First Record of Balanophora elongata var. ungeriana Species in South Sumatra

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First Record of *Balanophora elongata* var. ungeriana Species in South Sumatra

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Abstract:
The study of Balanophora *in South Sumatra has been carried out from July-August 2018. This research uses the direct observation and collection method in 3 km long track in the Bukit Jambul Gunung Patah Protection Forest Area, South Sumatra. Sample identification was carried out in the Biology Department of the Faculty of Mathematics and Natural Sciences, Sriwijaya University. The results show that there is one* Balanophora *species,* B. elongata. *There are 2 subspecies of this species, namely* B. elongata *var. elongata and* B. elongata *var. ungeriana (Valeton)* B. Hansen. *The difference between these 2 subspecies is var. ungeriana in the tubers is not elongated with longitudinally coarse luruk leaves. At that location only found species of* B. elongata *var. ungeriana. Distribution: Peninsula Malaysia, Borneo, Sumatra, Java, and mostly in West Java for subsp. ungeriana is only recorded on the island of Java precisely at Mount Salak and Mount Gede in West Java. This species is the first record for the Sumatra Island. There are around 30 individual species of* B. elongata *var. ungeriana respectively 23 female individuals and 7 male individuals. Bulbs, leaf characters and flower types are important to identifying the species of* Balanophora. *Most of these species are found in habitats where they have a height of 1000-2800 meters above sea level which are suitable for habitat in the Bukit Jambul Gunung Patah Protection Forest Area.*

Keywords: first record; Balanophoraceae; Balanophora elongate; *character; Sumatera*

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1. Introduction

Bukit Jambul Gunung Patah Protected Forest (HL BJGP) is a forest area that has a protection function with elevations above 800 masl [2]. Based on Minister of Forestry's Decree No. 866 / Menhut-II / 2014. KPHL The Dempo Unit XII Region has an area of 26,064.72 Ha consisting of two forest groups namely Bukit Dingin Protected Forest Group with an area of 2,280.36 Ha, and the Bukit Jambul Protection Forest Group in Gunung Patah with an area of 23,784.36 Ha [3]. States that South Sumatra has 5 types of ecosystems in general, namely, riparian ecosystems, mangrove ecosystems, peat ecosystems, lowland ecosystems and mountainous ecosystems. HL BJGP is located at the Sumatran submontane and montane rainforest ecosystem region, South Sumatra [4].

Reciprocal relationship between an individual with other individuals or between one species and another to be survive of survival. This relationship can be in the form of mutual benefit (symbiosis mutualism), there is also a relationship that fights for a place to live and a source of food (parasitism). Parasitism can occur in several plant families. Plants whose life forms are parasitic and are very commonly known are from the *Rafflesia* family, namely *Rafflesia arnoldi*. In addition, there is also from the family Balanophoraceae which has a living character that is almost the same as Rafflesiaaceae. According to [5] Balanophoraceae includes herbaceous, monoecious and dioecious plants, root parasites that do not have chlorophyll, whitish yellow to yellow, brown, orange to red or pink. Stems appear from endogenous or exogenous tubers.

Balanophoraceae family group can live at an altitude of 900-2800 masl. Many types of plants that are hosts of these parasitic plants, including *Ficus* sp. (Moraceae), *Carissa carandas* (Apocynaceae), *Euonymus crenulatus* (Celastraceae), *Albizia* sp., *Milletia* sp., *Pithecellobium* sp.

Leguminosae), *Baringtonia asiatica* (Lecythidaceae), *Syzygium cuminii* (Myrtaceae), *Cissus* sp., *Tetrastigma* sp. (Vitaceae), and *Endospermum* sp. (Euphorbiaceae) [6]. The morphology of the Balanophora flower as shown in Figure 1.

