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Research Paper

Morphological Diversity of Rattan on Three Conservation Areas in South Sumatra

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Abstract
Research on the diversity of rattan morphology has been conducted in three forest conservation areas in South Sumatra, i.e. Bentayan Wildlife Reserve, Bukit Cogong, and Gunung Raya Wildlife Reserve. This study aims to analyze the diversity of rattan morphology in three protected areas in South Sumatra. This research uses purposive sampling method by exploring the forest area. The results showed that in the Bentayan Wildlife Reserve area were found 3 species of 3 families while in Bukit Cogong Protected Forest was found 9 species of 3 families and in the Gunung Raya Wildlife Reserve area were found 5 species of 3 families. The morphology of rattans species in the three regions has different shapes and colors of thorns on the stem, the top and the bottom surfaces of the leaves, the climbing organ and the growth nature. The same rattan species were being found in the same of two or three locations, having morphological differences in diameter and length of the stem.

Keywords
Identification, morphology, rattan, South Sumatra

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1. INTRODUCTION

Indonesia became the world's leading and considered as one of the centers of world economic diversity. Many types of commercial timber, tropical fruits (durian, duku, salak, rambutan, bananas, etc.), orchids, bamboo, rattan, coconut, and others are mostly from Indonesia. Therefore, Indonesia is known as one of the world's largest biodiversity (megadiversity) and is the center of the world's biodiversity (megacenter of biodiversity) (Astirin, 2000). Basically, rattan is a plant belonging to the group of palms that live vine. This group belongs to the *calamoideae* sub family that has 13 genera and about 600 species grow in the tropical rain forest of Southeast Asia (Hartanti, 2012). Rattan is one of the plants that naturally grow in primary forest and secondary forest including in the area of former shifting cultivation and shrubs. Rattan belongs to a species of climbing plants that requires a host tree for its growth process (Dransfield and Manokaran, 1996).

Rattan origin is a plant belonging to the group of palms that live vine. This group belongs to the Calamoideae sub family that has 13 genera and about 600 species grow in the tropical rain forest of Southeast Asia (Hartanti, 2012). According to Rachman and Jasni (2006), rattan comes from the Angiospermae subdivision, the Monocotyledonae class, the Palmales order and the Palmae family. Rattan generally grows naturally, spreading from coast to mountains, at an elevation of 0-2900 m above sea level; ecologically rattan thrives in various places, both in the lowlands and highlands, especially in humid areas such as riverbanks (Kalima, 2008).

According to Kunut et al. (2014), the classification of rattan species is typically based on the equality of features that each species possesses. The determination of rattan species can be identified by morphological characteristics of plant organs such as roots, stems, leaves, flowers, fruit and additional tools. Sustainable utilization of natural rattan can be done through proper planning by basing on information about the habitat, population, potential, and distributions. Such information can be obtained through inventory activities conducted in various places in Indonesia (Witono et al., 2003).

Potential spread of rattan one of which was found in the protected forest areas. The protected forest area itself has certain characteristics such as preservation of plant species diversity, as well as the utilization of biological natural resources and their ecosystems (Uslinawaty et al., 2014). Some protected forest areas in South Sumatra are Bentayan Wildlife Reserve, Bukit Cogong Protected Forest and Gunung Raya Wildlife Reserve, which are necessary to study the morphological diversity of rattan in the three protected areas in South Sumatra.

2. EXPERIMENTAL SECTION

2.1 Research Location

The research was conducted in March (Initial Survey) and May - June 2017. The location of the research was conducted in Bentayan Wildlife Reserve, Bukit Cogong Protected Forest and Gunung Raya Wildlife Reserve. Samples of rattan that have been obtained were identified in the Postgraduate Integrated Research Laboratory of Sriwijaya University, Palembang.

2.2 Materials and Instrumentation

The tools that used in the research were stationery, GPS (Global Positioning System), digital camera, machetes, kispray bottle, newsprint, big plastic sacks, twig scissors, cloth scissors, transparent plastic bags (40 x 60 cm), plastic ropes, anti theft gloves, sample boxes, gauges. The materials used at the time of the study were rattan samples and alcohol 70%.

