International Journal of Ecophysiology Vol. 03, No. 02, 2021 |226-245

Internasional Journal of Ecophysiology

Inventarization of Zingiberaceae in The West Block Batang Toru Forest of North Tapanuli North Sumatra

Nursahara Pasaribu[1], Mutia Muharani[1],

[1]*Departement of Biology, Faculty of Mathematics and Natural Sciences, Universitas Sumatera Utara, Medan, Indonesia*

Abstract. Zingiberaceae is one of the dominating plant family in West Block, Batang Toru forest region. According to preliminary survey, the forest is inhabited by many species of Zingiberaceae while information on its species richness is still limited. The aim of the study was to collect the species of Zingiberaceae in West Block, Batang Toru forest region, conducted from July to September 2018. Inventarization was conducted using exploration method, by exploring along designated tracking ways. The study found 18 species of Zingiberaceae belonging to 10 genera was obtained, two of them were Alpinia hansenii and Boesenbergia belalongensis were new record in Sumatra. From all species that was found, two species were known to live as epiphytes and the other 16 were terresterials. Zingiberaceae occur in varying habitats, starting from forest edge, open area with optimum sunlight and inside
forest floor. The most species found belong to Globba and Amomum.

Keyword: Batang Toru Forest, Inventarization, North Sumatra, Zingiberaceae

Received 6th June 2021 | Revised 23th July 2021 | Accepted 22th August 2021

1. Introduction

Sumatra is the sixth largest island in the world and the second largest island in Indonesia after Borneo. The island of Sumatra has tropical forests that are rich in biodiversity. The species diversity in Sumatra's forests is comparable to that found in Borneo and Papua New Guinea and richer than that found on Java, Sulawesi and other small islands. Sumatra has 17 endemic plant genera and several spectacular and unique plant species such as Rafflesia arnoldi, the world's largest flower and Amorphophallus titanum, the world's tallest flower . The Batang Toru natural forest area is divided into two main blocks, namely the West block and the East block. The western block of Batang Toru forest has Dipterocarpaceae forest habitat types at medium and high elevations and mountain forest at low elevations, while the East Block Batang Toru forest has a pure stand forest habitat type of Pinus mercusii [1]. The West Block Batang Toru natural

**Corresponding author at: Departement of Biology, Faculty Mathematics and Natural Science, Universitas Sumatera Utara, Medan, Indonesia

E-mail address: nursahara@usu.ac.id

 e-ISSN: 2656 - 0674
DOI: 10.32734/ijoep.v3i2.10097
Journal Homepage: http://ijoep.usu.ac.id

forest area is one of the tropical forests in Sumatra with a biogeographical transition area between the northern biogeographical areas of Lake Toba and Southern Lake Toba. The occurrence of this biogeographical transition area is probably caused by tectonic forces and the eruption of the Toba Volcano 150,000 years ago. Transitional conditions make this area unique and high in biodiversity [2]. Zingiberaceae is one of the plants that are commonly found in tropical forest areas. especially Indo-Malay. This Zingiberaceae is not known with certainty how many species. So far, areas rich in Zingiberaceae species are Indonesia, Malaysia, Brunei, Singapore, Thailand, the Philippines and Papua. Sumatra and Borneo are areas that have large areas. However, it is still unknown and further investigated for the diversity of this type of ginger [3]

2. Research Methods

Research in the field is carried out using exploration methods, namely exploration along the main track path, namely line A (3000 meters), B (3500 meters), C (4000 meters), H (2600 meters), G (3300 meters), JMK (2400 meters) and Cave (2600 meters) (Attachment 2). Observations and collecting are carried out along the track that has been set in accordance with the habitat of Zingiberaceae. The types of Zingiberaceae found, measured morphologically, photographed, recorded important characters in detail and collected. The collection of specimens is carried out in wet or dry form. The vegetative part of a small-bodied plant is collected entirely. Types of plants that are high in stature, separated into rhizomes, lower leaves, middle and ends. Other plant organs such as flowers, fruits and seeds that will be used as wet specimens, preserved using 70% alcohol and put in a sample bottle. Specimens obtained in the field are taken to the laboratory, then opened, replaced by newspapers with new ones, flanked with sasak, then dried in a drying oven with a temperature of ±600 until the specimen is dry and the weight of the specimen becomes constant. Specimens that have been dried are identified in the Herbarium Medanense (MEDA). Data on the types of Zingiberaceae are presented in the form of a table of types, morphological descriptions, habitat descriptions and general identification keys of each type of Zingiberaceae found.

3. Result and Discussion

Based on research that has been conducted in the Batang Toru Forest area of the West Block obtained 18 types of ginger that are included in 10 genera, namely Alpinia, Amomum, Boesenbergia, Camptandra, Conamomum, Etlingera, Globba, Hornstedtia, Meistera and Zingiber (Table 1). In this study found two new types of recordings for Sumatra namely *Alpinia hansenii* and *Boesenbergia belalongensis*.

Tabel 1. Types of Zingiberaceae in the forest area of Batang Toru West Block North Tapanuli Regency North Sumatra Province

Genus	Species	Habitat	
		Teresterial	Epifit
Alpinia	*Alpinia hansenii**	+	-
	Alpinia scabra	+	-
Amomum	*Amomum centrocephalum*	+	-
	Amomum cerasinum	+	-
	Amomum citrinum	+	-
	Amomum hastilabium	+	-
Boesenbergia	*Boesenbergia belalongensis**	+	-
Camptandra	*Camptandra* sp.	+	+
Conamomum	*Conamomum xanthophlebium*	+	-
Etlingera	*Etlingera coccinea*	+	-
Globba	*Globba leuchanta*	+	-
	Globba multifolia	+	+
	Globba patens	+	-
	Globba pendula	+	-
Hornstedtia	*Hornstedtia leonurus*	+	-
	Hornstedtia tomentosa	+	-
Meistera	*Meistera gyrolophos*	+	-
Zingiber	*Zingiber puberulum*	+	-

Information

* : new types of recordings for Sumatra
\+ : found
\- : not found

From Table 1, it is known that the genera Amomum and Globba have the highest number of species, namely four species each, followed by the genera Alpinia and Hornstedtia with two species each and the genera Boesenbergia, Camptandra, Conamomum, Etlingera, Meistera and Zingiber each with one species. In this study, three species of Zingiberaceae were found as new records for Sumatra, namely *Alpinia hansenii, Boesenbergia belalongensis* and *Conamomum xanthoplebium*, these species were previously only found in Borneo, Sabah and Sarawak.