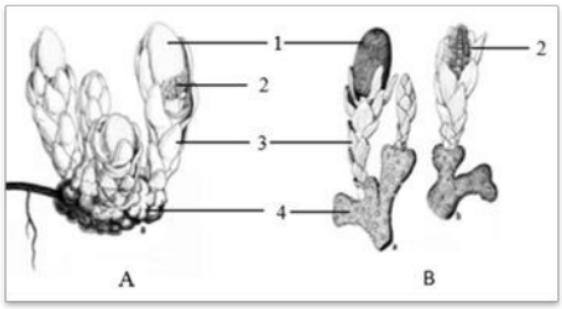

Figure 1. Flowering Morphology of *Balanophora*: (A) Flowers ♂ and ♀ in the same individual (Monoceus); (B) Flowers ♀ and ♂ on different individuals (Dioceus); (A) Female flowers; (2) male flowers; (3) Leaves; (4) Bulbs (Modified)

Balanophora J.R. Forst & G. Forst, the genus of Balanophoraceae, currently consists of 19 species, known from tropical regions of Africa and Australia, tropical Asia, and the Pacific Islands [7]. Pham Hoang Ho recorded 5 species of the genus *Balanophora* JR Forst & G. Forst in Vietmam, namely: (*Balanophora abbreviata* Bl., *Balanophora latisepala* (Tiegh.) Lecomte, *Balanophora fungosa* var. Fungosa, *Balanophora fungosa* Forst. & Forst.f. subsp. Subsp. indica (Arn.) B. Hans., and *Balanophora laxiflora* Hemsl.). There are 7 recorded species of Balanophora genus, namely: *Balanophora abbreviata* Blume, *Balanophora cucphuongensis* N. T. Ban, *Balanophora elongata Blume*, *Balanophora fungosa* Forst. & Amp; Forst.f., *Balanophora indica* (Arnott) Griff., *Balanophora latisepala* (Tiegh.) Lecomte, *Balanophora laxiflora* Hemsl Ban. Most recently, *Balanophora subcupularis*. Tam was published as a new recording species for Flora of Viet Nam [8].

Based on literature studies, no research has been found on the Balanophoraceae group in South Sumatra. [9] Stated that this family was included in the family which still needed further research. According to [10], there are only 5 studies on Balanophoraceae in Indonesia. One of them was a study conducted by [11], about the species of Balanophoraceae in West Sumatra. These species are *B. elongata var. elongata, B. indica*, and *B. dioica* and conservation also support the protection efforts for this group.

Balanophoraceae consists of 4 genera in Indonesia with a difference that is located on the leaves. The genus *Balanophora* and *Langsdorffia* have leaves, whereas the genus *Rhopalocnemis* and *Exorhorpala* do not have leaves. The genus *Rhopalocnemis* lives in mountain forests at an altitude of 1000-2700 meters above sea level, spread over the Himalayas, Indo-China, Sumatra, Java and Celebes. Hosts of the genus *Rhopalocnemis* are *Ficus fistulosa*, *Quercus pruinosa, Macaranga tanarius, Schima wallichii*, and *Albizia lophantha*. *Exorhopala* genus is one of the genera that live at an altitude of 100-1200 masl which is spread in Penang and Malay peninsula. The host plant of the genus is unknown. The genus *Langsdorffia* is distributed only in New Guinea at an altitude of 1500 meters above sea level with hosts *Vaccinium* sp., *Meliosma pinnata*, *Metrosideros eugenioides* and *Eugenia* sp. [5] Balanophoraceae, including rare plants consisting of 17 genera throughout the world.

This study was conducted to determine the species of *Balanophora* in HL BJGP, found the key characters for determining and determinate the host of *Balanophora* found in South Sumatra.

2. Materials and Methods

2.1. Site area

The research was conducted at HL BJGP (Figure 2) in July - August 2018. The research location is in the working area of PT. Supreme Energy Rantau Dedap (SERD) where the company is engaged in geothermal exploitation for the 250 MW Rantau Dedap PLTP located in Muara Enim Regency, Lahat Regency and Pagaralam City, South Sumatra Province.

2.2. Materials

The materials used in the study were 90% alcohol or spritus and FAA (Formalin Asetic acid Alcohol) in a ratio of 5: 5: 90 and special glue. While the tools used are knives, machetes, hanging labels, duct tape, plastic bags, 1 kg plastic bags, 5 kg plastic bags, rubber bands, GPS, smartphones with applications (Cybertracker), digital cameras, stationery, microscopes, bottles collection, and a set of computers equipped with the Quantum GIS 2.0 program.