2.3 Methods

Sampling was done by means of exploration using purposive sampling method, and then performed the inventory of plants. Specimens obtained in the field were taken especially from the main organs of plants such as stems, leaves, and climbing organs for further identification. Morphological observation was done by descriptive method. Observations and measurements of morphological data were performed on plant vegetative organs i.e. stems, leaves, climbing organs and growth nature in the form of qualitative and quantitative data. Further identification was done by using Taxonomy books e.g. Flora (Steenis et al., 2006), Atlas Rattan Indonesia Volume 1 (Jasni et al., 2012a), Atlas Rattan Indonesia Volume 3 (Jasni et al., 2012b) and other articles on rattan. Each sample was documented in the form of photos and herbarium. Making herbarium followed the Kalima (2008) methods i.e. collecting samples, Processing and Preservation, and drying the specimens in the herbarium collection (Laboratory).

3. RESULTS AND DISCUSSION

Based on the identification results from the three research sites i.e. Bentayan Wildlife Reserve, Bukit Cogong Protected Forest and Gunung Raya Wildlife Reserve, each site have different morphological characters, especially on the shape and color of thorns on the stem, the top and the bottom surfaces of the leaves, climbing organ and growth nature. The rattans were being found in the three locations of the research are 13 species of rattans, including in 4 genera which are *Calamus* (6 species), *Daemonorops* (3 species), *Korthalsia* (3 species), *Plectocomiopsis* (1 species). Morphological characters of 13 species have differences especially on the character of growing properties. In 13 species of rattan were being found from the three research sites, 11 species of rattan have growth nature in a clump, while 2 rattan species are single. Compared with previous research results in Papalia Protected Forests, the rattan species found in Papalia Protected Forests were fewer, i.e. 8 species and two are single (Uslinawaty et al., 2014).

The climbing organ is one of the rattan species characters. From the thirteen species of rattan were being found, there were 10 species that have cirrus and 3 species that have flagellum as the climbing organs. Cirrus and flagellum play an important role as the main tool for climbing, because cirrus and flagellum can float in the air so that rattan can easily attach its tip/crown to the other plants which stand nearby (Uslinawaty et al., 2014). The cirrus is an extension of the leaf rachis by exceeding the tip of the leaflet, while the flagellum is an inflorescence of barren leaves that grow on the leaf midrib near the knee (Dransfield and Manokaran, 1996).

According to Table 1, rattans species were being found in all three regions have different characters in stems and leaves. On the stem of each species of rattans have different shape and color of thorns. In the genus of Calamus have triangular thorns and different thorn colors. *Calamus pogonacanthus* has long triangular thorns which are blackish brown. *Calamus orthostachys* has long triangular thorns and blackish dark green. *Calamus scipionum* has flat, yellowish white and triangular thorns. The *Calamus manan* have black triangular thorns. *Calamus javensis* have small and yellowish green triangular thorns. There is no thorn on the stem of *Calamus ulur*, and the stems are yellowish green.

In the genus of *Daemonorops* also have different shape and color of thorns. *Daemonorops robusta* have slim thorns, usually soft and whitish to black. *Daemonorops sabut* have thorns on the stem that forming a tunnel consisting of long and smooth thorns which are black and brown. *Daemonorops margaritae* have red brown triangle thorns on the stem. While in the genus of *Korthalsia* also have the variations of shape and color of thorns. *Korthalsia ferox* have triangular thorns on the stem and the thorns are light brown. *Korthalsia junghuhnii* have spreading thorns on a single stem and the thorns are yellowish green. *Korthalsia echinometra* have black thorns the stem. The genus of *Plectocomiopsis geminiflora* have slim and long thorns on the stem and the thorns are gray.

In rattans species, thorns have the function on helping rattan to climb. According to Sinaga (1986), rattan is a plant that propagates in a supporting tree with the help of the hooks found in the end of the petiole or flagella on the leaf midrib. The thorn pattern and the leaf width can be used to characterize the diagnosis of a species (Ramadhani et al., 2014). The morphological differences of thorns on the stems of rattan species found in the three regions can be presented in Figure 1.