Zingiberaceae found in the West Block Batang Toru Forest Area is known to be low compared to the total genera of 40 genera with more than 1200 species [4]. The number of Zingiberaceae found in the research location is relatively high when compared to previous research by [5], in the Forest Agrotourism Area of Eden Park which obtained six genera with 10 species

Perbeand the number of Zingiberaceae obtained in the two research locations, one of which is caused by differences in the area of forest that can be explored according to the habitat of Zingiberaceae. The Forest Agrotourism area of Eden Park has a forest area of approximately

1,890 ha with an altitude of 1700 mdpl and environmental factors such as air humidity of 73 to 91% with sunlight intensity ranging from 120 to 312 Candela. The West Block Batang Toru Forest area has a forest area of approximately 76,000 ha and the research location is an area that includes lowland to highland forest with an altitude of 669 to 1,875 masl. This is in accordance with the opinion of [6], who stated that the Zingiberaceae tribe can live at an altitude of more than 2000 meters above sea level so that the location of this study supports the growth of Zingiberaceae. The research area has environmental factors that are suitable for Zingiberaceae growth, such as air humidity of 33% to 95% and high rainfall ranging from 3,500 to 5,000 mm per year. [4], suggested that the habitat favored by the Zingiberaceae tribe is generally in humid, slightly shaded places and some species live in slightly open forest areas with full sun.

3.1 Morphology of Zingiberaceae

3.1.1 Habitat

The types of Zingiberaceae are found in two types of habitats, namely teresterial and epiphyte. The terrestrial habitat is found in two types of substrates, namely soil and stone. Epiphytic habitat found attached to trees

Figure 1 Habitat Zingiberaceae; the terrestrial habitat in *Boesenbergia* sp (A), the terrestrial habitat in the rock in *Meistera gyrolophos* (B), the epiphytic habitat in *Globba multifolia* (C).

In this study found 16 species with the most terrestrial habitats, namely (*Alpinia hansenii, Alpinia scabra, Amomum centrocephalum, Amomum cerasinum, Amomum hastilabium, Amomum citrinum, Boesenbergia belalongensis, Conamomum xanthoplebium, Globba leuchanta, Globba patens, Globba pendula, Hornstedtia leonurus, Hornstedtia tomentosa, Zingiber puberulum*). The Meistera type of gyrolophos is found growing at ground level and attached to rocks, some individuals of this type are found above ground level. In the epiphytic habitat or attached to trees found two types, namely *Camptandra* sp. and *Globba multifolia*. Zingiberaceae is found at altitudes of 600 to 800 masl. The Zingiberaceae type is also found in forest peripheries as well as open areas with full sunlight (Figure 1). Most types of Zingiberaceae are found in forests, one type is found in forest periphery (*Etlingera coccinea*).

3.1.2. Rhizomes

The position of rhizomes of the types of Zingiberaceae can be distinguished into two groups, namely types with rhizomes above ground level with root stilts. (supporting roots) and rhizomes below ground level (Figure 2). The types that have rhizomes above ground level are *Amomum centrocephalum, Amomum citrinum* and *Hornstedtia tomentosa*, while other types have rhizomes below ground level

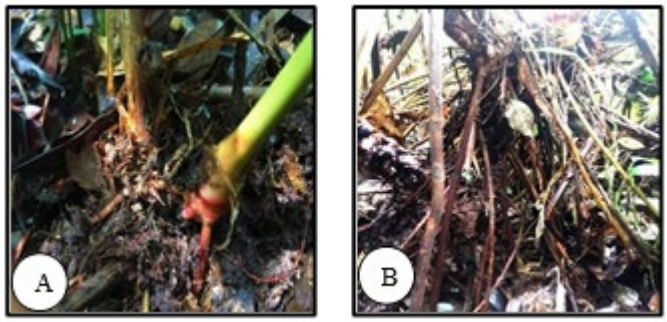

Figure 2 The position of the rhizome; rhizomes below ground level in *Conamomum xanthoplebium* (A), rhizomes above ground level with root stilts on *Amomum citrinum* (B).

In general, Zingiberaceae rhizome meat has two different types, namely soft rhizomes and hard rhizomes. In this study obtained seven types with soft rhizomes (*Camptandra* sp. *Globba multifolia, Globba leuchanta, Globba patens, Globba pendula* and *Zingiber puberulum*), 11 types with hard rhizomes (*Alpinia hansenii, Alpinia scabra, Amomum centrocephalum, Amomum hastilabium, Amomum citrinum, Boesenbergia belalongensis, Conamomum xanthoplebium, Etlingera coccinea, Hornstedtia leonurus, Hornstedtia tomentosa* and *Meistera gyrolophos*) (Figure 3).

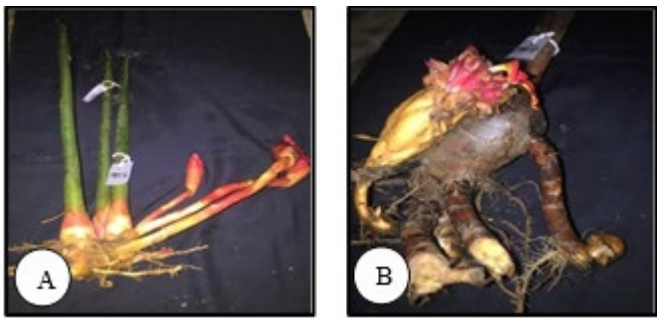

Figure 3 Rhizome meat; rhizomes with soft meat on *Zingiber pubescent* (A), rhizomes with hard meat on *Etlingera coccinea* (B).

3.1.3. Leaves

The leaves in the Zingiberaceae tribe have a single leaf type with varying leaf build, namely jorong, lanceolate and elongated. The shape of the jorong leaves is found in the Camptandra and Globba clans, an elongated shape in the Hornstedtia clan and lanceolate in the *Conamomum xanthoplebium* and *Alpinia scabra* types.

