
Research Article

The Mosses of Mount Muruk Mio and Bukit Rimau in Sipitang District of Sabah, Malaysian Borneo

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ABSTRACT

This study presents the results of bryological surveys conducted in 2003 and 2012 on Mount Muruk Mio and Bukit Rimau in Sipitang, Sabah, Malaysian Borneo, with a focus on assessing species richness and composition of mosses. A total of 142 taxa in 70 genera and 31 families of mosses were collected, representing 18% of the mosses reported for Borneo and 21% for Sabah. The families with the highest number of taxa were Dicranaceae, Sematophyllaceae, Leucobryaceae, and Pylaisiadelphaceae. Among these species was one new record for Borneo, *Sphagnum palustre* L., and four for Sabah, *Chaetomitrium darnaedii* H. Akiyama & Suleiman, *Chionostomum rostratum* (Griff.) Müll. Hal., *Garovaglia plicata* subsp. *punctidens* (R.S. Williams) During and *Papillidiopsis koponenii* B.C. Tan. The findings underscore the importance of these areas as significant moss diversity hotspots in Sabah, contributing valuable data to regional bryophyte inventories.

Keywords: Bryophytes; Long Pasia; moss flora; Muruk Miau; Sinipung Hill.

INTRODUCTION

Mount Muruk Mio (2,083 m) and Bukit (Hill) Rimau (1,908 m) are located in the Ulu Padas region, Sipitang District of Sabah, Malaysian Borneo. This region is part of the Central Bornean Montane forests, a transboundary area of mountainous terrain that extends over the northern highlands of Sarawak, Malaysia and Kalimantan, Indonesia. This region is known for very rich biodiversity with a high level of species endemism (Phillips & Lamb, 1997) due to its diverse forest types, including the unique heath forest, which is a suitable habitat for orchids and *Nepenthes*. Mount Muruk Mio and Bukit Rimau can be accessed from Long Pasia Village, located 113 km from Sipitang Town and 249 km from Kota Kinabalu, the capital city of Sabah. Long Pasia is a highland village, sitting at 1,000 m above sea level (a.s.l.), and is a popular ecotourism site in Sabah.

Mount Muruk Mio, also spelled as Muruk Miao, is the highest peak in Sipitang District, located at the south-westernmost tip of Sabah. It lies in the vicinity of the Malaysian border with East Kalimantan and is less known locally due to its remoteness and inaccessibility. This mountain is within the Sipitang Forest Reserve and classified as a Class II Commercial Forest Reserve, and is managed by the Sabah Forestry Department. The lower region of the mountain was logged in the 1970s and 1980s, however, the upper montane region remains largely undisturbed, dominated by mossy and oak-chestnut forests.

Bukit Rimau (locally known as Bukit Sinipung or Senipong) on the other hand, is more accessible compared to Mount Muruk Mio. Located between the villages of Long Pasia and Long Mio, it is a popular attraction for visitors due to its rich flora, cool weather and scenic views from the hilltop. Its vegetation is categorised as lower and upper montane heath forests. This hill is also situated within the Sipitang Forest Reserve.

The moss flora of the Ulu Padas region remains poorly known, except for Mount Lumaku (Suleiman et al., 2011). Thus, the objective of this study is to carry out an inventory of mosses from Mount Muruk Mio and Bukit Rimau.

METHODOLOGY

Moss specimens were collected by the senior author from Bukit Rimau and Mount Muruk Mio (Fig. 1) during surveys in 2003 and 2012, respectively. The first survey was conducted at Bukit Rimau from 7th to 8th of November 2003. The second survey took place at Mount Muruk Mio from 21st to 23rd of February 2012 as part of the Long Pasia Scientific Expedition 2012, organised by Sabah Parks. Based on these two surveys, a total of 249 specimens of mosses were identified and deposited at the BORNEENSIS Herbarium (BORH), Universiti Malaysia Sabah. Taxonomic keys for Malesian mosses were used in species identification, such as Eddy (1988, 1990, 1996), Enroth (1989), Menzel (1992), Menzel & Schultze-Motel (1990), Tan & Iwatsuki (1989), and Touw (2001).

In addition, six specimens of mosses deposited in BORH were also examined and verified; these specimens were collected by Nur Hafizah Razali from Mount Muruk Mio in 2011. The classification of the moss families, genera and species names were based on The Bryophyte Nomenclator (Brinda & Atwood, 2026) whereas the geographic distributions of new records of mosses were based on occurrence data from Global Biodiversity and Information Facility (GBIF, 2026) and relevant references.

