

Hymenophyllaceae Collected in the Mt. Kinabalu Area in 2000 and 2007

Atsushi Ebihara

Department of Botany, National Museum of Nature and Science, 4–1–1 Amakubo, Tsukuba 305–0005, Japan
E-mail: ebihara@kahaku.go.jp

Abstract. Hymenophyllaceae specimens collected in the Mt. Kinabalu area are enumerated by the latest classification system, and four genera and 24 species are recognized. Ample morphological variation is observed in the cosmopolitan species *Hymenophyllum polyanthos* even within this limited area. At least three forms are recognizable according to analyses of chloroplast DNA and their morphological characters.

Key words: Hymenophyllaceae, *Hymenophyllum polyanthos*, Mt. Kinabalu.

Introduction

The filmy fern family Hymenophyllaceae shows great diversity in mountain mossy forests. Mt. Kinabalu and its adjacent areas (Borneo, Malaysia) are one of the best fields for studying this family, especially the mostly epiphytic genus *Hymenophyllum* s.l. The author conducted a field investigation in the Mt. Kinabalu area in 2000 and 2007, and more than one hundred specimens of this family have been collected by the author and his colleagues. Those specimens are enumerated here following the latest classification (Ebihara *et al.*, 2006). Phylogenetic relationships within this family have gradually been clarified by recent studies (Ebihara *et al.*, 2007; Hennequin *et al.*, 2006) at higher levels (genus and subgenus), but there is still much taxonomic problem at the species level. One of the most problematic species, *Hymenophyllum polyanthos*, is particularly focused on in this study.

Materials and Methods

The specimens were collected in the Mt. Kinabalu area (Sabah, Malaysia); by Ebihara *et al.* (=A. Ebihara, K. Iwatsuki, Y. Yatabe & R. Jaman) in February 21–26, 2000; by Sugawara *et al.* (=A. Sugawara, A. Ebihara, T. Nakamura & S. Matsumoto) in January 31–February 3, 2007.

Specimens collected by T. Arikawa in November 27–30, 2001 are also included in this study.

Results and Discussions

In total, four genera and 24 species are recognized among the 105 collections. The Mt. Kinabalu area is especially rich in one of the genera *Hymenophyllum*—75% of the species belong to *Hymenophyllum*.

List of species

Genus 1: *Hymenophyllum*

Subgen. 1. *Hymenophyllum*

Hymenophyllum peltatum (Poir.) Desv.

Syn. *Hymenophyllum perfissum* Copel.

Specimens examined. Ebihara *et al.* 00223-004 (Summit Trail, 3400 m, TNS 766151); Ebihara *et al.* 000223-008 (Summit Trail, 3400 m, TNS 766154); Ebihara *et al.* 000223-010 (Summit Trail, 3400 m, TNS 766156); Ebihara *et al.* 000223-011 (Summit Trail, 3400 m, TNS 766157); T. Arikawa 298 (Summit Trail, 3300 m, TNS 766188).

Notes. *Hymenophyllum perfissum*, described from Mt. Kinabalu is undoubtedly the cosmopolitan species *H. peltatum* itself based on both morphological and molecular evidences. But its distribution in the Malesia region is limited to

Mt. Kinabalu and New Guinea so far.

Hymenophyllum acanthoides (Bosch) Rosenst.

Syn. *Meringium acanthoides* (Bosch) Copel.

Specimens examined. Sugawara *et al.* SB2007-54 (Masilau, Nepenthes Trail, ca. 2000 m, TNS 764881); Sugawara *et al.* SB2007-74 (Silau Silau Trail, ca. 1500 m, TNS 764899); Ebihara *et al.* 000225-030 (Liwagu River Trail, 1800 m, TNS 766174); T. Arikawa 332C (Summit Trail, 1800 m, TNS 766193).

Hymenophyllum denticulatum Sw.

Syn. *Meringium denticulatum* (Sw.) Copel.

Specimens examined. Sugawara *et al.* SB2007-7 (Summit Trail, 1850–1950 m, TNS 764822); Sugawara *et al.* SB2007-27 (Summit Trail, 1950–2130 m, TNS 764840); Sugawara *et al.* SB2007-32 (Summit Trail, 1950–2130 m, TNS 764845).

Hymenophyllum blandum Racib.

Syn. *Meringium blandum* (Racib.) Copel.

Specimens examined. Sugawara *et al.* SB2007-4 (Summit Trail, 1850–1950 m, TNS 764820); Sugawara *et al.* SB2007-30 (Summit Trail, 1950–2130 m, TNS 764843).