The types of rattan have differences on the leaves where the differences are leaves color and the presence of thorns on surfaces of the leaves. On the species of *Calamus pogonacanthus*, the top and bottom surface of the leaves are thorny. On *Calamus orthostachys*, the top and bottom surface of the leaves are not thorny. The top surfaces of the leaves on *Calamus scipionum* are green, while the bottoms surfaces are brownish green, and both surfaces are thorny. On *Calamus manan*, the top surfaces of the leaves are pale green, and the bottoms surfaces are brownish gray. On *Calamus javensis*, the top and bottom surfaces of the leaves are reddish brown. *Calamus ulur*, the top and bottom

Table 1. Morphological Differences of Rattan Species Found in The Three Conservation Areas in South Sumatera

Species (Local name)	Morphology				Distribution
	Stem	Leaves	Climbing Organs	Growth Nature	
(*C. pogonacanthus*) Rattan Batang	The shapes of the thorns on the stem are long triangle, blackish brown	The top and bottom surface of the leaves are thorny.	Cirrus	Clumping	1
(*C. orthostachys*) Rattan Manau Riang	The shapes of the thorns on the stem are long triangle, blackish dark green.	The top and bottom surface of the leaves are not thorny	Cirrus	Single	2
(*C. scipionum*) Rattan Semambu	The shapes of the thorns on the stem are big flat triangle, yellowish black	The top surfaces of the leaves are green, the bottoms surfaces are brownish green, and both surfaces are thorny.	Flagellum	Clumping	2 and 3
(*C. manan*) Rattan Manau	The shapes of the thorns on the stem are triangle and black.	The top surfaces of the leaves are pale green; the bottoms surfaces are brownish gray.	Cirrus	Single	2 and 3
(*C. javensis*) Rattan Cacing	The shapes of the thorns on the stem are small triangle and yellowish black	The top and bottom surfaces of the leaves are reddish brown.	Flagellum	Clumping	2
(*C. ulur*) Rattan Ulur	No thorn on the stem and the stem is yellowish green	The top and bottom surfaces of the leaves are brownish green and thorny.	Cirrus	Clumping	3
(*D. robusta*) Rattan Susu	Smooth thorns and whitish into black	The top and bottom surfaces of the leaves are green and thorny.	Cirrus	Clumping	1
(*D. sabut*) Rattan Lelak	The shapes of the thorns on the stem forming a tunnel consisting of long and smooth thorns those are black and brown.	The top and bottom surfaces of the leaves are brownish green.	Cirrus	Clumping	2 and 3
(*D. margaritae*) Rattan Semijau	The shapes of the thorn on the stem are triangle and red brown.	The top and bottom surfaces of the leaves are gloomy green.	Flagellum	Clumping	2
(*K. ferox*) Rattan Kayu	The shapes of the thorn on the stem are triangle and light brown.	The top surfaces of the leaves are light green, and the bottom surfaces arewhitish gray.	Cirrus	Clumping	2 and 3
(*K. junghuhnii*) Rattan Semut	The shapes of the thorn on the single stem are spread and yellowish green.	The top surfaces of the leaves are green; the bottoms surfaces are whitish gray. Both surfaces are thorny.	Cirrus	Clumping	2
(*K. echinometra*) Rattan Udang	Thorn on the stem are black	The top surfaces of the leaves are green; the bottoms surfaces are whitish green.	Cirrus	Clumping	2
(*P. geminiflora*) Rattan Kesu	The shapes of the thorn on the stem are slim and long and gray.	The top and bottom surfaces of the leaves are light green.	Cirrus	Clumping	3

Note: 1) Bentayan Wildlife Reserve. 2) Bukit Cogong Protected Forest. 3) Gunung Raya Wildlife Reserve.