Figure 4 Build leaves; build jorong on *Camptandra* sp. (A), build elongated on *Hornstedtia leonurus* (B), wake up jorong on *Globba pendula* (C), build lanceoplebium on *Conamomum xanthoplebium* (D).

3.1.4 Inflorescence Type

Inflorescences of the tribe Zingiberaceae based on the place where the flower appears can be grouped into three, namely from the rhizome (radicalis) of the armpits of the leaves (axilaris) and from the tip of the stem (terminalis) (Figure 5). Terminalis inflorescences are found in the types *Alpinia scabra, Globba leuchanta, Globba patens, Globba pendula, Globba multifolia*. Axillary inflorescences are found in the *Boesenbergia* sp type. and *Alpinia hansenii*. Other types have radicalistic inflorescences. Radicalis inflorescences come from rhizomes close to the ground level, these inflorescences are found in the types *Amomum centrocephalum, Amomum cerasinum, Amomum hastilabium, Amomum citrinum, Conamomum xanthoplebium, Etlingera coccinea, Hornstedtia leonurus, Hornstedtia tomentosa, Meistera gyrolophos, Zingiber puberulum*. The difference between Zingiberaceae flowers based on the direction of growth is divided into two are the direction of growing hanging flowers and perpendicular or leaning upwards.

Figure 5 Types of inflorescences in the Zingiberaceae tribe; inflorescences from the armpits of the leaves in *Boesenbergia belalongensis* (A), inflorescences from rhizomes in *Amomum centrocephalum* (B), inflorescences from the ends of the stems on *Globba leuchanta* (C)

3.1.5 Fruit

The shape of the fruit in the Zingiberaceae tribe as a whole is round. The surface of the fruit varies, in the type of *Alpinia scabra* and *Amomum cerasinum* the surface of the fruit is slippery. The surface of the fruit in *Amomum cerasinum* kasap, there are lines on the surface and when the fruit is split it will look like it has space on the inside and the same as the surface of the fruit. on the Globba clan (Figure 6)

Figure 6 Fruit form in the Zingiberaceae tribe; Round shape with a slippery fruit surface on *Alpinia scabra* (A), a round shape with a fruit surface has stripes and has space on the inside of the *Amomum cerasinum* (B), a round shape with three *Globba pendula* (C)

3.2. Ecology of Zingiberaceae

The types of Zingiberaceae generally occupy habitats that vary from a height of 669 to 1010 meters above sea level with air humidity ranging from 86 to 99%, the intensity of sunlight ranges from 125 to 78 Candela and rainfall ranges from 3500 to 4000 mm / year. The habitat occupied by the Zingiberaceae tribe starts from within the forest, forest periphery and open areas with full sunlight. In general, the types of Zingiberaceae are found to occupy the area around the river flow, while the relatively dry area is occupied by Etlingera coccinea. This is in accordance with the opinion of [7], who stated that the Etlingera clan grows clustered in places, secondary forests and open forests.

The diversity and abundance of the types of Zingiberaceae is affected by environmental conditions such as altitude, air temperature, light intensity, and air humidity. Zingiberaceae

ecological data in Batang Toru Blok forest area West shows air temperature ranging from 21 to 23°C, humidity ranges from 84°C up to 99%, the pH of the soil ranges from 6 to 6.7, the light intensity ranges from 125 to 578 Candela. From the results of the study, it can be stated that the condition of the research site is classified as moist with the pH of the soil appropriate for growth and spread of Zingiberaceae plants. It is related to [8], who posits that the temperature range is allows optimum ginger growth is 25 to 30ºC. Temperature above 35 ºC will make the leaves dry out, while the lower the temperature then the age .The plant will get longer. Ginger plants can grow at a soil acidity (pH) of 4.3 to 7.4, but the optimum pH for ginger is 6.8 to 7.0 [9]

Rainfall at the research station is about 3500 to 5000 mm/year. The number of types of Zingiberaceae scattered in this location is suspected to be one of them. because it has rainfall suitable for the growth of the Zingiberaceae type. This is in accordance with the opinion of [9], who stated that the area with an annual rainfall amount of 2500 to 4000 mm with the moon Wet 7 to 9 months is good for the growth of the Zingiberaceae tribe.

3.3 Identification Key

3.3.1 Clan identification key

1. a. Epiphytic herbs..... 2
   b. Terrestrial herbs..... 3
2. a. Leaves ovate, anthers free of appendage ..... Camptandra
   b. Jorong leaves, anthers with appendage.....Globba
3. a. Free rhizomestyle root..... 4
   b. Rhizome hasstyle root..... 5
4. a. Semi-circular petiole..... Boesenbergia
   b. Round petiole..... 6
5. a. The lip of the flower is longer than the flower tent..... Amomum
   b. The lip of the flower is the same length as the flower tent..... Hornstedtia
6. a. Inflorescence free of conical, terminal or axillary flowers..... Alpinia
   b. Inflorescences with cones, flowers from rhizomes..... 7
7. a. Sterile bracts produce 1 flower..... Etlingera
   b. Sterile bracts produce > 1 flower..... 8
8. a. The base of the petiole swells, the ligules split..... Zingiber
   b. The base of the petiole is flat, the ligules are rounded..... 9
9. a. Distance between shoots 5 cm, bracts rounded ..... Meistera
   b. Distance between shoots > 5 cm, tapered bracts.....Conamomum

3.3.2. Type identification key

1. a. Small plant, 50 cm tall..... 2

b. Large plant, height > 50 cm..... 11

2. a. Epiphytic herbs..... 3

b. Terrestrial herbs..... 4

3. a. Leaves ovate, spine curved ..... *Camptandra* sp.

b. Jorong leaves, pinnate spines..... *Globba multifolia*

4. a. Soft rhizome, leaf length 15 cm..... 5

b. Hard rhizome, leaf length >15 cm..... 7

5. a. Growing hanging flowers, the number of appendices 2..... *Globba pendula*

b. Growing flowers inclined upwards, the number of appendix 4 6

6. a. The upper surface of the leaves is smooth, single rhizome..... *Globba leuchanta*

b. The upper surface of the leaves is downy……*Globba patens*

7. a. Inflorescence from stem, distance between shoots > 5 cm.....*Boesenbergia* sp.

