Malaysian Journal of Science **24** : 111 - 117 (2005)

A Checklist of Mosses for the North-Eastern Region of the Langkawi Islands, Peninsular Malaysia with Additional Records for the Langkawi Group of Islands

Haji Mohamed* and **Yong Kien-Thai**

Institute of Biological Sciences, Faculty of Science, University of Malaya, 50603 Kuala Lumpur, Malaysia
*haji@um.edu.my

ABSTRACT A checklist comprising 89 species and 1 variety in 48 genera and 22 families of mosses and one species of hornwort have been compiled as a result of two bryological expeditions carried out in the north-eastern part of Langkawi Islands. Ten species are reported as new additions to Langkawi Islands. These bring the total number of mosses reported for the Islands to 137 species and 1 subspecies, 1 variety in 60 genera and 24 families. This total represents 27.4 % of the moss taxa which have been reported for Peninsular Malaysia. The North Eastern part of Langkawi Islands supports a higher percentage of mosses than Tioman Island (18.4%) and Pangkor Island (10.6%).

ABSTRAK Satu senarai semak yang mengandungi 89 spesies dan 1 varieti dalam 48 genus dan 22 famili lumut jati dan satu spesies lumut kerak telah dilaporkan untuk bahagian Timur Laut Pulau Langkawi, sebagai hasil daripada dua ekspedisi ke Pulau Langkawi. Sepuluh spesies daripada lumut jati yang ditemui daripada kutipan Ekspedisi Langkawi adalah rekod baru kepada Pulau Langkawi. Ini menjadikan jumlah lumut jati yang dilaporkan untuk Pulau Langkawi mencapai 137 spesies dan 1 subspesies, 1 varieti dalam 60 genus dan 24 famili. Jumlah ini mewakili 27.4 % daripada taxa lumut jati yang pernah dilaporkan untuk Semenanjung Malaysia. Peratusan lumut jati yang dilaporkan di bahagian Timur Laut Pulau Langkawi adalah lebih tinggi daripada Pulau Tioman (18.4%) dan Pulau Pangkor (10.6%).

(Bryophyte, Musci, Anthocerotae, North-eastern Langkawi Islands, Peninsular Malaysia, limestone)

INTRODUCTION

The first large scale scientific excursion to the Langkawi Islands was jointly organized by the Malayan Nature Society, Langkawi Development Authority and Forestry Department of Kedah in 2003. This resulted in a new checklist of mosses of Langkawi Islands [1]. The Second Langkawi Islands Expedition was carried out between 5th and 9th April 2004 with particular emphasis on the north-eastern part of the Island.

The North-eastern part of Langkawi Island comprises a few offshore limestone islets, limestone outcrop-mangrove forest intermixed area, primary forest and scattered plantations and villages. The elevation changes from sea level to about 900 m above sea level at the summit of Gunung Raya. The unique geographical and diverse physical features at the north-eastern region of Langkawi Island provide various suitable habitats for mosses. All the specimens are preserved in the herbarium of the University of Malaya (KLU).

RESULTS AND DISCUSSION

A checklist of 89 species and 1 variety in 48 genera and 22 families of mosses and one species of hornwort have been compiled after two bryological expeditions to the north-eastern part of Langkawi Islands. Among these, 42 genera and 75 species and 1 variety of mosses were identified from the collections of the Second Langkawi Islands Expedition of which ten species are new records for the islands. These are: *Calymperes serratum* A. Braun *ex* Müll. Hal., *Chaetomitrium orthorrynchum* (Dozy & Molk.) Bosch & Sande Lac. (Fig. 1), *Hyophila rosea* R. S. Williams, *Leucophanes octoblepharioides* Brid., *Mitthyridium papuanum* (Broth.) H. Rob. (Fig. 2), *Symphysodontella*

attenuatula M. Fleisch., *Taxithelium alare* Broth., *T. kerianum* (Broth.) Broth., *Thuidium pristocalyx* (Müll. Hal.) A. Jaeger and *Trachypus humilis* Lindb. All the new additions above were collected from the north-eastern part of Langkawi Island, with the exception of *H. rosea* which was collected from Pulau Dayang Bunting at the southern part of Langkawi.

The total moss flora of Langkawi Islands now stands at 137 species and 1 subspecies,1 variety in 60 genera and 24 families (Table 1), based on past reports [1, 2, 3] and the current study. The total moss flora represents 27.4 % out of 508 total moss taxa reported for Peninsular Malaysia and this percentage is much higher than Tioman Island (18.4%) [4] and Pangkor Island (10.6%) [5]. The probable reasons for the richer moss flora of Langkawi Islands compared with other islands of Peninsular Malaysia, such as the influence of Indochina element, Tropical monsoon climate, size of island, occurrence of limestone habitat, wide range of elevation and others have been discussed in Mohamed *et al.* 2005 [1].