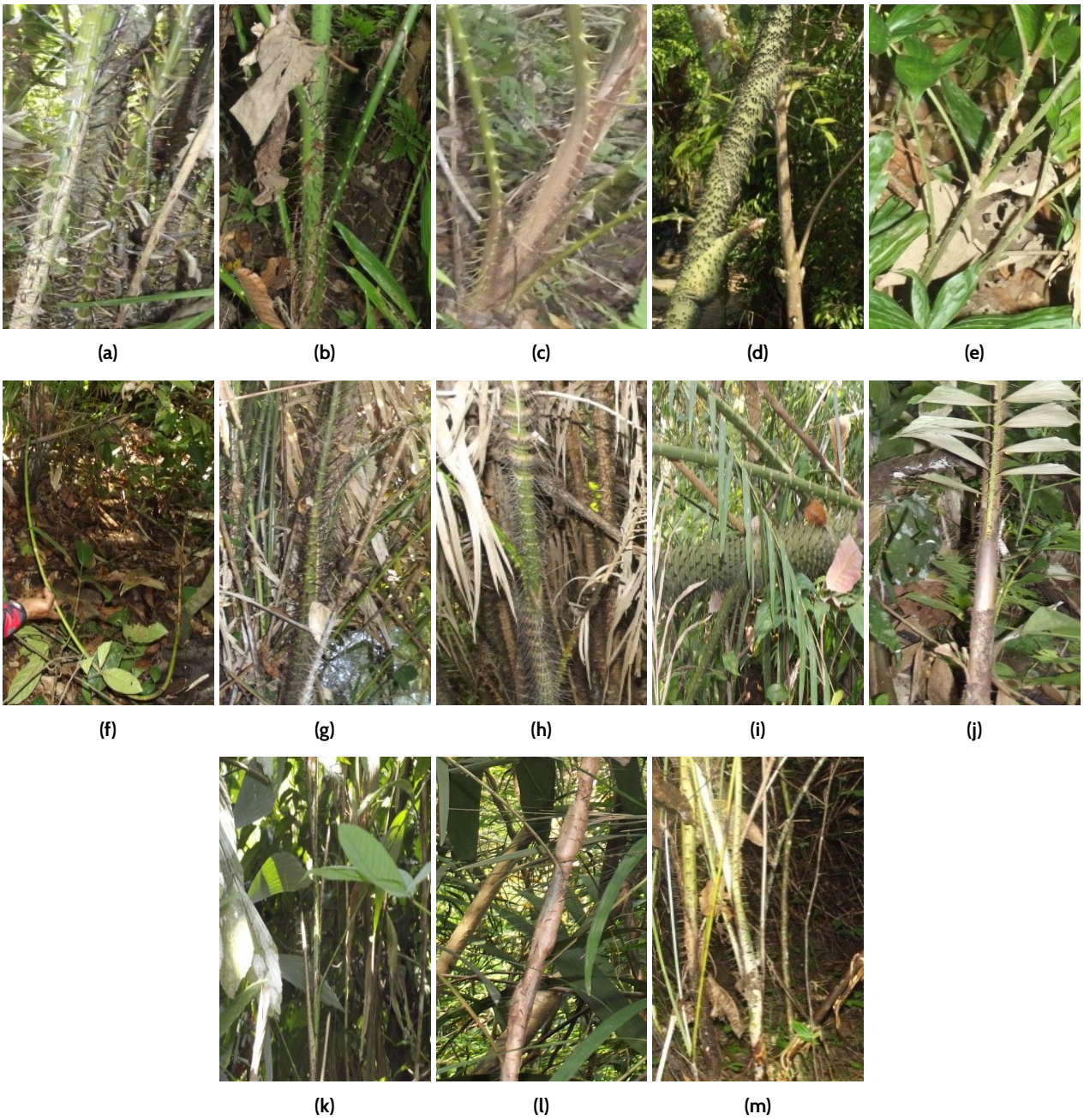

Figure 1. Morphological Differences of thorns on the stems of rattan species (a) *Calamus pogonacanthus* (b) *Calamus orthostachys* (c) *Calamus scipionum* (d) *Calamus manan* (e) *Calamus javensis* (f) *Calamus ulur* (g) *Daemonorops robusta* (h) *Daemonorops sabut* (i) *Daemonorops margaritae* (j) *Korthalsia ferox* (k) *Korthalsia junghuhnii*(l) *Korthalsia echinometra* (m) *Plectocomiopsis geminiflora.*