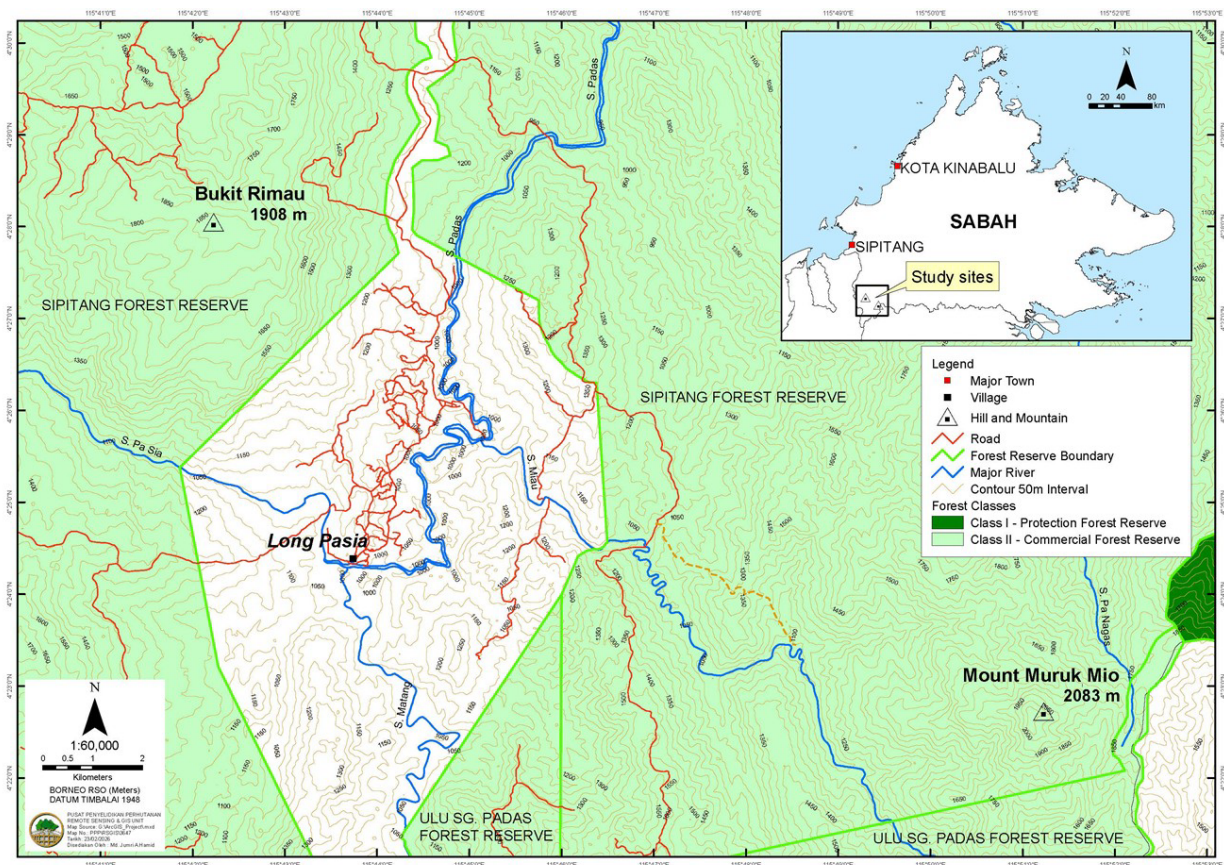


Figure 1: Map of the south-westernmost tip of Sabah showing the location of Mount Muruk Mio and Bukit Rimau, Sabah, Malaysian Borneo. Insert is a map of Sabah showing the study sites.

RESULTS

A total of 134 species, two subspecies, five varieties and a form of mosses were identified from Mount Muruk Mio and Bukit Rimau (Appendix 1; Table 1). Dicranaceae has the highest number of species (13 species), followed by the Sematophyllaceae (12 species and one variety), the Leucobryaceae (11 species), and the Pylaisiadelphaceae (eight species and three varieties).

Table 1: Summary of mosses collected from Mount Muruk Mio and Bukit Rimau, Sabah, Malaysian Borneo.

No.	Family	Genus	No. of species and infraspecific taxa
1.	Dicranaceae	5	13
2.	Sematophyllaceae	6	12 + 1 var.
3.	Leucobryaceae	2	11
4.	Pylaisiadelphaceae	5	8 + 3 var.
5.	Meteoriaceae	7	8
6.	Neckeraceae	6	7
7.	Spiridentaceae	4	6
8.	Pterobryaceae	3	6
9.	Fissidentaceae	1	6
10.	Symphyodontaceae	2	6
11.	Ptychomniaceae	1	4 + 1 subsp. + 1 fo.

12.	Daltoniaceae	2	5
13.	Hypnaceae	3	5
14.	Hypopterygiaceae	3	5
15.	Orthotrichaceae	1	6
16.	Polytrichaceae	2	4 + 1 subsp.
17.	Calymperaceae	2	4
18.	Racopilaceae	1	2 + 1 var.
19.	Bryaceae	2	2
20.	Bartramiaceae	1	2
21.	Rhizogoniaceae	1	2
22.	Callicostellaceae	1	1
23.	Calomniaceae	1	1
24.	Calypstrochaetaceae	1	1
25.	Dicranellaceae	1	1
26.	Mniaceae	1	1
27.	Plagiotheciaceae	1	1
28.	Pottiaceae	1	1
29.	Sphagnaceae	1	1
30.	Taxiphyllaceae	1	1
31.	Thuidiaceae	1	1
		70	134 +2 subsp. + 5 var. + 1 fo.

