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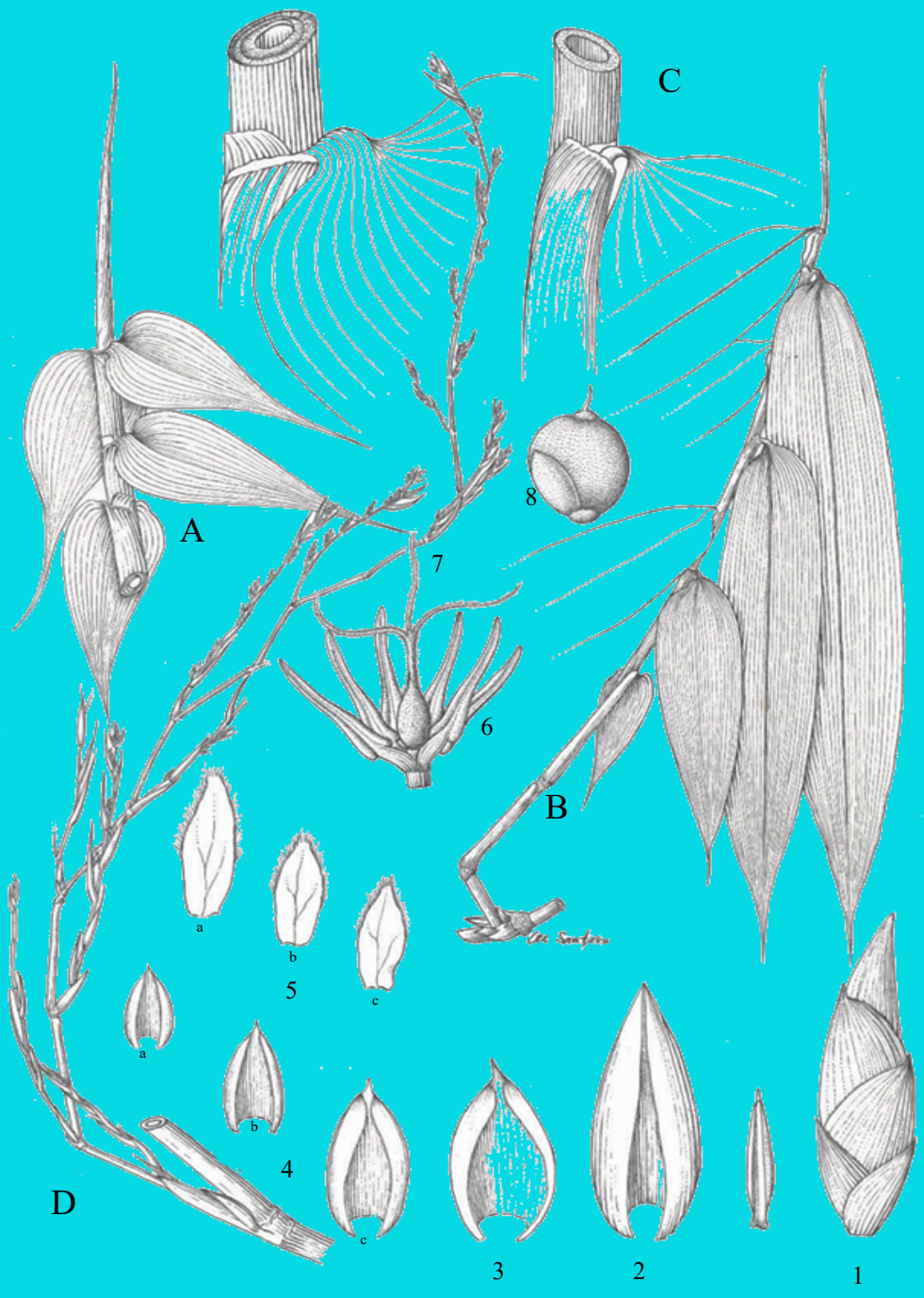

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RAFFLESIA HASSELTII SURINGAR (RAFFLESIACEAE): A NEW RECORD TO KALIMANTAN, INDONESIA

