Tropical Bryology 24: 139-145, 2003

Mosses of Gunung Serapi, Sarawak, Borneo

Haji Mohamed, Yong Kien Thai and Baki Bakar

Institute of Biological Sciences, Universiti Malaya, 50603 Kuala Lumpur, Malaysia. haji@um.edu.my

Abstract. Collections of mosses have been made from the 911 metre high Gunung (Mount) Serapi in Sarawak. A total of 77 species in 37 genera within 17 families were discovered and are enumerated below. Five species are reported for the first time for Borneo: *Aerobryidium aureonitens* (Hook. *ex* Schwägr.)Broth., *Distichophyllum schmidtii* Broth., *Mitthyridium fasciculatum* subsp *obtusifolium* (Lindb.) M.Menzel, *Papillidiopsis complanata* (Dixon) W.R.Buck & B.C.Tan and *Trichosteleum stigmosum* Mitt. Seventeen species are new records for Sarawak. One family, Bartramiaceae, and 3 genera, *Aerobryidium*, *Leucoloma*, *Philonotis*, are new to Sarawak. The largest family is Calymperaceae, with 6 genera and 21 species, followed by Sematophyllaceae, with 10 genera and 19 species.

INTRODUCTION

Gunung (Mount) Serapi is situated about 22 km west of Kuching city, Sarawak (Fig.1). The highest point at 911m is located at the southeastern border of the Kubah National Park. A steep sealed road leads from the Kubah Park Headquarters to the telecommunications tower on the summit of Gunung Serapi. Visitors are allowed to walk to the summit by using the road, a journey of 2-3 hours. The rainforest at the foothill of Gunung Serapi was the principal film location featured in a 1987 Hollywood production „Farewell to the King".

Gunung Serapi consists of a thick succession of sandstone, conglomerate and interbedded shale, which belongs to the Plateau Sandstone Formation (deposited between 45 & 100 million years ago) (Wolfenden and Haile, 1963). The shale is hard, dark grey or blue, and in places rich in fossils. Dark-coloured igneous rocks can be seen in road-cuts at Serapi's main summit area. The metamorphic sandstone surrounding these igneous bodies forms the highest point on Gunung Serapi.

Forests covering Serapi's steep slopes prevent rainwater from rushing downhill and allow its absorption into the sandstone rocks. Consequently, a reservoir is formed that holds drinking water for Kuching even during periods of drought. Serapi's northwest flank is the main water catchment for the Rayu river.