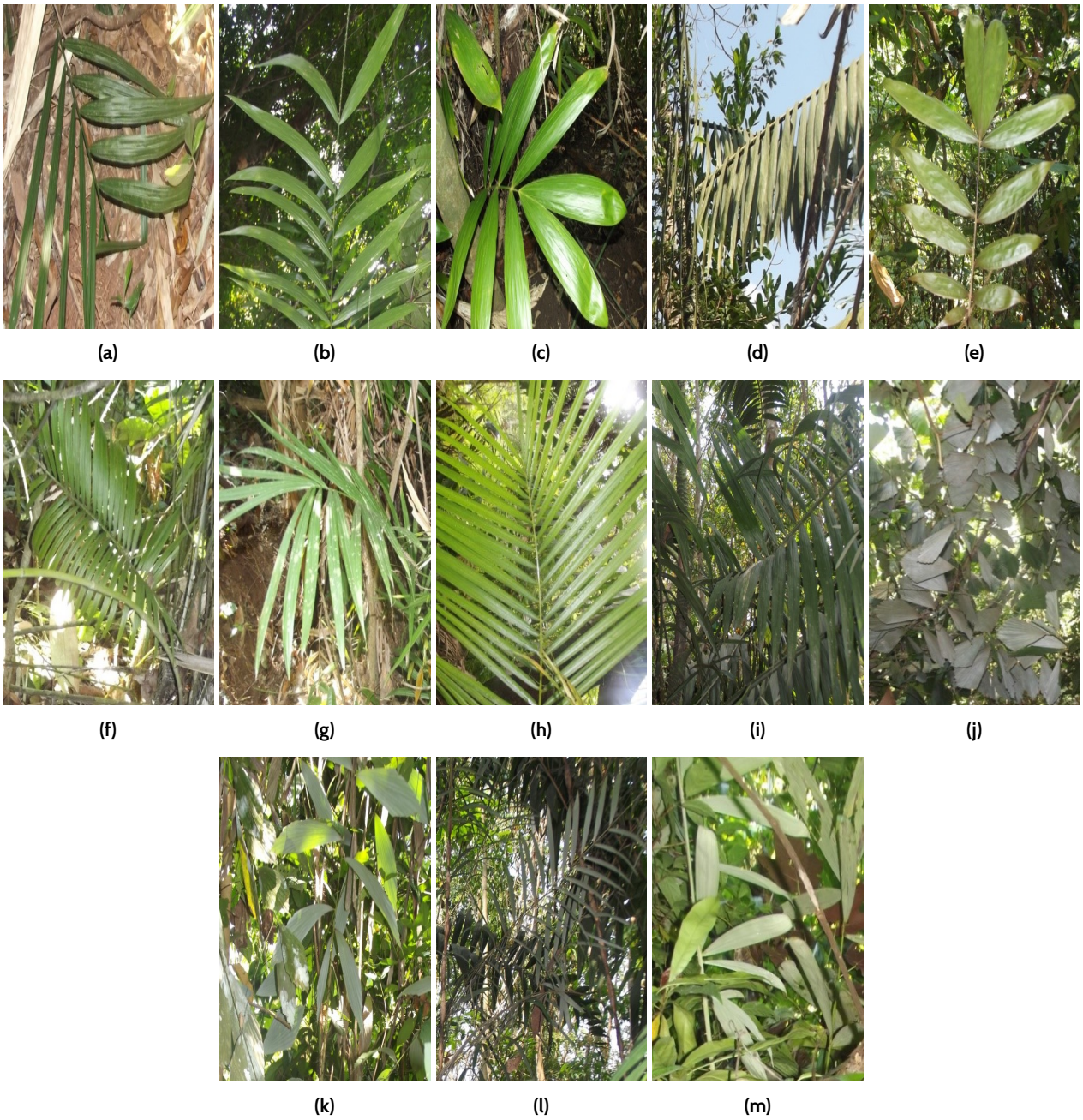

Figure 2. The morphological differences of thorns and leaf color in rattan species (a) *Calamus pogonacanthus* (b) *Calamus orthostachys* (c) *Calamus scipionum* (d) *Calamus manan* (e) *Calamus javensis* (f) *Calamus ulur* (g) *Daemonorops robusta* (h) *Daemonorops sabut* (i) *Daemonorops margaritae* (j) *Korthalsia ferox* (k) *Korthalsia junghuhnii*(l) *Korthalsia echinometra* (m) *Plectocomiopsis geminiflora.*