b. Inflorescence from rhizome, distance between shoots <5 cm..... 8

8. a. The base of the leaf stalk swells……..*Zingiber multibracteatum*

b. The base of the petiole is flat 9

9. a. Clumped herb, pointed flower lips ..... *Etlingera coccinea*

b. Solitary herb, flat flower lips 10

10. a. The shape of the bracts is rounded, ...*Meistera gyrolophos*

b. Sharp bracts 12

11. a. Rhizome withstyle root..... 13

b. Free rhizomestilt root .....*Conamomum xanthoplebium*

12. a. Conus forms fusiform .....*Hornstedtia tomentosa*

b. Cones form cylinders 14

13. a. Inflorescence from stem, asymmetrical leaf base .....*Alpinia scabra*

b. Inflorescence from rhizome, leaf base symmetrical 15

14. a. Triplets fruit, total 20 .....*Amomum cerasinum*

b. Round fruit, number > 20 ....*Amomum citrinum*

15. a. Ligula length > 10 cm, tapered tip .....*Hornstedtia leonurus*

b. Ligula length 10 cm, rounded tip 16

16. a. Cone-free inflorescences, inflorescences from stems .....*Alpinia hansenii*

b. Inflorescence with cones, inflorescence from rhizomes 17

17. a. The bracts cover each other .....*Amomum hastilabium*

b. Bracts are separated from each other .....*Amomum centrocephalu*

3.4. Description of The Types of Zingiberaceae in the Batang Toru Forest of the West Block

3.4.1 *Alpinia hansenii* R.M. Sm.

Teresterial. Herbs. Height 202 to 230 cm. Soft rhizomes, creeping in below the surface of the soil, slippery scales, yellowish-white, soft-scented flesh. The distance between shoots is 15 cm. Stilt root was not found. Pseudostem round, slippery, tall 25 cm, diameter 4 to 5 cm, green, number of leaves 4 to 8, green fronds, flattened, length 37 cm. rounded ligula, slippery, 0.3 cm long, reddish green. Lanceolate leaf sheet, 40x6 cm, rounded base, tapered tip, flat edges, surface top and bottom hairy, green, number 7 to 12 sheets . flat petioles, yellowish green, 12 cm long. Axial inflorescences, blooming flowers 2. Stalk flowers are yellow, slippery, 3 cm long. Elongated petals, blunt ends, white, length 5 cm, width 1 to 1.5 cm, slippery surface. Elongated crown, red, length 3 cm, width 0.5 to 1 cm, slippery surface. Lip lanceolate shape, red, length 2 cm, width 0.3 cm, blunt tip, flat base, white edge, middle part red. Red stamens, 1 cm long. Yellowish-white cider stalks, long 0.6 cm. White sari head. Yellowish-white pistils, 4 cm long. Pistil stalk white, length 1.8 cm

Specimen : MM 19

Distribution : Indonesia (Sumatra: new record), Malaysia (Sabah) and Sarawak) [10]

Habitat and Ecology: Grows at an altitude of 781 meters above sea level

3.4.2 *Alpinia scabra* (Blume) Naves

Teresterial. Herbs. Height 250 to 300 cm. soft rhizomes, small, creeping below the surface of the ground, slippery scales, yellowish-white, flavorful flesh soft. The distance between shoots is 3 cm. Stilt root was not found. Pseudostem round, green yellowish, height 3 to 5 cm, thin fronds, grooved, green upper surface, pale green lower surface, pointed base, pointed tip, flat edges, length 22 cm, rounded ligula, slippery, 0.5 cm long, green. Lanceolate leaf sheet, 46x9 cm, asymmetrical base, pointed end, flat edges, green, grooved upper surface, the lower surface is slippery, the number is 16 to 20. Flat petioles, green 23 brownish, flat base, length 3 cm. Flowers were not found. Round, green fruit blackness, slippery surface, length 0 to 5 mm, diameter 2 cm, amount 45 up to 60

Specimen : MM 12, MM 20

Distribution : Indonesia (Sumatra: new record), Malaysia (Sabah) and Sarawak) [10]

Habitat and Ecology: Large large-scale plants on the outskirts of the forest and in around the river with a height of 741 to 910 mdpl

3.4.3 *Amomum cerasinum* Ridl.

Teresterial. Herbs. Height 450 to 500 cm. Rhizomes are hard and woody, round, below ground level, slippery scales, brown, fleshy, white, sour-scented. The distance between shoots is 7 cm.

Stilt root was not found. Pseudostem round, green, height 25 cm, base diameter 3.5 cm, thin frond, slippery, long cm, green, rounded ligula, green, slippery surface, length 0.1 cm. Lanceolate leaf sheet, 30 to 60 cm, green, grooved upper surface, slippery lower surface, rounded base, tapered end, flat edges, number of 15 to 20 sheets. Flat petioles, flat base, green, 6 cm long. Flowers were not found. Round fruits, emerging from the rhizome, above ground level, 5 to 6 cm long, 6 to 10 cm in diameter, grooved surface, green, number 10 to 15.

Specimen: MM 21
Distribution: Brunei, Indonesia (Java, Sumatra), Malaysia (Sabah and Sarawak)
Habitat and Ecology: Large plants on the outskirts of forests and around river grooves at an altitude of 809 meters above sea level.

3.4.4 *Amomum centrocephalum* A. D. Poulsen

Teresterial. Herbs, berumpun. Height approximately 205 cm. Rhizomes are hard, small, creeping over ground level, light brown, slippery scales, brown, fleshy, brown, unscented. The distance between shoots is 3.5 cm. Stilt roots slippery, brown, height 5 up to 8 cm. Pseudostem round, brown, height 1.5 to 4 cm, base diameter1.8 cm, thin leaf, slippery, length 25 cm, green, rounded ligula, hard membrane, slippery, green, length 0.3 cm Elongated leaf sheet, slippery, pointed base, tapered tip, flat edges, top and bottom surface slippery leaves, long 22.5x10 cm, amount from 17 to 25. Petioles are brownish green, thin, slippery, 0.8 cm long. Inflorescences emerge from the rhizome, like a bongkol forming a conus, composed of several red braktea, tapered braktea tips, 4.2 cm long, number 1, flowers bloom present. Pink flower stalks, tapered scales, 5 cm long. Petals of lanceolate shape, pointed tip, pink, length 2.3 cm, width 0.4 cm, slippery surface. The crown of the shape is lanceolate, red, 2.2 cm long, 0.3 cm wide, slippery surface. Lanceolate lip, red, 2.1 cm long, 0.3 cm wide, white pointed tip, flat base, white edge, red center. Red stamens, length 4 mm. Sari stalks are 2 mm long. The sari head is 2 mm long. Yellowish-white pistils. Fluffy pistil stalks. Broken pistil head
Specimens : MM 33, MM 15, MM 14
Distribution: Indonesia (Sumatra), Malaysia (Sabah and Sarawak) Habitat and Ecology: Large plants on the outskirts of forests and in around the river flow at an altitude of 809 to 1003 meters above sea level.