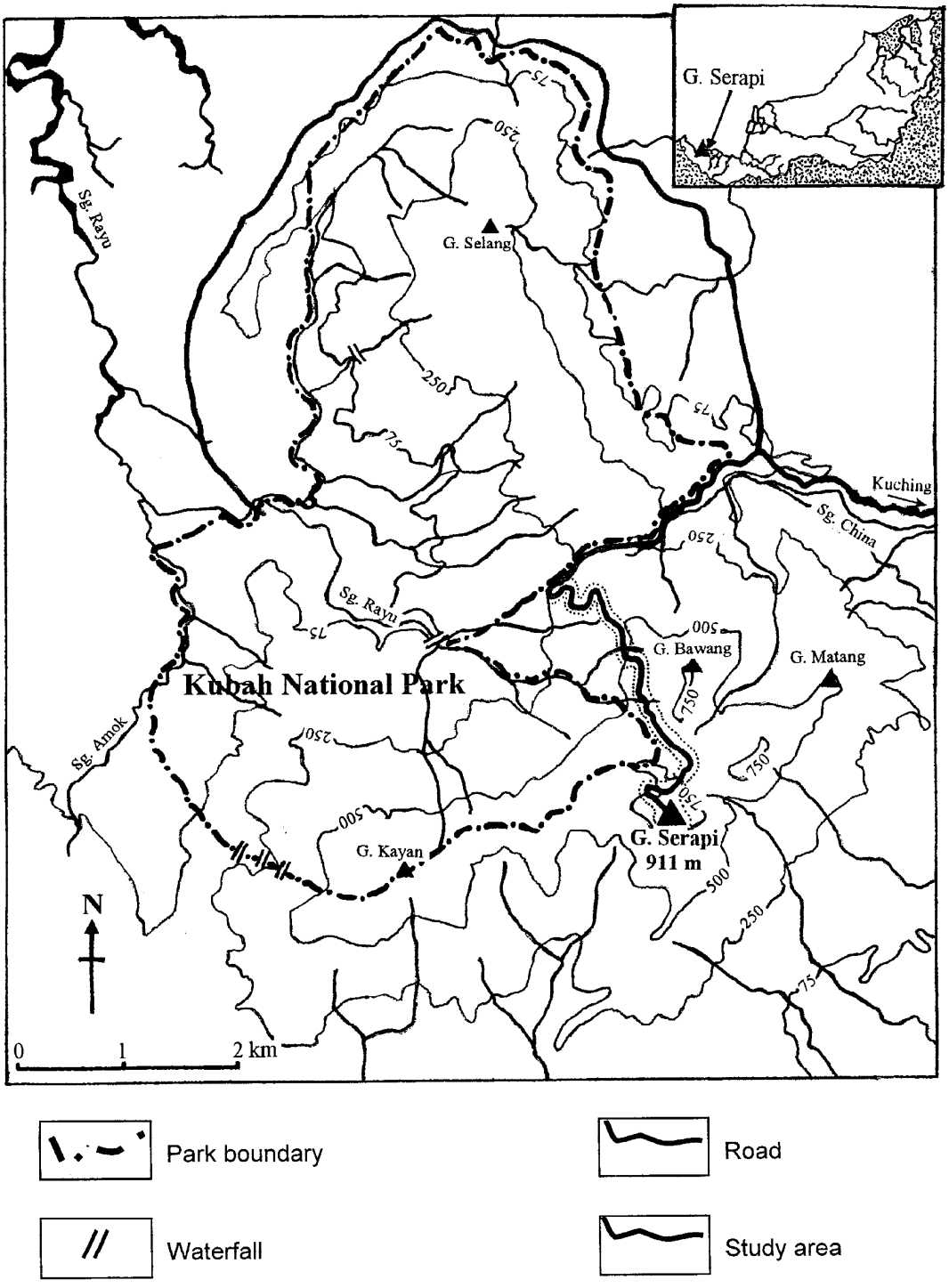

Figure 1. Map Showing Gunung Serapi and Kubah National Park (Inset: Map of Sarawak)

MATERIALS AND METHOD

This study is based on the collections made by the first author and Baki Bakar on 21-22 July 1991 and 28 July 1991. They were made in the forest on either side of the road leading towards the summit of Gunung Serapi. Voucher specimens are preserved at the Herbarium of Unviersity of Malaya (KLU).

RESULTS AND DISCUSSION

A total of 77 species in 37 genera of 17 families were discovered in Gunung Serapi during this study. Five species are reported for the first time in Borneo: *Aerobryidium aureonitens* (Hook. *ex* Schwägr.)Broth., *Distichophyllum schmidtii* Broth., *Mitthyridium fasciculatum* subsp *obtusifolium* (Lindb.) M.Menzel, *Papillidiopsis complanata* (Dixon) W.R.Buck & B.C.Tan and *Trichosteleum stigmosum* Mitt. *Distichophyllum santosii* E.B.Bartram and *Daltonia armata* E.B.Bartram collected in the same locality have been reported earlier as new to Borneo (Mohamed, H., A. Damanhuri & B. Bakar 1992). Seventeen species are new records for Sarawak. One family, Bartramiaceae, and 3 genera, *Aerobryidium*, *Leucoloma*, *Philonotis*, are new to Sarawak.

The largest family is Calymperaceae, with 6 genera and 21 species, followed by Sematophyllaceae, with 10 genera and 19 species (Table 1).

Table 1. Summary of taxa of mosses reported from Gunung Serapi, Sarawak.