Mangrove habitat often bear a low diversity of mosses, the two common species found in mangrove area of North-eastern Langkawi Islands are *Calymperes moluccense* Schwägr. (Fig. 3) and *C. palisotii* Schwägr. Members of leafy hepatic, another class of bryophyte, are found to be more diverse and well represented in mangrove area, as reported in a study of bryophyte flora of mangrove forest in Thailand [6]. Comparatively, the limestone habitat located in between the mangrove forest of North-eastern Langkawi is very rich in mosses. The limestone habitat can be divided into various subdivisions based on the geology, topography and physiognomy of the vegetation according to Chin [7], these provide a great variety of niches for the growth of different species of mosses. A total of 22 species out of 73 species of Peninsular Malayan limestone mosses reported by first author in 1987 [8] were collected during the expedition. *Taxithelium instratum* (Brid.) Broth. in Renauld & Cardot, *T. kerianum* and *T. nepalense* (Schwägr.) Broth., which are common to limestone hills of North-eastern Langkawi Islands are three additional records for limestone moss flora of Peninsular Malaysia. New account shows by 1/3 of the Peninsular Malayan limestone moss species are found in North-eastern Langkawi Islands, this give a very important reason to conserve this area in order to protect the biological diversity and natural resources.

22 out of 90 taxa of mosses collected from North-eastern Langkawi region are among the Gunung Raya which is the highest peak of Langkawi Island with an elevation of 893.9 m a.s.l. at the summit, is very rich in bryophytes. Sixty out of 90 taxa of bryophytes reported for north-eastern Langkawi were found in this area. Prior to this study, *Trachypus humilis,* a minute epiphytic moss, was only reported from Maxwell Hill, Perak [9]. Discovery of this species in Gunung Raya extends its distribution to northern Peninsular Malaysia. *Symphysodontella attenuatula* and *S. cylindracea* (Mont.) M. Fleisch. which are only reported from elevations above 1000 m on the mainland were collected at elevations as low as 600 m above sea level on Gunung Raya.

The moss flora of the North Eastern part of Langkawi Islands is richer than other offshore islands in Peninsular Malaysia and as such conservation measures must be put in place to protect these rare plants.

Table 1. Sumary of North-eastern Langkawi moss flora as comparised to the overall moss flora of Langkawi Islands.

		North-eastern area		Langkawi Islands	
	Families	**Genera**	**Species**	**Genera**	**Species**
1.	Bartramiaceae	1	2	1	3
2.	Bruchiaceae	-	-	1	1
3.	Bryaceae	3	4	3	5
4.	Buxbaumiaceae	-	-	1	1
5.	Calymperaceae	6	24	6	35+1 ssp.
6.	Dicranaceae	3	3	3	6
7.	Ditrichaceae	1	1	1	1
8.	Fissidentaceae	1	7+1 var.	1	9+1 var.
9.	Hookeriaceae	2	4	3	5
10.	Hypnaceae	1	1	3	4
11.	Leptodontaceae	1	1	1	1
12.	Leucobryaceae	1	2	1	5
13.	Meteoriaceae	1	1	1	1
14.	Neckeraceae	4	6	4	9
15.	Octoblepharaceae	1	1	1	1
16.	Orthotrichaceae	1	1	2	2
17.	Polytrichaceae	1	1	1	1
18.	Pottiaceae	4	4	5	7
19.	Pterobryaceae	1	2	3	4
20.	Racopilaceae	1	1	1	1
21.	Rhizogoniaceae	1	1	1	1
22.	Sematophyllaceae	9	16	12	28
23.	Thuidiaceae	3	4	3	5
24.	Trachypodaceae	1	1	1	1
	Total	**48**	**88+1 var.**	**60**	**137+1 ssp.+1 var.**

Figure 1. *Lucophanes octoblepharioides* Brid., a new record for Langkawi Islands collected from Gunung Raya.

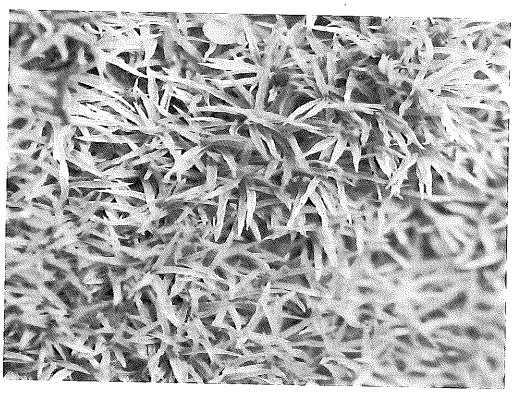

Figure 2. *Mitthyridium papuanum* (Broth.) H. Rob., a new record for Langkawi Islands collected from Gunung Raya.