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ABSTRACT
SARI, R., HUDA, M., SUSANDARINI, R. & ASTUTI, I. P. 2019. *Rafflesia hasseltii* Suringar (Rafflesiaceae): A new record to Kalimantan, Indonesia. *Reinwardtia* 18(2): 65–70. — *Rafflesia hasseltii* Suringar flower has been observed for the first time in Sambas District, West Kalimantan by the Flora Fauna Research Team during the Khatulistiwa Expedition organized by Special Forces Command of Indonesian Army in 2012. This finding is the first record of *Rafflesia hasseltii* in Kalimantan following the previous record in Sarawak. The flower has 5–6 perigone lobes. This paper presents the detail characteristic of the flowers.

Key words: *Rafflesia hasseltii* Suringar, Rafflesiaceae.

ABSTRAK
SARI, R., HUDA, M., SUSANDARINI, R. & ASTUTI, I. P. 2019. *Rafflesia hasseltii* Suringar (Rafflesiaceae): Sebuah catatan baru di Kalimantan, Indonesia. *Reinwardtia* 18(2): 65–70. — Bunga *Rafflesia hasseltii* Suringar ditemukan pertama kali di Kabupaten Sambas, Kalimantan Barat oleh Tim Penelitian Flora dan Fauna Ekspedisi Khatulistiwa yang diorganisir oleh Komando Pasukan Khusus, Tentara Nasional Indonesia-Angkatan Darat (TNI-AD) pada tahun 2012. Penemuan ini adalah catatan pertama ditemukannya *R. hasseltii* di Kalimantan setelah penemuan sebelumnya di Sarawak. Bunga memiliki 5–6 helai perigon. Tulisan ini menyajikan karakter rinci bunga *Rafflesia hasseltii* yang ditemukan.

Kata kunci: *Rafflesia hasseltii* Suringar, Rafflesiaceae.

INTRODUCTION

Rafflesia (Rafflesiaceae) is a genus of parasitic plants that grows on a host plant *Tetrastigma* spp. (Vitaceae) (Meijer, 1997). Currently there are 30 species of *Rafflesia* have been described (Lestari *et al.*, 2014). This genus is a holoparasite on the species of *Tetrastigma* which grows in the lowland forest and low to mid-elevation montane forests of Thailand, Peninsular Malaysia, Sumatra, Java, Anambas Island, Borneo and the Philippines (Barcelona *et al*., 2009).

A population of *Rafflesia* was recorded for the first time from Sambas District in West Kalimantan (Indonesian Borneo), during the Khatulistiwa expedition organized by the Special Army Forces in 2012. The Flora Fauna Research Team of the expedition which discovered a specimen in full blossom and three rotten flowers in a protected forest in Temajuk village, Paloh sub district. Field photographs were taken and the full blooming flower was collected and dried as a herbarium specimen.

Identification was difficult due to dried specimen being fragile and brittle. Finally, after thorough examination this *Rafflesia* was noticeably different from the other Bornean *Rafflesia* that have been found near Sambas district such as *R. arnoldii* R.Br. var. *arnoldii* and *R. tuan-mudae* Becc. However, it is similar to *Rafflesia hasseltii* from Tanjung Datu, Sarawak (Ong, 2004) but slightly different in colour (Fig.1).

In 2013, another expedition by a team from the Research Center for Plant Conservation and Botanical Gardens–Indonesian Institute of Sciences (Lembaga Ilmu Pengetahuan Indonesia, LIPI) was undertaken to the same location. The team successfully collected a full blooming flower

Fig. 1. *Rafflesia hasseltii* flower from Sambas (left) (Photo: M. Huda) and *R. hasseltii* from Tanjung Datu, Sarawak (right) (https://www.flickr.com/photos/kmatsalleh/ 889970528/in/photostream).

of *Rafflesia* and preserved the specimen in 70% alcohol. After careful examination and study of the flower parts, we identified the specimen as *Rafflesia hasseltii* Suringar. The important morphological characters used to distinguish this species from other *Rafflesia* species were its processes and ramenta.