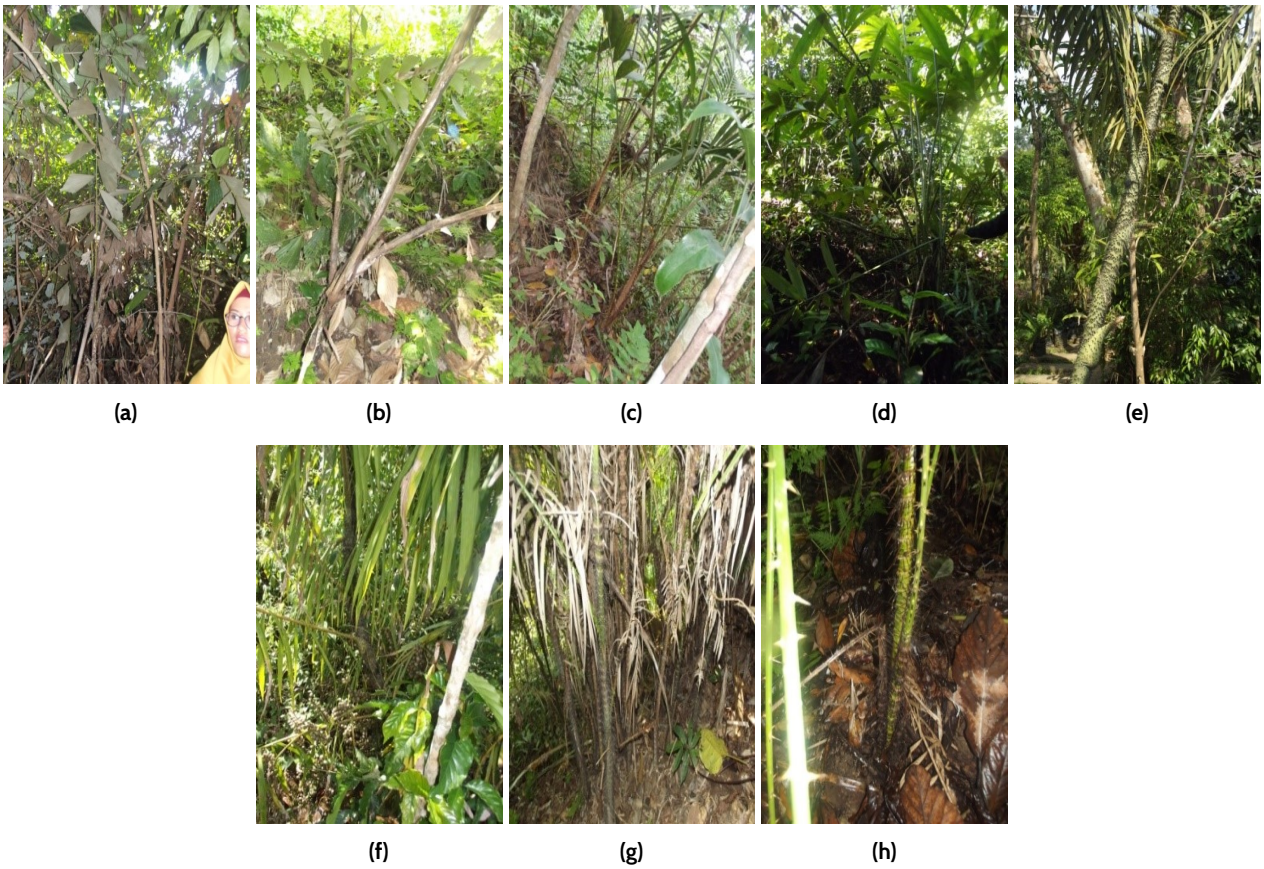

Figure 3. (a) Rattan Kayu in Bentayan Wildlife Reserve, (b) Rattan Kayu in Bukit Cogong Protected Forest, (c) Rattan Semambu in Bukit Cogong Protected Forest, (d) Rattan Semambu in Gunung Raya Wildlife Reserve, (e) Rattan Manau in Bukit Cogong Protected Forest, (f) Rattan Manau in Gunung Raya Wildlife Reserve, (g) Rattan Lelak in Bukit Cogong Protected Forest, (h) Rattan Lelak in Gunung Raya Wildlife Reserve.

surfaces of the leaves are brownish green and thorny.