3.4.5 *Amomum citrinum* (Ridl.) Holttum.

Teresterial. Herbs, clumps, 200 to 250 cm tall. Rhizome hard and woody, long creeping, above ground level, white, smooth scales, brown, fleshy, white, sour smelling. The distance between shoots is 9.5 cm. Stilt root brownish green, 30 cm high. Pseudostem round, green, 1 to 3.5 cm in diameter, 1 m long, flat midrib, smooth, green, 7 cm long, ligular pointed, 1.5 cm long, smooth surface, green. Leaves elongated, 40x15 cm, green, smooth top surface, smooth bottom surface,

asymmetrical base, pointed tip, flat edge, total 12 to 15 sheets. Petiole flat, green, 1 cm long. Inflorescences emerge from the rhizome. Flowers not found. Fruit emerges from rhizome, above ground level, covered by bracts, 0.5 to 3 mm in diameter, smooth surface, green, number 40 to 50 pieces (Appendix 6.5).

Sspecimen : MM 26

Distribution: Indonesia (Sumatra) and Malaysia (Silver)

Habitat and Ecology: Plants in large clumps in open and slightly shaded forests at an altitude of 1010 masl.

3.4.6 Amomum hastilabium Ridl.

Teresterial. Herbs, clumps. Height approximately 205 to 300 cm. Rhizome hard and woody, round, below ground level, smooth scales, yellowish white, odorless. Distance between shoots 7 to 8 cm. Stilt root not found. Pseudostem round, brown, 14 cm high, 1.5 to 3 cm in diameter, midrib flat, smooth, 35 cm long, green, ligule rounded and split, grooved, flat, green, 1.5 cm long Leaf blade lengthwise, 52x17 cm , yellowish green, rounded base, pointed tip, flat edge, number 16 to 20. Leaf stalk flat, green, 2.2 cm long. Inflorescences emerge from the rhizome, like a hump to form a cone, composed of several brown bracts, the tip of the bracts is tapered, 11 cm long, the number 1, the flowers bloom. Flower stalks white to yellow, 2 to 3 cm long. Petals lanceolate, pointed tip, yellow, 3 to 5 cm long, 2 to 3 cm long, smooth surface. Crown lanceolate, yellow, 3 cm long, 2 cm wide, smooth surface. Lip lanceolate, yellow, 2 cm long, 2 cm wide, white pointed tip, flat base, white edge, red center. Yellow stamens. Reddish yellow sari stalk, 3 cm long. Anthers reddish brown, 1.2 cm long.

Specimen : MM 18

Distribution: Indonesia (Sumatra)

Habitat and Ecology: Plants in small clumps in the forest slightly open at an altitude of 804 mdpl.

3.4.7 *Boesenbergia belalongensis* AD Poulsen.

Teresterial. Herbs, solitary. Height 75 to 85 cm. Rhizome hard, round, small, short creeping, below ground level, scales rough, brown, fleshy, white, odorless. The distance between the shoots 4 to 8 cm. Stilt root not found. Pseudostem round, green, 15 cm high, base diameter 4 to 7 cm, midrib flat, smooth, reddish green, 7 to 9 cm long, ligules flat, thin, 0.6 to 1.4 cm long or sometimes absent. Leaves lanceolate, dark green, smooth top and bottom surface, asymmetrical base, pointed tip, flat edge, pinnate bone, 25x12 cm, total 6. Stem flat, reddish green, smooth surface, 8 to 11 cm long, green. Inflorescence above ground level, 11 to 20 cm long. White flower stalk, 3 cm long. Crown. Petals lanceolate, white, wavy tips.

Sspecimen : MM 10, MM 11

Distribution: Brunei and Indonesia (Sumatra: new record)

Habitat and Ecology : Plants in small clumps in swamp forest are not permanent at an altitude of 906 to 907 masl.

3.4.8 *Camptandra* sp.

Epifit. Herb, solitary, 24 cm tall. Rhizome soft, elongated, below ground level, short creeping, white, smooth scales, brown, odorless. The distance between shoots is 1.5 cm. Stilt root not found. Pseudostem round, green, diameter 0.5 to 1 cm, 4 cm long, midrib flat, smooth, green, 3 cm long, ligule pointed, 1.3 mm long, smooth surface, green. Leaves ovate, asymmetrical, 15x8 cm long, green, smooth top surface, smooth bottom surface, rounded base, pointed tip, flat edge, number 4 to 6. Stem flat, green, 3 cm long

Sspecimen : MM 28, MM 34

Distribution: Indonesia (Sumatra)

Habitat and Ecology: Plants in small clumps in the forest and several species grow in epiphytic habitats at an altitude of 904 to 974 meters above sea level.

3.4.9 *Conamomum xanthoplelium* Baker.

Teresterial. Herbs, clumps, Height approx. 230 cm. Small rhizome, long creeping, below ground level, white, smooth surface, brown scales, yellowish white flesh, sour aroma. The distance between the shoots is 10 cm. Stilt root not found. Pseudostem round, green, 20 cm high, base diameter 2 to 3 cm, midrib thin, smooth, green, 28 cm long, ligule rounded, thin, smooth, green, 1 cm long. Leaves lanceolate, pointed base, pointed tip, flat edge, smooth top and bottom surface, green top surface, red bottom surface, length 68x6 cm, total 17 to 20. Leaf stalk flat, green, 2 cm long. The inflorescence arises from the rhizome, like a cone to form a cone, composed of several red bracts. The flowers bloom in the number of 2 to 3. The flower stalks are round, red orange, 4 cm long. lanceolate petals, flat tip, red orange, 2 cm long, 4 cm wide, smooth surface. Crown lanceolate, yellowish red, 2.2 cm long, 2 cm wide, smooth surface. Lip shape lanceolate, red yellow, 4 cm long, 3 cm wide, white pointed tip, flat base, white edge, red center. Red yellow stamens, 1 cm long. Stalks yellowish white, 0.6 cm long. White anther. White yellow pistil, 4 cm long. White pistil stalk, 1.8 cm long (Appendix 6.9). White yellow pistil, 4 cm long. White pistil stalk, 1.8 cm long (Appendix 6.9). White yellow pistil, 4 cm long. White pistil stalk, 1.8 cm long (Appendix 6.9).