Figure 3. *Calymperes moluccense* Schwägr., an epiphytic moss found in mangrove forest.

Figure 4. *Bryum coronatum* Schwägr. with mature sporophytes.

Figure 5. *Groutiella tomentosa* (Hornsch.) Wijk. & Margad., an epiphytic species usually found on tree canopies.

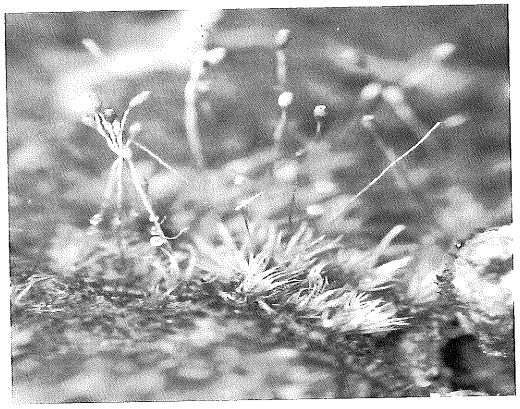

Figure 6. *Orthodontium infractum* Dozy & Molk., found on disturbed soil bank on Gunung Raya.

Figure 7. *Philonotis secunda* (Dozy & Molk.) Bosch & Sande Lac., growing on moist soil banks at the summit of Gunung Raya.

Figure 8. *Pyrrhobryum spiniforme* (Hedw.) Mitt., from submontane forest zone of Gunung Raya.

A Checklist Of Bryophytes Of The North-Eastern Langkawi Islands

(Additional records to Langkawi Islands are indicated by "*" and short notes about the locality and habitat are given)

Class Anthocerotae (hornwort)
Anthoceros formosae Stephani

Class Musci (mosses)
Acanthorrhynchium papillatum (Harv. in Hook.) M. Fleisch.
Acroporium convolutum (Sande Lac.) M. Fleisch.
A. downii (Dixon) Broth.
A. lamprophyllum Mitt.
A. secundum (Reinw. & Hornsch.) M. Fleisch.
Aequatoriella bifaria (Bosch & Sande Lac.) Touw
Aerobryopsis longissima (Dozy & Molk.) M. Fleisch.
Arthrocormus schimperi (Dozy & Molk.) Dozy & Molk.
Barbula javanica Dozy & Molk.
Brachymenium exile (Dozy & Molk.) Bosch & Sande Lac.
Bryum clavatum (Schimp.) Müll. Hal. (Fig. 4)
B. coronatum Schwägr.
Caduciella mariei (Besch.) Enroth
Callicostella papillata (Mont.) Mitt.
C. prabaktiana (Müll. Hal.) Bosch & Sande Lac.
Calymperes aeruginosum Hampe *ex* Sande Lac.
C. afzelii Sw.
C. boulayi Besch.
C. erosum Müll. Hal.
C. graeffeanum Müll. Hal.
C. lonchophyllum Schwägr.
C. moluccense Schwägr. (Fig. 3)
C. motleyi Mitt. in Dozy & Molk.
C. palisotii Schwägr.
**C. serratum* A. Braun *ex* Müll. Hal. — collected on tree trunk at 600-700 m on Gunung Raya.
C. taitense (Sull.) Mitt.
C. tenerum Müll. Hal.
Campylopus umbellatus (Schwägr. & Gaudich. *ex* Arn.) Paris
**Chaetomitrium orthorrynchum* (Dozy & Molk.) Bosch & Sande Lac. — collected on tree trunk at 600-700 m on Gunung Raya.
C. papillifolium Bosch & Sande Lac.
Exostratum blumii (Nees *ex* Hampe) L.T. Ellis
Fissidens ceylonensis Dozy & Molk.
F. crispulus Brid.
F. crispulus var. *robinsonii* (Broth.) Z. Iwats. & Z.H. Li
F. hollianus Dozy & Molk.
F. javanicus Dozy & Molk.
F. oblongifolius Hook. f. & Wilson
F. pellucidus Hornsch.
F. zollingeri Mont.
Garckea comosa (Dozy & Molk.) Wijk & Margad.
Glossadelphus sp.
Groutiella tomentosa (Hornsch.) Wijk. & Margad. (Fig. 5)
Himantocladium plumula (Nees in Brid.) M. Fleisch.
Homaliodendron exiguum (Bosch & Sande Lac.) M. Fleisch.
Hyophila involuta (Hook.) A. Jaeger
Isocladiella surcularis (Dixon) B.C. Tan & Mohamed
Isopterygium minutirameum (Müll. Hal.) A. Jaeger
Leucobryum aduncum Dozy & Molk.
L. chlorophyllosum Müll. Hal.
Leucoloma molle (Müll. Hal.) Mitt.
**Leucophanes octoblepharioides* Brid. (Fig. 1) — collected on tree trunk at 600-700 m on Gunung Raya.