The top and bottom surfaces of the leaves on *Daemonorops robusta* are green and thorny. On *Daemonorops sabut*, the top and bottom surfaces of the leaves are brownish green. *Daemonorops margaritae*, the top and bottom surfaces of the leaves are gloomy green. *Korthalsia ferox*, the top surfaces of the leaves are light green, and the bottom surfaces are whitish gray. *Korthalsia junghuhnii*, the top surfaces of the leaves are green, the bottoms surfaces are whitish gray and both surfaces are thorny. *Korthalsia echinometra*, the top surfaces of the leaves are green, the bottoms surfaces are whitish green. *Plectocomiopsis geminiflora*, the top and bottom surfaces of the leaves are light green. According to Abrahamson (2007), variations in leaf organs can be caused by the influence of light intensity. The differences of morphology of thorns and leaf color in rattan species found in three regions can be presented in Figure 2.

The morphological differences in diameter and length of stem segments of the same species were found in two or three different locations. In Bentayan Wildlife Reserve and Bukit Cogong Protected Forest the same species of rattan found are rattan kayu (*Korthalsia ferox*). In Bentayan Wildlife Reserve stem diameter is 7 cm, the length of the stem segment is 24 cm, while in the Bukit Cogong Protected Forest stem diameter is 11 cm, the length of the stem segment is 37 cm, which means the diameter and length of the stem in Bukit Cogong Protected Forest is larger than in Bentayan Wildlife Reserve. The difference in diameter and length of the wooden rattan stem can be presented in Figure 3a and 3b.

The same rattan species were found in Bukit Cogong Protected Forest and Gunung Raya Wildlife Reserve are rattan semambu (*Calamus scipionum*), rattan manau (*Calamus manan*), and rattan lelak (*Daemonorops sabut*). In the Bukit Cogong Protected Forest, the stem diameter of rattan semambu is 10 cm, the stem length is 29 cm, while in Gunung Raya, the stem diameter of rattan semambu is 9 cm, and the stem length is 27 cm, which means the diameter and the length of the stem of rattan semambu in Bukit Cogong Protected Forest is larger than in Gunung Raya Wildlife Reserve. The difference in diameter and length of the segment of the rattan can be shown in Figure 3c and 3d.

In the area of Bukit Cogong Protected Forest, stem diameter of rattan manau is 23 cm, stem length is 33 cm, while in

the area of Gunung Raya Wildlife Reserve, stem diameter of rattan manau is 21 cm, the length of the stem is 29 cm, which means the diameter and the length of stem of rattan manau in the Bukit Cogong Protected Forest is larger than Gunung Raya Wildlife Reserve area. The difference in diameter and length of the stem of rattan manau can be presented in Figure 3e and 3f.

In Bukit Cogong Protected Forest area, the stem diameter of rattan lelak is 8 cm, stem length is 34 cm, while in Gunung Raya area, the stem diameter of rattan lelak is 6 cm, stem length is 32 cm, which means the diameter and length of stem of rattan lelak in Bukit Cogong Protected Forest area is larger than in Gunung Raya Wildlife Reserve area. According to Sanusi (2012), the morphological characteristic of stem on rattan species is a non mechanical physical property possessed by a rattan species naturally. Non mechanical physical properties include the shape, length of the segment and the diameter of the stem. The difference in diameter and length of the stem of rattan lelak can be presented in Figure 3g and 3h.

4. CONCLUSIONS

In Bentayan Wildlife Reserve area were found 3 species of 3 genera, Bukit Cogong Protected Forest area were found 9 species of 3 genera. In the area of Gunung Raya Wildlife Reserve were found 5 species of 3 genera. The morphology of rattan species in the three regions have different shapes and colors of thorns on the stem, the top and the bottom surfaces of the leaves, the climbing organ and the growth nature. The same rattan species were being found in the same of two or three locations, having morphological differences in diameter and length of the stem.

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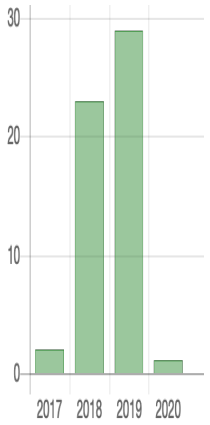

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