Sspecimen : MM 29, MM 30, MM 31

Distribution : Indonesia (Sumatra), the Malay Peninsula and Singate

Habitat and Ecology: Plants in large clumps in open and slightly shaded forests at an altitude of 890 to 912 masl

3.4.10 *Etlingera coccinea* (Blume) S. Sakai & Nagam.

Teresterial. Herbs, clumps. Height 500 to 600 cm. Rhizome hard, round, below ground level, rough scales, whitish brown, fleshy, white, soft scented. Distance between shoots 6 to 38 cm. Stilt root not found. Pseudostem round, brownish red, 5 cm high, 4 cm in diameter, thin midrib, 30 to 55 cm long, green, ligule rounded, smooth, reddish brown, long 1.4 to 1.6 cm. Leaves elongated, tapered base, pointed tip, flat edge, smooth upper and lower surface of leaves, green, well-defined veins, 20 to 82 cm long, 7 to 12.8 cm wide, 13 to 25 in number. Leaf stalk flat, green, 0.8 cm long. The inflorescences from the rhizome, the direction of growing upright, are above the ground. Blooms found, red, number 5 to 10. Long sterile bracts 7 cm, 3 cm wide, elongated, smooth, red. Fertile bracts 9 cm long, 2.8 cm wide, lanceolate, smooth, red. Bracteola 3 to 5 cm long, 1 cm wide, tube, red. Petals 8 cm long, 0.5 cm wide, tubular, three-toothed, smooth, red. Crown tube 7 cm long, red. Lip length 6 cm, width 1.5 cm, lanceolate, flat base, tip split, red, red edge, yellow middle. Stamens white, 1 cm long, 0.45 cm wide. Pink sari stalk, 0.1 cm long. Pink pistil, 4 cm long. White pistil stalk, 9 cm long. Pink pistil (Appendix 6.10).

Sspecimen : MM 17

Distribution : Indonesia (Sumatra, Java), Sarawak and the Peninsula Malaya

Habitat and Ecology: Plants in large clumps in open and slightly shaded forests at an altitude of 812 meters above sea level.

3.4.11 *Globba leuchanta* Miq.

Teresterial. Herbs, solitary. Approximately 110 cm high, single rhizome, soft in the ground, round, short creeping, smooth, reddish brown, odorless. Distance between shoots not found. Stilt root not found. Pseudostem green, 2.8 cm high, 1.47 cm diameter, downy surface. midrib flat, green, 8 cm long, ligular pointed, smooth, green, 0.6 cm long. The leaves are elongated, the top and bottom are green with a smooth surface, a pointed base, a pointed tip, a serrated edge, a clear spine, 20x9.2 cm long, 11 to 15 in total. Green petiole, 0.4 cm long. Inflorescence from the tip of the stem, white to purple, 25 cm long, green flower stalk, 4 cm long, 4 to 5 in number. Stamens 12 to 20 mm long. Stalks 3 to 4.5 mm long. Broken pistil. Fruit round, pale green, diameter 0.7 mm, number 2 (Appendix 6.

Specimen : MM 32

Distribution : Indonesia (Sumatra, Java), Malay Peninsula and Thailand

Habitat and Ecology: Small plants live solitarily in humid areas and in riverbanks, growing at high altitudes 832 masl.

3.4.12 *Globba multifolia* A. Takano & H. Okada

Epifit. Herbs, solitary. Height 118 cm. Soft rhizome, not clear scales, smooth skin, red, odorless flesh, white, distance between shoots 0.3 cm. Stilt root not found. Pseudostem 7 cm high, 0.5 cm in diameter, red, long midrib 4 cm, green with red spots, rounded ligules, 0.2 cm long, smooth,

green with red spots. Leaflets oblong, 3 to 13.3 cm long, 1.7 to 5 cm wide, rounded base, pointed tip, flat edge, upper surface of cassava leaves, green, undersurface of cassava leaves, green, clear ribs, smooth, green, Number of leaves 5 to 12. Inflorescence from the tip of the stem, growing direction upright, 10 to 25 cm long, orange, 1 to 3 blooms. Bracts not found. long bracteole 0.3 cm, 0.2 cm wide, oblong, orange. Petals 0.5 cm long, 0.15 cm wide, tubular, three-toothed tip, smooth, orange-brown. Crown tube 1.5 cm long, orange. Lip length 1.5 cm, width 0.5 cm, triangular, blunt tip, curved base, whole orange brown middle. Orange stamens, long 0.21 cm, 0.1 cm wide. Orange sari stalk, 1.2 cm long. Appendix orange, number 4. Pistil orange, 4 cm long. Orange pistil stalk, 4 cm long. The stigma is round, orange.

Sspecimen : MM 06

Distribution : Indonesia (Sumatra, Java), Malaysia (Sabah and Sarawak, and Thailand**)**

Habitat and Ecology: Small plants live solitary in humid areas and on riverbanks, sometimes growing epiphytes at an altitude of 900 meters above sea level.

3.4.13 *Globba patens* Miq.

Teresterial. Herbs, solitary. Height about 110 cm, rhizome soft, below ground level, round, short creeping, smooth, reddish brown, odorless. The distance between the shoots 3 to 5 cm. Stilt root not found. Pseudostem 25 cm high, smooth surface, reddish green, 2.3 cm in diameter, thin midrib, flat base, green, 8 cm long, ligule pointed, green, long 0.6 cm, hairy, soft membrane form. Leaves oblong, smooth top and bottom, green, pointed base, pointed tip, flat edge, 20.5x9.2 cm long, 5 to 6 in total. Stem thin, surface downy, green, 0.4 cm long. Inflorescence terminal, yellow, 16 cm long. Green flower stalk, 16 cm long, downy surface. Bracts elongated, green with yellow tips, pointed tip, 2 cm x 0.1 cm long, smooth surface (Appendix 6.13).