Family	Genera	Species
Bartramiaceae	1	2
Buxbaumiaceae	1	1
Calymperaceae	6	21
Daltoniaceae	1	1
Dicranaceae	2	3
Fissidentaceae	1	1
Hookeriaceae	3	9
Hypnaceae	2	3
Hypnodendraceae	1	1
Leucobryaceae	1	4
Meteoriaceae	2	2
Orthotrichaceae	1	3
Phyllodrepaniaceae	1	1
Pottiaceae	1	1
Pterobryaceae	1	2
Rhizogoniaceae	1	2
Sematophyllaceae	10	19
Total	**37**	**77**

A total of 22 families, 76 genera and 220 species of mosses have now been reported from Sarawak (Akiyama, H. & M. Suleiman 2001; Eddy, A. 1977, 1988, 1990, 1996; Ellis, L. T. 1985; Hyvönen, J. 1989; Klazenga, N. 1999; Mohamed, H., A. Damanhuri & B. Bakar 1992; Reese, W. D. & B. C. Tan. 1983; Tan, B. C. 1991, 1994; Touw, A. 1978, 1986; Yamaguchi, T. 1993). The present report increases the number of families to 23, the number of genera to 79, and number of species to 237. It may be expected that an increase in the number of collections from Sarawak will further increase the number of recorded taxa. Neighbouring Sabah, where intensive collecting has been undertaken, especially on Mount Kinabalu, has twice the number of recorded moss taxa as Sarawak.

SPECIES CHECKLIST

(* indicates species new to Sarawak; ** indicates new records for Borneo)

1. Fissidentaceae

1.1. *Fissidens crassinervis* Sande Lac. — 3122b.
On soil at 720 m.

2. Dicranaceae

2.1. **Campylopus comosus* (Schwägr.) Bosch & Sande Lac. — 3123d, 3130.
On wet soil and exposed earth at 720 -740 m.
2.2. **Campylopus laxitextus* Sande Lac. — 3061, 3075.
On exposed soil at 820 m .
2.3. **Leucoloma molle* (Müll. Hal.) Mitt. — 3082.
On wood at 800 m.

3. Leucobryaceae

3.1. *Leucobryum aduncum* Dozy & Molk. — 3122a, 3106, 3064c.
On log and exposed soil at 720 - 820 m.

3.2. **Leucobryum chlorophyllosum* Müll. Hal. — 3059.
On *Cyathea* sp. at 820 m.
3.3. *Leucobryum javense* (Brid.) Mitt. — 8057c.
On soil at 820 m.
3.4. *Leucobryum sanctum* (Nees *ex* Schwägr.) Hampe — 3145a, 3182d, 3142, 3168, 3123b, 3128a.
On humus, wet soil and shaded rocks in dry stream at 690 - 820 m.

4. Calymperaceae

4.1. *Arthrocormus schimperi* (Dozy & Molk.) Dozy & Molk. — 3177c, 3082.
On rotten moist logs at 600 - 800 m.
4.2. *Calymperes porrectum* Mitt. — 3195a, 3114a, 3088, 3093a, 3096, 3045b, 3076.
On rocks and at base of tree at 300 - 800 m.
4.3. *Calymperes subintegrum* Broth. — 3092e, 3094a, 3102.
On tree base at 780 m.
4.4. **Calymperes serratum* A. Braun *ex* Müll. Hal. — 3096.
On tree at 780 m.
4.5. *Calymperes taitense* (Sull.) Mitt. — 3195a.
On moist rocks at 300 m.
4.6. *Exostratum blumii* (Nees *ex* Hampe) L. T. Ellis — 3176b, 3152b.
On rocks in stream and in forest at 600 - 620 m.
4.7. **Leucophanes angustifolium* Renauld & Cardot — 3114e, 3087.
On logs and trees at 700 - 790 m.
4.8. *Leucophanes octoblepharioides* Brid. — 3118b.
On soil and humus at 720 m.
4.9. *Mitthyridium fasciculatum* (Hook. & Grev.) H. Rob. — 3188.
On wood at 700 m.
4.10. ***Mitthyridium fasciculatum* subsp. *obtusifolium* (Lindb.)M.Menzel.— 3099, 3081, 3158.
On tree twigs and trunk at 780 - 820 m.
4.11. **Mitthyridium jungquilianum* (Mitt. in Dozy & Molk.) H. Rob. 3180, 3104, 3087.
On logs and trees at 600 - 790 m.
4.12. *Mitthyridium undulatum* (Dozy & Molk.) H. Rob. — 3196a, 3179, 3173a, 3124, 3157.
On rocks in stream and logs at 600 -700 m.
4.13. *Syrrhopodon albovaginatus* Schwägr. — 3137.
On wood at 700 m.
4.14. *Syrrhopodon ciliatus* (Hook.) Schwägr. — 3143b.
On tree at 700 m.
4.15. *Syrrhopodon confertus* Sande Lac. — 3194a, 3104, 3165, 3110, 3065b, 3067, 3069.
On wood, fallen logs, trees and *Cyathea* sp. at 200 - 820 m.
4.16. *Syrrhopodon croceus* Mitt. — 3182c, 3137, 3112d, 3143b, 3058, 3064a, 3065c, 3085, 8057a.
On rotten log, wood, tree base and *Cyathea* sp.at 690 - 820 m.
4.17. *Syrrhopodon loreus* (Sande Lac.) W. D. Reese — 3175b, 3167a.
On rocks and wood at 640 - 680 m.
4.18. *Syrrhopodon muelleri* (Dozy & Molk.) Sande Lac. — 3194a, 3180, 3173b, 3106b.
On wood and trees at 200 - 820 m.
4.19. *Syrrhopodon spiculosus* Hook. & Grev. 3157, 3107, 3106c, 3085, 8057a.
On rocks in wet stream, rotten logs, trees and on *Cyathea* sp. at 700 – 820 m.
4.20. *Syrrhopodon trachyphyllus* Mont. — 3178, 3137, 3111.
On wood and tree. at 640 – 720 m.
4.21. *Syrrhopodon tristichus* Nees *ex* Schwägr. —3194a, 3134.
On tree and rock near stream at 200 - 700 m.

