic Garden and Botanical Museum Berlin (BGBM). Willdenowia. 46 (2):253-260.
- [15]Fredriksson G, Indra M, 2007. Hutan Batang Toru Harta Karun Tapanuli. YEL- SOCP. Medan.
- [16][YEL-SOCP] Yayasan Ekosistem Lestari-Sumatran Orangutan Conservation Programme. 2007. Medan. Hutan Batang Toru Harta Karun Tapanuli
- [17]Heng L, Guanghua Z, Boyce PC, Murata J, Hetterscheid WLA, Bogner J, Jacobsen N, 2010. Araceae. Flora of China. 23: 3.
- [18]Boyce PC, Wong SY, Ting APJ, Low SE, Ng KK, Ooi IH, 2010. The Araceae of Borneo-The Genera. Aroideana. 33: 3-73
- [19]Boyce PC, Mansor M, Othman AS, Sulaiman B, 2012. The Araceae of Peninsular Malaysia. Malaysia: Universiti Sains Malaysia.
- [20]Mayo SJ, Bogner J, Boyce PC, 1997. The Genera of Araceae. Kew: Royal Botanic Gardens.
- [21]Ananda RD, Des M, Rizki, 2013. Jenis-Jenis Araceae Di Kawasan Cagar Alam Lembah Anai Kabupaten Tanah Datar Sumatera Barat
- [22]Asih NPS, Warseno T, Kurniawan A, 2015. Studi inventarisasi Araceae di Gunung Seraya (Lempuyang), Karangasem, Bali. Pros Sem Nas Masy Biodiv Indon. 1 (3): 521-527.
- [23]Hamzah NHC, Mohammed A, Sirajudeen KNS, Asari MA, Hamzah Z, Shaik IK, 2019. Keladi Candik (*Alocasia longiloba* Miq.) Petiole Extracts Promote Wound Healing In A Full Thickness Excision Wound Model In Rats. Asian Pacific Journal of Tropical Biomedicine. 9 (4): 140-149.
- [24]Khoirul B, 2014. Identifikasi Tanaman Famili Araceae Di Cagar Alam Tangale Kabupaten Gorontalo. [Tesis]. Universitas Negeri Gorontalo.
- [25]Madi NF, 2014. Identifikasi Tumbuhan Famili Araceae Di Hutan Cagar Alam Gunung Ambang Sub-Kawasan Kabupaten Bolaang Mongondow Timur. [Skripsi]. Universitas Negeri Gorontalo.