Sspecimen : MM 04, MM 21

Distribution : Indonesia (Sumatra), the Malay Peninsula and Thailand

Habitat and Ecology: Small plants live solitary in humid areas and in riverbank areas, sometimes growing epiphytes at an altitude of 803 to 900 meters above sea level.

3.4.14 *Globba pendula* Roxb.

Teresterial. Herbs, solitary. Height 81 to 110 cm. Soft rhizome, in the soil, scales not found, smooth skin, red, odorless flesh, white. The distance between the shoots is 0.3 cm. Stilt root not found. Pseudostem smooth, green, 3.6 cm high, 0.5 cm in diameter, thin midrib, smooth, 4 cm long, green, ligula rounded, 0.2 cm long, smooth, green. Jorong leaf sheets, 3 to long

13.3 x 1.7 to 5 cm, base rounded, pointed tip, flat edge, upper surface of kaffir lime leaves, whitish green, lower surface of cassava leaves, green, clear ribs, number 5 to 12. Inflorescence from tip of stem, direction of growth dependent, 10 to 25 cm long, orange, 1 to 3 blooms. Inflorescence smooth, red, 40 cm long. Petals 0.5 cm long, 0.15 cm wide, tubular, three-toothed tip, smooth,

orange-brown. Crown tube 1.5 cm long, orange. Lip length 1.5 cm, width 0.5 cm, triangular, blunt tip, curved base, whole orange brown middle. Orange stamens, 0.21 cm long, 0.1 cm wide. Reddish orange sari stalk, 1.2 cm long. Appendix orange, number 2. Orange pistil. The pistil is 4 cm long. Pistil round, orange. Fruit number 2 to 3, 1 cm long, 1.1 cm wide, round,

Sspecimen : MM 02

Distribution : Indonesia (Kalimantan, Sumatra), Malaysia (Sabah and Sarawak, Malay Peninsula, Singapore and Thailand

Habitat and Ecology: Small plants at an altitude of 909 masl.

3.4.15 *Hornstedtia leonurus* (J. Konig) Rotz.

Teresterial. Herbs, clumps. Height 370 cm. Hard rhizome, above ground level, scaly scales, dark brown, smooth skin, reddish brown, sour-scented flesh, brown, distance between shoots 20 cm. Stilt root not found. Pseudostem round, 5.5 cm high, 4.5 cm in diameter, brown, thin midrib, hard, 61 cm long, reddish brown, ligule rounded, 1.3 cm long, downy, brown. Leaf blade elongated, 8 to 51 long, 3 to 10 cm wide, asymmetric base, pointed tip, flat edge, upper surface smooth, green, underside smooth, green, clear midrib, hairy, green, number 22 to 38. Inflorescence from the rhizome, growing direction upright, 11 cm long, red, flowers bloom 1 to 2 flowers. Petals elongated, smooth, 8 cm long, red. Lip length 3 cm, width 2.3 cm, elongated, flat base, rounded tip, all red. Red stamens, 2 to 2.9 cm long, 0.45 to 1 cm wide. Red stamens, 0.1 to 1.5 cm long (Appendix 6.15).

Sspecimen : MM 40

Distribution : Indonesia (Sumatra), the Malay Peninsula and Sabah

Habitat and Ecology: Plants with large clumps in a humid place in the outskirts of the forest at an altitude of 687 meters above sea level.

3.4.16 *Hornstedtia tomentosa* (Blume) Bakh. f.

Teresterial. Herbs, clumps. 250 cm high. Rhizome hard and woody, above ground level, smooth scales, yellowish white, fleshy, pale yellow, soft scented. The distance between the shoots 9 to 10 cm. Stilt root 4 cm long, smooth, red-brown. Pseudostem yellowish green, 4.2 cm high, 3.1 cm diameter, midrib 60 cm long, green, tapering ligules, 1.1 to 5 cm long, smooth, red edges, hairy, green. Leaf lanceolate, 14 to 66 long, 3 to wide

9 cm, pointed base, tapered tip, flat edge, smooth upper and lower surface of leaves, green, clear veins, green, number 7 to 18. Inflorescence from rhizome, growing direction upright, 18 cm long, red, flowers bloom 1 to 3 Sterile bracts 5 cm long, 2.2 cm wide, elongated, hairy, red. Fertile bracts 7 cm long, 1.8 cm wide, lanceolate, hairy, red. Bracteola 2.5 cm long, 0.4 cm wide, lanceolate, red. Petals 3.2 cm long, 0.3 cm wide, tubular, two-toothed tip, smooth, red. Crown tube 8 cm long, red. Long dorsal corolla lobe

2.6 cm long, 0.8 cm wide, elongated, smooth, red. Lateral corolla lobes 2.4 cm long, 0.5 cm wide, lanceolate, smooth, red. Lip 2.5 cm long, 1 cm wide, elongated, flat base, rounded tip, all yellow. Yellow stamens, long
1.6 to 2, 0.5 to 1.5 cm wide. Yellow sari stalk, 0.4 to 1 cm long. Red pistil, 12 to 15 cm long. White pistil stalk, 9 cm long. Pistil round, white, fruit number 2 to 4, 3 cm long, 2 cm wide, round, pink, soft aroma.
Sspecimen : MM 23
Distribution : Indonesia (Sumatra, Java), Malaysia (Sabah, Sarawak)
Habitat and Ecology : Plants in large clumps in the forest near the groove sriver at an altitude of 669 meters above sea level.

3.4.17 *Meistera gyrolophos* RM Sm.