5. Pottiaceae

5.1. **Pseudosymblepharis angustata* (Mitt.) Hilp. — 3108a.
On exposed rock at 780 m.

6. Buxbaumiaceae

6.1. *Diphyscium mucronifolium* Mitt. in Dozy & Molk. — 3196b, 3141b.
On rocks in stream at 700 m.

7. Orthotrichaceae

7.1. **Macromitrium blumei* Nees *ex* Schwägr. — 3091, 3093b.
On tree at 780 m.

7.2. *Macromitrium cuspidatum* Hampe — 3114c, 3082.
On trees at 700 - 800 m.
7.3. *Macromitrium* cf. *perdensifolium* Dixon — 3093b.
On tree at 780 m.

8. Rhizogoniaceae

8.1. *Pyrrhobryum latifolium* (Bosch & Sande Lac.) Mitt. — 3165c, 3145b, 3182a, 3149, 3183a.
On rock, wood and tree buttress at 680 - 700 m.
8.2. *Pyrrhobryum spiniforme* (Hedw.) Mitt. — 3175c.
On wood and rocks at 640 m.

9. Bartramiaceae

9.1. **Philonotis hastata* (Duby in Moritzi) Wijk & Margad. — 3194c, 3045c.
On rock and trees near stream at 200 - 800 m.
9.2. **Philonotis secunda* (Dozy & Molk.) Bosch & Sande Lac. — 3084.
On exposed slope at 800 m.

10. Phyllodrepaniaceae

10.1. *Mniomalia semilimbata* (Mitt.) Müll. Hal. — 3195c.
On rock in moist area at 300 m.

11. Hypnodendraceae

11.1. *Hypnodendron subspininervium* (Müll. Hal.) A. Jaeger — 3163c, 3186a.
On wood, rock and tree near waterfall at 690 - 700 m.

12. Pterobryaceae

12.1. *Garovaglia compressa* Mitt. — 3103.
On tree at 720 m.
12.2. *Garovaglia plicata* (Brid.) Bosch & Sande Lac. — 3091.
On tree at 780 m.

13. Meteoriaceae

13.1. ***Aerobryidium aureonitens* (Hook. *ex* Schwägr.) Broth. — 3109, 3115, 3105.
On humus and tree at 720-730 m.
13.2. *Aerobryopsis wallichii* (Brid.) M. Fleisch. — 3118f.
On twig at 720 m.

14. Daltoniaceae

14.1. *Daltonia armata* E. B. Bartram — 3098.
On tree at 780 m.