2.3. Collecting technique and data analysis

The method used is observations with 10 cruising points. The length of the observation path is ± 3 km with the length of each point is 300 m. Then do the direct collection of species of Balanophoraceae. Field research begins with direct observation and collection of the Balanophoraceae family, recording important data or information

in the field in the form of morphological characters that may be lost after preserving such as presence / absence of sap, leaf color, stem color, host plant, altitude. Then the sample in the photo, collected, labeled hanging. Analysis and identification of samples at the Plant Taxonomy Laboratory, Department of Biology, Faculty of Mathematics and Natural Sciences, Sriwijaya University, Indralaya. Preservation of all species of Balanophoraceae were found using 90% alcohol or spritus. The research continued with the making of herbarium specimens consisting of 4 stages, namely preservation, identification with taxonomic journal guides and relevant books such as [12], [13], [14] ,making key determination and monoghraph description also.

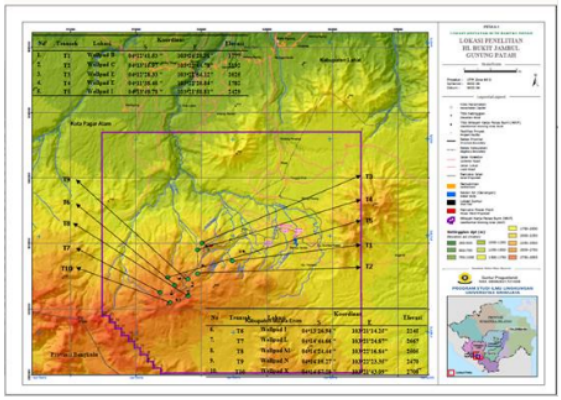

Figure 2. Map of research location

3. Results and Discussion

Based on research that has been done, the distribution of *Balanophora* was found. The location of this species is found only on line 1 (T1) with an observation distance of + 300 m. Then an observation of the morphological characteristics of the species of *Balanophora* has been identified from the species of *Balanophora elongata* . There are many names for this species (synonym), namely *Balanophora ungeriana* (now this species is a subspecies), *Balaniella elongata*, *Balaniella multibrachiata*, *Balanophora forbesii, Balanophora hansenii, Balanophora maxima,* and *Balanophora multibrachiata*.

Balanophora elongata belongs to dioecious root parasites, fleshy, without chlorophyll, red to brown, with basal tubers from which the stem appears. Tubers are cylindrical in shape, 3-8 cm × 1-1.5 cm with scattered warts. Stems on male plants up to 20 cm, shorter in female plants, with a diameter of 58 mm. The leaves are arranged in a spiral gradually rising to the top, the top leaves cover all or part of flowering, the ratio of the upper leaves is wider than the lower leaves, elliptical, up to 4 cm × 2 cm, the color of the reddish to yellowish petals, partially conceal the flowering. Male inflorescence structure, length 35 cm; stamen length 37 mm; 4-stemmed filaments in one segment (very rarely 5-stemmed); tepal around 4 mm; stamens form sinandrium with a fertile part of 2 mm and 20-30 locus (space of the sari) vertically open lengthwise. The inflorescence structure in females, shaped like an ellipsoidal (vessel lid) to subspherical (slightly rounded), measuring 34 cm × 23 cm; bracts (sprout leaves) form spadicles (cobs) or more or less club-shaped (inverted ovoid); female flowers on the main axis of flowering, perianth (sepals and petals) will fall on the bottom of the spadicles; largest flower with pistil 1.3 mm long, longer than the stalk. *B. elongata* flowers bloom throughout the year and are found in green forests at an altitude of 1,000-3,000 masl.

3.1 *B. elongata* Bl. var. elongata and *B. elongata* Bl. var. ungeriana (J. R. & G. Forster)

There are 2 subspecies of this species, namely var. elongata and var. ungeriana (Valeton) B. Hansen. In this study only var ungeriana was found. The difference is in the tubers and flowers that are not elongated and the leaves are longitudinally coarse. More clearly can be seen in Figure 3 and Table 1.

Table 1. Differences in subspecies of *B. elongata* var. elongata and *B. elongata* var. ungeriana.