Meiothecium microcarpum (Hook.) Mitt.
Microdus brasiliensis (Duby) Thér.
Mitthyridium fasciculatum (Hook. & Grev.) H. Rob.
M. flavum (Müll. Hal.) H. Rob.
M. jungquilianum (Mitt. in Dozy & Molk.) H. Rob.
**M. papuanum* (Broth.) H. Rob. (Fig. 2) — collected on tree trunk at 600-700 m on Gunung Raya.
M. subluteum (Müll. Hal.) H. K. Nowak
Neckeropsis fimbriata (Harv. in Hook.) M. Fleisch.
N. gracilenta (Bosch & Sande Lac.) M. Flesich.
Octoblepharum albidum Hedw.
Orthodontium infractum Dozy & Molk. (Fig. 6)
Papillidiopsis malayana (Dixon) B.C. Tan
P. malesiana W.R. Buck & B.C. Tan
Pelekium velatum Mitt.
Philonotis hastata (Duby in Moritzi) Wijk & Margad.
P. secunda (Dozy & Molk.) Bosch & Sande Lac. (Fig. 7)
Pinnatella alopecuroides (Hook.) M. Fleisch.
P. ambigua (Bosch & Sande Lac.) M. Fleisch.
Pogonatum camusii (Thér.) Touw
**Pseudosymblepharis angustata* (Mitt.) Hilp. — collected on limestone rock at sea elevation at Gua Kelawar, Kuala Kisap area.
Pyrrhobryum spiniforme (Hedw.) Mitt. (Fig. 8)
Racopilum cuspidigerum (Schwägr.) Ångström
Radulina hamata (Dozy & Molk.) W.R. Buck & B.C. Tan
**Symphysodontella attenuatula* M. Fleisch. — collected on tree trunk at 600-700 m on Gunung Raya.
S. cylindracea (Mont.) M. Fleisch.
Syrrhopodon gardneri (Hook.) Schwägr.
S. loreus (Sande Lac.) W.D. Reese
S. muelleri (Dozy & Molk.) Sande Lac.
S. trachyphyllus Mont.
**Taxithelium alare* Broth. — collected on rock at 600-700 m on Gunung Raya.
T. instratum (Brid.) Broth. in Renauld & Cardot
**T. kerianum* (Broth.) Broth. — collected on limestone rock at sea elevation at Gua Kelawar, Kuala Kisap area.
T. nepalense (Schwägr.) Broth.
Thuidium plumulosum (Dozy & Molk.) Dozy & Molk.
**T. pristocalyx* (Müll. Hal.) A. Jaeger — collected on rock at 100 m at Durian Berangin Waterfall.
**Trachypus humilis* Lindb. — collected on tree trunk at 600-700 m on Gunung Raya. This is the first report for the family Trachypodaceae in Langkawi .
Trichosteleum boschii (Dozy & Molk.) A. Jaeger
Weissia edentula Mitt.

Acknowledgements The authors acknowledge a grant provided by University of Malaya (FP006/2003b) in support of the present study. We are indebted to the University of Malaya Maritime Research Centre (UMMReC) which coordinated the Langkawi Islands Scientific Expedition 2004.

REFERENCES

1. Mohamed, H, Yong K.T., Damanhuri, A. and Abdul Latiff, Q. (2005). Moss diversity of Langkawi Islands, Peninsular Malaysia. *Malayan Nature Journal.* (in press).
2. Dixon, H.N. (1926). A list of the mosses of the Malay Peninsula. *The Gardens' Bulletin Straits Settlements* **4**: 1-46.
3. Mohamed, H. (1987). A contribution to the moss flora of Pulau Langkawi. *Malayan Naturalist* **40 (3 & 4)**: 54-56.
4. Tan, B.C. and Mohamed, H. (1999). A preliminary checklist of mosses of Pulau Tioman, Peninsular Malaysia. *The Raffles Bulletin of Zoology, supplement* **6**: 73-76.
5. Maideen, H. & A. Damanhuri. 2000. On the moss flora of Pulau Pangkor, Perak, Peninsular Malaysia. *Journal of Malaysian Applied Biology* **29 (1 & 2)**: 105-110.
6. Thaitong, O. (1984). Bryophytes of the mangrove forest. *Journal of the Hattori Botanical Laboratory* **56**: 85-87.

7. Chin, S.C. (1977). The limestone hill flora of Malaya I. *Gardens' Bulletin, Singapore* **30**: 165-219.
8. Mohamed, H. (1987). The limestone moss flora of Malaya. *Symposia Biologica Hungarica* **35**: 649-663.
9. Manuel, M.G. (1981). Additions to the bryoflora of Malaya. *The Bryologist* **84(2)**: 220-221.