15. Hookeriaceae

15.1. *Callicostella papillata* (Mont.) Mitt. — 3153c, 3171a, 3131, 3131, 3058, 3060, 3066d, 3068, 3089.
On wood, fallen log and tree bark at 620 - 820 m.
15.2. *Callicostella prabaktiana* (Müll. Hal.) Bosch & Sande Lac. — 3195b.
On wet rock at 300 m.
15.3. *Chaetomitrium fimbriatum* (Dozy & Molk.) Bosch & Sande Lac. — 3078.
On tree at 800 m.
15.4. *Chaetomitrium leptopoma* (Schwägr.) Bosch & Sande Lac. — 3114f, 3091, 3092d, 3094b.
On tree at 700 - 780 m.
15.5. *Chaetomitrium setosum* Broth. *ex* Dixon — 3112a.
On tree at 720 m.
15.6. **Distichophyllum cirratum* Renauld & Cardot — 3134, 3140, 3141a, 3121, 3125, 3100a.
On rock in stream, dry stream bed and moist soil at 700 - 740 m.
15.7. *Distichophyllum cuspidatum* (Dozy & Molk.) Dozy & Molk. — 3165b, 3160a, 3163b, 3137, 3144b, 3155, 3159a, 3186b, 3101a, 3101c, 3066b, 3086.
On rocks, fallen logs, shrubs, tree twigs and tree bases at 680 - 820 m.
15.8. *Distichophyllum santosii* E. B. Bartram — 3177a, 3152a.
On rock in stream, rotten and moist logs at 600 - 620 m.
15.9. ***Distichophyllum schmidtii* Broth. — 3176a, 3151b, 3152a, 3171b.
On wood, rocks in forest and stream at 600 - 660 m.

16. Sematophyllaceae

16.1. *Acanthorrhynchium papillatum* (Harv. in Hook.) M. Fleisch. — 3066e, 3194b, 3181b, 3141c, 3154, 3184, 3187.

On rocks, logs and trees near stream at 200 - 820 m.
16.2. *Acroporium adspersum* (Hampe) Broth. — 3160c.
On wood at 690 m.
16.3. *Acroporium convolutum* (Sande Lac.) M. Fleisch. — 3104, 3118d.
On soil, humus and trees at 720 m.
16.4. *Acroporium johannis-winkleri* Broth.
— 3161a, 3072a, 3072b, 3066c.
On soil banks, fallen logs, tree bark and branches at 700 - 820 m.
16.5. *Acroporium rigens* (Broth. *ex* Dixon) Dixon — 3165a, 3143a, 3150, 3156b, 3162, 3164b, 3123e, 3129.
On rocks, soil, and rotten logs at 680 - 720 m.
16.6. *Acroporium rufum* (Reinw. & Hornsch.) M. Fleisch. — 3123f.
On wet soil at 720 m.
16.7. **Acroporium secundum* (Reinw. & Hornsch.) M. Fleisch. — 3112c.
On tree at 720 m.
16.8. *Clastobryophilum bogoricum* (Bosch & Sande Lac.) M. Fleisch. — 3166, 3114a, 3092a, 3094a.
On tree at 680 - 780 m.
16.9. *Isocladiella surcularis* (Dixon) B.C. Tan & H. Mohamed [syn. *I. flagellifera* (Sakurai) S. H. Lin] — 3073.
On twigs at 820 m.
16.10. *Mastopoma armitii* (Broth. & Geh.) Broth. — 3177d, 3139a, 3164a, 3079, 3066a, 3128b.
On humus, tree bark and moist logs at 600 - 820 m.
16.11. **Mastopoma papillosum* Broth. — 3171b, 3057a, 3065a, 3130.
On fallen log, wood and shaded tree base at 660 - 820 m.
16.12. ***Papillidiopsis complanata* (Dixon) W. R. Buck & B. C. Tan — 3159b, 3115b, 3118h.
On humus, soil and shrub at 700 - 720 m.
16.13. *Radulina hamata* (Dozy & Molk.) W. R. Buck & B. C. Tan — 3153b, 3175a, 3181c.
On rocks, wood and tree bark at 620 - 660 m.
16.14. **Taxithelium instratum* (Brid.) Broth. in Renauld & Cardot — 3045d.
On rocks at 800 m.
16.15. *Taxithelium vernieri* (Duby) Besch. — 3175d, 3092b.
On rocks, wood and trees at 640 m and 780 m.
16.16. *Trichosteleum boschii* (Dozy & Molk.) A. Jaeger — 3151a, 3144a, 3161b, 3101b, 3064b.
On shrub, fallen logs, twigs and branches at 620 - 820 m.
16.17. ***Trichosteleum stigmosum* Mitt. — 3153a, 306b, 8057b.
On rotten log and tree bark at 620 - 820 m.
16.18. **Trismegistia calderensis* (Sull.) Broth. — 3167b, 3136, 3116, 3123a.
On rocks, moist soil, humus and wood at 680 - 720 m.
16.19. *Trismegistia rigida* (Mitt.) Broth. — 3225, 3165e, 3181a, 3165e, 3163a, 3189, 3139b, 3156a, 3183b, 3186c, 3193, 3113, 3115a, 3118g, 3100b, 3108b.
On exposed rock, soil at roadside, humus, wood, fallen log, tree and shaded tree base at 600 - 780 m.