No	Aspects	*B. elongata* var. elongata	*B. elongata* var. ungeriana
1	Bulbs	Long tuber[1]	Short tuber [2]
2	Inflorences	Long[3]	Short[4]
3	Leaf	Smooth	Grooved (striated) and rough[6]
4	Host	Some genera	Ficus only

Information: [1] [2] [3] [4] [5] [6] (numbers in figure)

Distribution: Peninsula Malaysia, Borneo, Sumatra, Java, and mostly in West Java for subsp. ungeriana is only recorded on the island of Java precisely on Mount Salak and Mount Gede in West Java (Figure 4). This species is the first finding in South Sumatra and even on the island of Sumatra. The roots of various species of trees and shrubs have been recorded as hosts of *B. elongata* var. elongata, for example *Schefflera aromatica* (Blume) Harms, *Vaccinium laurifolium* (Blume) Miq., V. lucidum (Blume) Miq. and various *Ficus* species, but only *Ficus* species are registered as var hosts. Ungeriana [1].

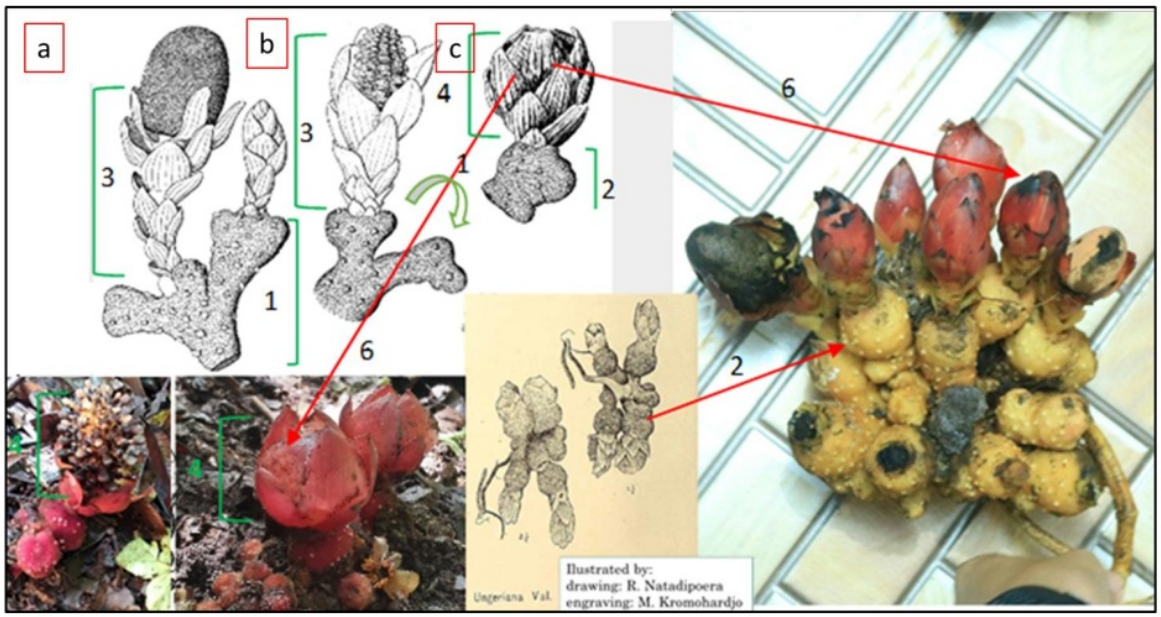

Figure 3. Differences in subspesies of *B. elongata* var. elongata and *B. elongata* var. ungeriana (Prosea: 2019), *Balanophora elongata* Bl. Var. elongata a. ♀ Specimen, habit (ilustrated by B.Hansen). b. ♂ specimen, habit. *B. elongata* var. ungeriana (Val.) Hansen. c. ♀ specimen, habit.