Among the 142 taxa of mosses from the study sites, one species, *Sphagnum palustre* L. (Appendix 1; Plate 1A), is a new record for Borneo. Four taxa of mosses are also newly recorded for Sabah, *Chaetomitrium darnaedii* H. Akiyama & Suleiman, *Chionostomum rostratum* (Griff.) Müll. Hal., *Garovaglia plicata* subsp. *punctidens* (R.S. Williams) During and *Papillidiopsis kopenhagenii* B.C. Tan.

DISCUSSION

The mosses collected from Mount Muruk Mio and Bukit Rimau represent ca. 18% of the total amount of moss taxa reported for Borneo and ca. 21% for Sabah (Suleiman et al., 2006, 2017, 2022, 2024). These findings indicate that both study sites, particularly Mount Muruk Mio, are rich in bryophytes, comparable to Mount Lumaku and Mount Trusmadi (Suleiman et al., 2011; Andi et al., 2024).

Similar to Mount Lumaku, the Sematophyllaceae (when combined with the Pylaisiadelphaceae) was dominant in the study sites (Suleiman et al., 2011). However, the number of the Calymperaceae species was much lower than Mount Lumaku as both Mount Muruk Mio and Bukit Rimau are situated above 1,000 m a.s.l. This moss family is very common in tropical lowland and lower montane forests (Suleiman et al., 2017, 2019, 2025). In addition, collection of mosses from Mount Muruk Mio was only possible from 1,600 m a.s.l. as the lower elevation was highly degraded due to timber harvesting in the past.

The addition of *Sphagnum palustre* to the Bornean moss flora is noteworthy. Although this species is widely distributed globally, it has been very rarely recorded in the Malesian region. *Sphagnum palustre* can be mistaken for *S. perichaetiale* Hampe, the only known species of the

genus in Borneo with fibrillose stem and branch hyalodermis. However, the outermost cortical cells of the stem of the latter species have only a single pore whereas *S. palustre* has 3–8 pores; the photosynthetic cells of this species are also exposed and broad on the ventral surface in cross section (Gao & Crosby, 1999). *Sphagnum palustre* may also occur in other mountainous areas in Borneo but was mistaken for *S. perichaetiale*, a more common species in this region.

The addition of *Chaetomitrium darnaedii*, *Chionostomum rostratum*, *Garovaglia plicata* subsp. *punctidens* and *Papillidiopsis koponenii* to the moss flora of Sabah also contributes to the rich species diversity of the state. With these additions, Sabah now has a total of 680 moss taxa (Suleiman et al., 2006, 2017, 2022, 2024), which is significantly higher than Sarawak and Kalimantan. *Chaetomitrium darnaedii* was described in 2001 from Long Bawan in East Kalimantan (Akiyama & Suleiman, 2001), geographically not far from Mount Muruk Mio. No other specimens of this species were collected after the type, suggesting that it is endemic to the central part of Borneo. The only record of *Chionostomum rostratum* in Borneo was from Sarawak (Ellis et al., 2010), suggesting that it is locally rare. *Papillidiopsis koponenii* was only recorded once in Kalimantan and Brunei, while *Garovaglia plicata* subsp. *punctidens* is restricted to the Philippines, Taiwan and Borneo (GBIF, 2026; Suleiman et al., 2006).

This study shows that the study sites, particularly Mount Muruk Mio, are rich in mosses and have a high potential to contribute more new records for Sabah and Borneo. However, poor infrastructure and lack of facilities, particularly at Mount Muruk Mio, hinder bryologists from exploring the mountain and adjacent areas. The study highlights the need for continued explorations in this under-surveyed region, particularly in the face of increasing environmental pressures from land use and climatic changes.

CONCLUSION

The checklist presented here was based on short surveys at Mount Muruk Mio and Bukit Rimau. The presence of new records of mosses shows that these areas are significantly important, thus warrant continued protection from the authorities. More bryological explorations should be undertaken in these remote areas to attain a complete picture of their rich moss flora.

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DECLARATIONS

Research permit(s). Sabah Forestry Department (2003) and Sabah Parks Board of Trustees (2012).

Ethical approval/statement. Not applicable.

Generative AI use. The authors declare that generative AI has been used in compliance with the JTBC policies, and that we have reviewed and edited the content after using this tool/service and we take full responsibility for the content of the publication.

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Supplementary material

Appendix

Authors: Suleiman et al.

Data Type: PDF

Explanation note: Checklist of mosses from Mount Muruk Mio and Bukit Rimau, Sabah, Malaysian Borneo.

Link: <https://doi.org/10.51200/jtbc.v23i.7410.g5064>