Rafflesia hasseltii Suringar was first published in 1879 which was collected from Sumatra (Latiff & Mat-Salleh, 2001). It has been found in other localities afterwards covering three provinces in Sumatra, that are W. Sumatra, Riau and Jambi (Meijer, 1997; Akhriadi *et al*., 2010), and two locations in Sarawak, Samunsam (Nais, 2001) and Tanjung Datu (Ong, 2004). The finding of *Rafflesia hasseltii* in Sambas marked the first record of the species in Kalimantan.

MATERIALS AND METHODS

Both dry herbarium and 70% alcohol of floral specimens were used for the study. The dry collection was recorded as no. MH1 and spirit collection no. SH74 are lodged at the Center for Plant Conservation Botanical Gardens-Indonesian Institute of Sciences in Bogor. Measurement recorded were: diameter of the flower, number of perigone lobes, number of blotches, diameter of aperture, diameter of diaphragm, processes and ramenta. Photographs of fresh flowers were also used for identification and comparison with the images of closely related species.

The ramenta from both dry and spirit specimens were examined under a microscope camera (Optika® SZ-CTV, Optika SRL, Ponteranica, Bergamo, Italy) connected to a computer that facilitated photography. The ramenta were also measured using a ruler. The morphological characters were compared to the closely related species namely, *Rafflesia cantleyi* Solms-Laubach, *R. azlanii* Latiff & M.Wong and *R. hasseltii* Suringar to ascertain the identity of the species.

RESULTS

The comparison of *Rafflesia hasseltii* in Sambas, *R. azlanii* and *R. cantleyi* is presented in Table 1. The comparison of morphological data of *Rafflesia hasseltii* in Sambas is presented in Table 2. The references were taken from Meijer (1997) and Sofiyanti *et al*. (2007).

DISCUSSION

The morphological characters of *Rafflesia hasseltii* are diverse, especially the variation of the blotches on the perigones that sometimes makes identification difficult (Sofiyanti *et al*., 2007). The diameter of the flower ranges from 33 to 50 cm, which misleads in identification (see Table 1). The main distinct character is the blotches which dominates the perigone lobes, up to 60.15% (Sofiyanti *et al*., 2007). We initially thought the species was *Rafflesia cantleyi* based on the blotches, however, with the characters of processes, the diameter and the size of perigone it is clearly *R. hasseltii*.

Perigone and blotches

The perigones of *Rafflesia hasseltii* in Sambas consists of 5–6 lobes while *R. hasseltii* from other sites have been observed to have only 5 lobes (Meijer, 1997; Sofiyanti *et al*., 2007). The colour of the perigone was very similar to that of *Rafflesia hasseltii* from Bukit Tiga Puluh National Park (BTNP), which was natural brick red (Sofiyanti *et al*., 2007).

The blotches of *Rafflesia hasseltii* from Sambas were found to be scattered over the surface of the

Table 1. Comparison of *Rafflesia hasseltii* in Sambas with *R. hasseltii*, *R. azlanii* and *R. cantleyi* (modified from Latiff & Wong, 2003).

Characters	*Rafflesia hasseltii*[1]	*Rafflesia cantleyi*[2]	*Rafflesia azlanii*[2]
Size (diameter)	35 cm	30–55 cm	38–50 cm
Perigone lobes	11.3–14 × 7–11 cm deflexed, one or two semi vertical	14 × 18 cm all fully deflexed	9.5–10.5 × 12–14.54 cm fully deflexed, one or two vertical
Warts	>10 white discrete with some coalesced	6–8 discrete white	4–6 many coalesced white
Pattern	Scattered over the surface of perigone	Well spaced	Almost covering the perigone surface
Diaphragm (diameter)	12–12.5 cm	4.8 cm	4.7 cm
Ramenta	Linear, swollen apices with 1–3 heads, heads aciculated or papillate, 5–7 mm	Branched, swollen many rows, 10–12 mm	Branched, capitate 3 rows, 4–6 mm
Processes	15–21	21	15–17

[1]*Rafflesia hasseltii* from Sambas
[2]Cited from Meijer (1997) and Nais (2001)