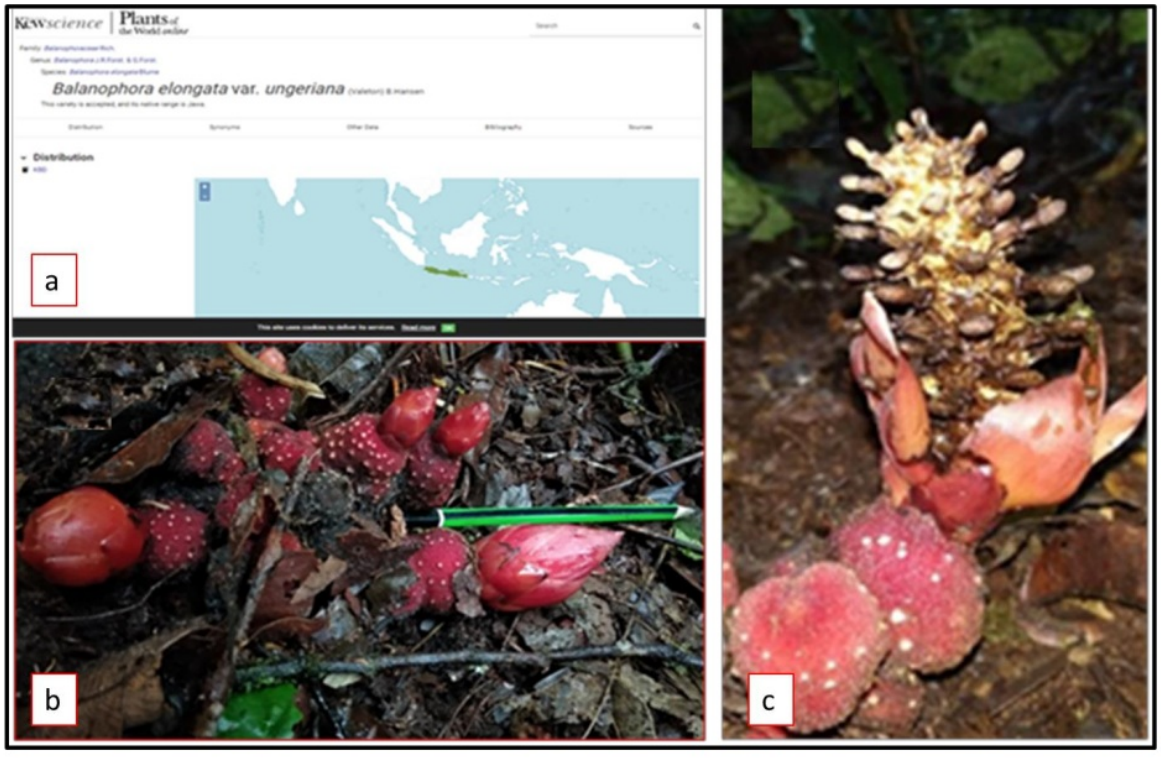

Figure 4. a. Distribution of *B. elongata* var. ungeriana, b. female ♀, c. male ♂ *Balanophora elongata*

HL BJGP forest area has a sheltered growth environment. The host of this species is *Ficus vasculosa*. For the species of trees that are around the place of growth, among others, Cikru (*Schima wallichii*), lengkenai (*Dacrycarpus imbricatus*), (*Talauma codollei* Bl), (*Dacryodes longifolia* (King) *Villebrunea rubescens, Macaranga triloba*, and *Laportea* sp. *Endospermum* sp., And *Macaranga tanaria*. Note: in this study found at 00°55'09,0" LS, 100°28'58,0" BT; and found as many as 30 individuals, 23 females and 7 males with different coordinates (Figure 4) [7]. State that B. elongata is scattered in moist forest areas at an altitude of 900-1600 masl. In this study B. elongata was found at an altitude of 1450 meters above sea level. This is because the condition of the forest, especially HL BJGP, is relatively humid and the place is sheltered and often rains, so this species of *B. elongata* can live well in this area.

3.2 Protection effort

Existence of species *B. elongata* var. ungeriana encountered very low. Only one point out of 10 locations that have been observed, found one species of Balanophora that is at point T1 with an observation path length of 300 m. Some of these locations have been issued geothermal business permits at an altitude of 1300-1500 masl. This situation is feared that in the future it will disrupt the growth area so that it can cause a reduction in the population of species *B. elongata* var. ungeriana.

Research for protection from the Balanophoraceae group has included protection such as; [15] Balanophoraceae species have individuals with high genetic diversity and have colors that can be easily compared with one another. As for *Balanophora dioica*, according to CITES data (Convention on International Trade in Endangered Species of wild flora and fauna) in India, including plants in the App II category[16]. As happened in Taiwan, IUCN data in 1994 *Balanophora fungosa* was designated as a plant in the Vulnarable plant category[11].

4. Conclusion

There is only one species of *Balanophora* found in this study is *B. elongata* var. ungeriana at point T1. This species is the first record on the Sumatran Island. The key character of the species lies in the tubers, inflorences, leaves and host. The host of the *Balanophora* species is *Ficus vasculosa*.

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