Teresterial. Herbs, clumps. Approximately 205 cm high. Rhizome hard and woody, below ground level, light brown, smooth surface, brown scales, brown flesh, odorless. The distance between the shoots is 3.5 cm. Stilt roots smooth, brown, 5 to 8 cm high. Brown pseudostem, 1.5 to 4 cm high, base diameter 1.8 cm, midrib thin, smooth, 28 cm long, green, hairy ligula, rounded, hard-coated, green, 0.3 cm long Leaf blade elongated, smooth, pointed tip, pointed base, leaf margin flat, upper surface smooth, the bottom surface is downy, 22.5x10 cm long, the number of 17 to 25 pieces. The petiole is flat, green, 0.3 cm long, the lower base swells. Inflorescences emerge from the rhizome, like a hump to form a cone, composed of several red bracts, tapered ends of bracts, 4.2 cm long, 1 in number, blooming flowers are present. Pink flower stalk, tapered scale shape, 5 cm long. Petals lanceolate, pointed tip, pink, 2.3 cm long, 0.4 cm wide, smooth surface. Crown lanceolate, red, 2.2 cm long, 0.3 cm wide, smooth surface. Lip lanceolate, red, 2.1 cm long, 0.3 cm wide, white pointed tip, flat base, white edge, red center. Red stamens. Stalk length 1.8 cm. The pistil is damaged.
Specimen : MM 01
Distribution : Indonesia (Sumatra, Java), Malaysia (Sabah, Sarawak)
Habitat and Ecology : Plants in large clumps in the forest near the groove sriver at an altitude of 904 meters above sea level.

3.4.18 *Zingiber puberulum* Ridl.

Teresterial. Herbs, clumps. Approximately 270 cm high. Rhizome soft and fleshy, in the ground, surface rough scales, brownish white, white flesh, sour aroma, distance between shoots 5.5 cm. Stilt root not found Pseudostem round, gummy, yellowish green, 3.5 cm high, 3.8 cm in diameter, midrib yellowish green, 56 cm long, ligules split, surface downy, soft membrane form, 1.5 cm long, brown . Leaf lanceolate, top and bottom smooth, pointed tip, tapered base, flat leaf edge, green, 42x9.5 cm long, number of leaves 20 to 25. Green petiole, 1.4 long cm, the base of the

bottom swells. Inflorescences emerge from the rhizome with a position above the ground. Pink bract, 17 cm long. Pink flower stalk, 20 cm long, brown. Bracteola tapered, yellow, 1.7 cm long, 0.4 cm wide. Yellow petals, lanceolate shape, smooth surface, toothed tip
2, 3 cm long, 0.5 cm wide. Red crown, lanceolate shape, long corolla tube 10 to 15 cm. Petals lanceolate with blunt ends, 2.6 cm long, wide 0.48 cm. Yellow lip, 1.8 cm long, 1.67 cm wide, the tip is split in 3, yellow, the middle is flat, the edges and middle are yellow. Stamens yellow, 1.6 cm long x 0.4 cm wide. Yellow sari stalk, 3.1 cm long. The anthers are yellowish white. Pistil yellow, pistil stalk 3.1 cm long. Triangular pistil, yellow hairy tip.
Sspecimen : MM 16
Distribution : Indonesia (Sumatra, Java), Malaysia (Sabah, Sarawak) Habitat and Ecology : Plants in large clumps in the forest near the groove sriver at an altitude of 812 meters above sea level

4. Conclusion

The results of research on the inventory of types of Zingiberaceae in the Batang Toru Forest area of the West Block of North Tapanuli Regency of North Sumatra Province were obtained as many as 10 genera with 18 types, namely: *Alpinia hansenii, Alpinia scabra, Amomum centrocephalum, Amomum cerasinum, Amomum hastilabium, Amomum citrinum. Boesenbergia sp. Camptandra sp. Conamomum xanthoplebium, Etlingera coccinea, Globba leuchanta, Globba multifolia, Globba patens, Globba pendula. Hornstedtia tomentosa, Hornstedtia leonurus, Meistera gyrolophos, Zingiber multibracteatum*. Two of these types are new records for Sumatra: *Alpinia hansenii and Boesenbergia belalongensis..*

Reference

[1] Perbatakusuma EA, Supriatna J, Siregar RSE, Wurjanto D, Sihombing L, dan Sitaparasti D. 2006. Mengarustamakan Kebijakan Konservasi Bidiversitas dan Sistem Penyangga Kehidupan di Kawasan Hutan Alam Sungai Batang Toru Provinsi Sumatera Utara. Laporan Teknik. Departemen Kehutanan Konservasi International. Pandan.

[2] Fredriksson G, Indra M, 2007. Hutan Batang Toru Harta Karun Tapanuli. YELSOCP. Medan.

[3] Larsen KH, 1999. Gingers of Peninsular Malaysia and Singapore. Natural History Publications (Borneo). Kinabalu. Sabah. Malaysia.Fachrul MF, 2007. Bioecological Sampling Method. Jakarta. Earth Literature.Nell LA et al., 2016. Presence of Breeding Improves Body Condition for a Crocodilian Nest Protector. Plos ONE. 11 (3).

[4] Nurainas, Junaidi, 2007. Jahe-jahe Liar di Taman Nasional Siberut. Balai Taman Nasional Siberut. Siberut

[5] Siagian S, 2009. Inventarisasi Zingiberaceae Di Kawasan Agrowisata Hutan Taman Eden 100 Kabupaten Toba Samosir Sumatera Utara. Penelitian Mahasiswa Jurusan Biologi S1. Medan. USU. hlm. 16

[6] Pandey BP, 2003. A Text Book of Botany. Angiosperms: Taxonomy, Anatomy, Embryologi. Ram Nagar: S.Chand & Company Ltd. Barus TA, 2004. Introduction to Limnology, The Study of River and Lake Ecosystems.USU Medan

[7] Larsen, 2000. Zingiberaceae. Flora of China 24: 322-377

[8] Effendi DS, 2000. Identifikasi Lahan Bagi Pengembangan Tanaman Jahe (Zingiber officinale Rose.) Dan Melinjo (Gnetum gnemon L.). Berita Biologi. Vol 5 (2).

[9] Suprapti M, Lies, 2003. Aneka Awetan Jahe. Teknologi Pengolahan. Kanisius: Yogyakarta. Hal 14.

[10] Poulsen AD, 2006. A Pocket Guide Gingers of Sarawak. Natural History Publications (Borneo). Kinabalu.

[11] Poulsen AD, 2006. Etlingera of Borneo. Natural History Publications (Borneo). KinabaluHuet M, 1971. Textbook of Fish Culture.Breeding and Cultivation of Fish.Ryre & Spottiswoode Ltd, at the Press Margate. England