Table 2. Comparison of *Rafflesia hasseltii* morphological characters found in Sambas and those cited by previous

Character	*Rafflesia hasseltii* in Sambas	Meijer (1997)	Sofiyanti *et al*. (2007)
Diameter	35 cm	38–50 cm	33–35 cm
Perigone	5–6 lobes, 11.3–14 × 7–11 cm, brick red	5 lobes, 11.5–13 × 15–17 cm	5 lobes, 10–12×11–14 cm, bright red brick
Blotches (pustules)	Scattered on surface of perigones with 10 blotches on each perigone, light orange to pinkish	5 large pustules across, 5 × 3 to 10 × 1 cm.	Coverage 46.23–60.15%, density 2–12, whitish
Diaphragm	Round, or slightly hexagonal, 12–12.5 cm in diameter, light orange. Dots (warts) on diphragm round or elongated, reddish brown to light brown	Diaphragm pale whitish or yellowish with a dark brown zone near the rim and a basal ring of rounded or oblong dark brown warts	Mostly pentagonal, 4–7 cm wide. Dots on diaphragm rounded, sometime elongated, 21–30. Bright red and clearly present
Processes	15–21; 1.5–1.8 cm high, tips spathulate with undulate margin, bristles present along the margin	15–24, colored like the disk, light yellowish, but dark brown at the apex and not flattened as in some otherspecies	13–17; 1.5–1.7 cm high, not flattened, styliform
Ramenta	Linear, 5–7 mm, swollen apices with 1–3 heads at the apices, heads aciculated or papillate	Linear, with swollen apices	White, 0.9–1.3 mm, linear, unbranched, densely found in perigone tube

Fig. 2. Distribution of *Rafflesia hasseltii* in W. Sumatra (green), Riau (purple), Jambi (blue) (Sumatra), Samunsam (yellow), Tanjung Datu (orange) (Sarawak) and the new site in Sambas (red) (Kalimantan; map source: CartoGIS, College of Asia and the Pacific, The Australian National University).

perigones with each perigone consisting of more than 10 blotches. However, Nais (2001) recorded *Rafflesia hasseltii* as having 4–5 blotches in each perigone while Sofiyanti *et al.* (2007) found *R. hasseltii* to have diverse blotch patterns. The pattern of blotches of *R. hasseltii* from Sambas is similar to that of *R. hasseltii* from Tanjung Datu.

Diaphragm

The diaphragm shape of *Rafflesia hasseltii* from Sambas is round or slightly hexagonal, with reddish brown to light brown dots. The hexagonal shape seems to follow the number of lobes. According to Sofiyanti *et al*. (2007) *R. hasseltii* from BTNP has pentagonal diaphragm with 5 lobes. The diaphragm shape in the specimen with 5 lobes was round.

The dot colour ranges from bright red, reddish brown, light brown to dark brown (see Table 1), which are visible on the surface of the diaphragm.

Processes

The number of processes in *Rafflesia hasseltii* from Sambas varies between 15–21. It is very similar to *R. hasseltii* recorded by Nais (2001) in having 15–24 processes but differs from the one recorded by Sofiyanti *et al*. (2007) in having 13–17 processes. This indicates that the number of processes in *R. hasseltii* vary from 13–24.

In the available specimens, most processes have been damaged or broken which makes observations difficult. However, those with undamaged processes showed spathulate apices with undulate margins and bristle present along the margins (Fig. 3). Bristles are also present along the undulate margins of the coronal disk.

Ramenta

The ramenta of *R. hasseltii* have swollen apices with single elongate head or three heads (Fig. 4). The ramenta from dry specimens showed single head apices.

The length of ramenta ranges from 0.5–0.7 mm. Nais (2001) recorded the length of ramenta in *R. hasseltii* to be between 0.4–1 cm. The ramenta are slender with swollen apices. Under the microscope ramenta apices appear to have a single or three swollen structures or heads. The single head consists of a spathulate shape or a flat elongate structure.