17. Hypnaceae

17.1. **Ectropothecium eleganti-pinnatum* (Müll. Hal.) A. Jaeger — 3060, 3070.
On log and bark at 820 m.
17.2. *Ectropothecium ichnotocladum* (Müll. Hal.) A. Jaeger — 3114d.
On tree at 700 m.
17.3. *Pseudotaxiphyllum pohliaecarpum* (Sull. & Lesq.) Z. Iwats.— 3127.
On humus at 720 m.

Acknowledgements
We would like to thank the Sarawak Forestry Department for providing assistance during the collecting trips and the Missouri Botanical Garden for financial assistance. We are grateful to Dr Benito C. Tan for assistance with the identification of the Sematophyllaceae.

REFERENCES

Akiyama, H. & M. Suleiman 2001. Taxonomical notes on the genus *Chaetomitrium* (Hookeriaceae, Musci) of Borneo. Hikobia **13**: 491-509.

Eddy, A. 1977. Sphagnales of Tropical Asia. Bull. Br. Mus. Nat. Hist. (Bot.) **5**: 359-445.

Eddy, A. 1988. Handbook of Malesian mosses. Vol.**1**: 1-306, figs. 165. British Museum (Nat. Hist.), London.

Eddy, A. 1990. Handbook of Malesian mosses. Vol.**2**: 1-256, figs. 160. British Museum (Nat. His.), London.

Eddy, A. 1996. Handbook of Malesian mosses. Vol.**3**: 1-277, fig. 183. British Museum (Nat. His.), London.

Ellis, L. T. 1985. A taxonomic revision of *Exodictyon* Card. (Musci: Calymperaceae). Lindbergia **11**: 9-37.

Hyvönen, J. 1989. A synopsis of genus *Pogonatum* (Polytrichaceae, Musci). Acta Botanica Fennica **138**: 1-87.

Klazenga, N. 1999. A revision of the Malesian species of *Dicranoloma* (Dicranaceae, Musci). Journal of Hattori Botanical Laboratory **87**: 1-130.

Mohamed, H., A. Damanhuri & B. Bakar 1992. Three mosses new to Borneo. Journal of Bryology **17**: 285-288.

Reese, W. D. & B. C. Tan. 1983. The 'petiolate' Calymperaceae: a review with a new species. Bull. Nat. Sci. Mus., Tokyo, series B **9**: 23-32.

Tan, B. C. 1991. Miscellaneous notes on Asiatic mosses, especially Malesian Sematophyllaceae (Musci) and others. Journal of Hattori Botanical Laboratory **70**: 91-106.

Tan, B.C. 1994. The bryophytes of Sabah (North Borneo) with special reference to the BRYOTROP transect of Mount Kinabalu. xix. The genus *Acroporium* (Sematophyllaceae, Musci) in Borneo, with notes on species of Java and the Philippines. Willdenowia **24**: 255-294.

Touw, A. 1978. The mosses reported from Borneo. Journal of Hattori Botanical Laboratory **44**: 147-176.

Touw, A. 1986. A revision of *Pogonatum* sect. *Racelopus*, sect. nov., including *Racelopus* Dozy & Molk., *Pseudoracelopus* Broth., and *Racelopodopsis* Thér. Journal of Hattori Botanical Laboratory **60**: 1-33.

Wolfenden, E.B. & Haile , N.S. 1963. Sematan and Lundu area, West Sarawak. Geological Survey Department British Territories in Borneo, Government Printing Office, Kuching. 159pp.

Yamaguchi, T. 1993. A revision of the genus *Leucobryum* (Musci) in Asia. Journal of Hattori Botanical Laboratory **73**: 1-123.