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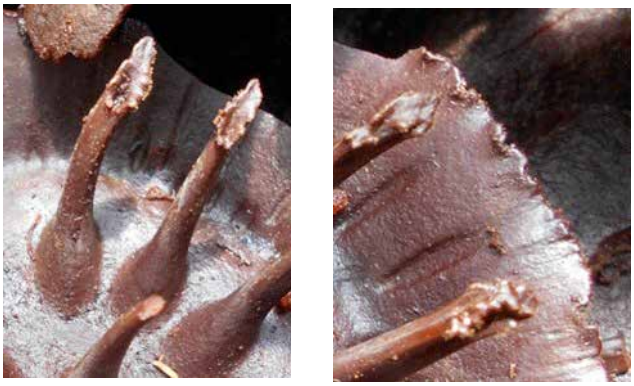

Fig. 3. Processes of *Rafflesia hasseltii* from Sambas showing spathulate apices with bristles along the undulate margin (left); undulate coronal disk crest with bristles (right). Photos from *SH74* (BOHB).

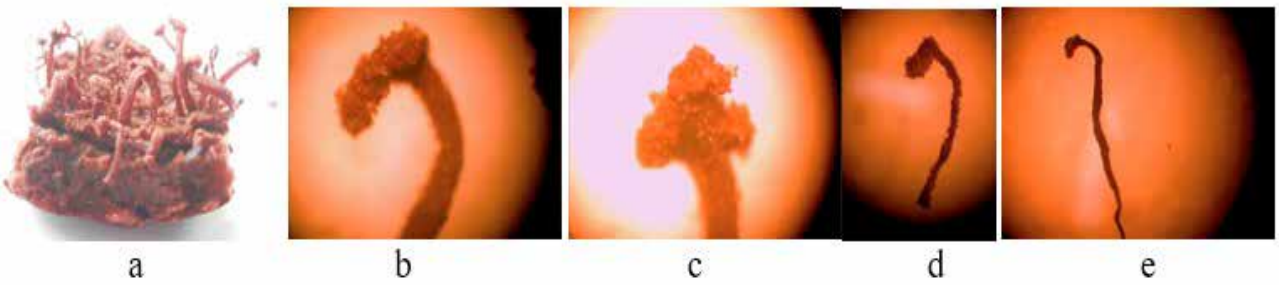

Fig. 4. A 70% alcohol preserved ramenta (a) two morphological types of the apices of ramenta with single and three heads (b, c) ramenta from the dry specimen showing single head (d, e). Figs. a-c from *SH74* (BOHB), d-e from *MH1* (BOHB).

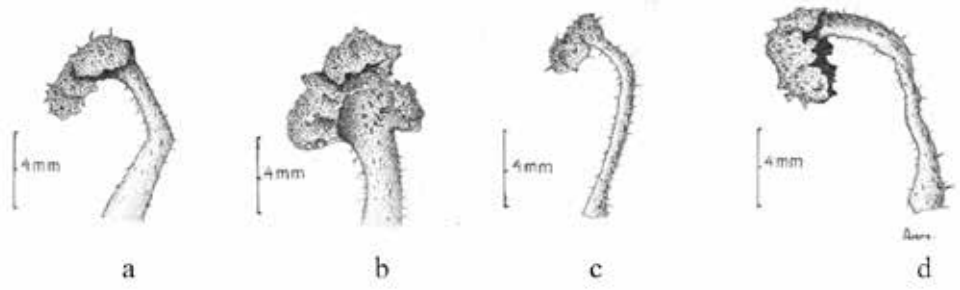

Fig. 5. The ramenta were randomly taken from a 70% alcohol preserved sample showing length 0.5–0.7 cm (a, b); ramenta from dry specimen with length between 0.6–0.7 cm (c, d). Figs. a-b from *SH74* (BOHB), c-d from *MH1* (BOHB), drawing by Anne Kusumawaty (BO).

CONCLUSION

Rafflesia hasseltii from Sambas shares characters similar to that of *R. hasseltii* from other sites but with variations. As *R. hasseltii* was previously found in Sumatra and Sarawak, by this finding *R. hasseltii* Suringar is a new record to Kalimantan.

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