Hymenophyllum pachydermicum Ces.

Syn. *Meringium pachydermicum* (Ces.) Copel.

Specimens examined. Ebihara *et al.* 000221-003B (around the head quarter, 1500 m, TNS 766149); T. Arikawa 252 (Summit Trail, 1800 m, TNS 766183); T. Arikawa 332B (Summit Trail, 1800 m, TNS 766192); Sugawara *et al.* SB2007-67 (Silau Silau Trail, ca. 1500 m, TNS 764892).

Hymenophyllum holochilum (Bosch) C.Chr.

Syn. *Meringium holochilum* (Bosch) Copel.;

Hymenophyllum subdemissum H.Christ.

Specimens examined. Ebihara *et al.* 000223-006 (Summit Trail, 3400 m TNS 766152); Ebihara *et al.* 000225-023 (Liwagu River Trail, 1800 m, TNS 766167); T. Arikawa 332A (Summit Trail, 1800 m, TNS 766191); Sugawara *et al.* SB2007-20 (Summit Trail, 1850–1950 m, TNS

764833); Sugawara *et al.* SB2007-21 (Summit Trail, 1850–1950 m, TNS 764834); Sugawara *et al.* SB2007-24 (Summit Trail, 1850–1950 m, TNS 764837); Sugawara *et al.* SB2007-34 (Summit Trail, 1950–2130 m, TNS 764847); Sugawara *et al.* SB2007-57 (Masilau, Nepenthes Trail, ca. 2000 m, TNS 764884); Sugawara *et al.* SB2007-99 (Mt. Alabu, 1900 m, TNS 764860); Sugawara *et al.* SB2007-103 (Mt. Alabu, 1900 m, TNS 764816).

Hymenophyllum serrulatum (C.Presl) C.Chr.

Syn. *Meringium meyenianum* C.Presl

Specimens examined. Ebihara *et al.* 000223-009 (Summit Trail, 3400 m, TNS 766155); Ebihara *et al.* 000225-036 (Liwagu River Trail, 1800 m, TNS 766179).

Hymenophyllum lobbii T.Moore ex Bosch

Syn. *Meringium lobbii* (T.Moore ex Bosch) Copel.

Specimens examined. Sugawara *et al.* SB2007-23 (Summit Trail, 1850–1950 m, TNS 764836); Sugawara *et al.* SB2007-36 (Summit Trail, 1950–2130 m, TNS 764849); T. Arikawa 277c (Summit Trail, 2200 m, TNS 766187).

Notes. This species is quite tiny, and forms mats on tree trunks.

Subgen. 2. ***Sphaerocionium***

Hymenophyllum pilosissimum C.Chr.

Syn. *Sphaerocionium pilosissimum* (C.Chr.) Copel.

Specimens examined. Ebihara *et al.* 000225-031 (Liwagu River Trail, 1800 m, TNS 766175); Sugawara *et al.* SB2007-73 (Silau Silau Trail, ca. 1500 m, TNS 764898); Sugawara *et al.* SB2007-102 (Mt. Alabu, 1900 m, TNS 764863).

Hymenophyllum nitidulum (Bosch) Ebihara et K.Iwats.

Syn. *Microtrichomanes nitidulum* (Bosch) Copel.

Specimens examined. Ebihara *et al.* 000225-029 (Liwagu River Trail, 1800 m, TNS 766173); Ebihara *et al.* 000225-037a (Liwagu River Trail,

1200 m, TNS 766180); Sugawara *et al.* SB2007-2 (Summit Trail, 1850–1950 m, TNS 764818); Sugawara *et al.* SB2007-22 (Summit Trail, 1850–1950 m, TNS 764835); Sugawara *et al.* SB2007-43 (Summit Trail, 2130–2250 m, TNS 764868); Sugawara *et al.* SB2007-93 (Mt. Alabu, 1900 m, TNS 764855).

Notes. This and the following two species were formerly included in *Trichomanes* s.l., but recently moved to *Hymenophyllum* (Ebihara *et al.*, 2005).

Hymenophyllum palmatifidum (Muell.Berol.)

Ebihara & K.Iwats.

Syn. *Microtrichomanes palmatifidum* (Muell.Berol.) Copel.

Specimens examined. Ebihara *et al.* 000224-017 (Summit Trail, 3000 m, TNS 766163); Ebihara *et al.* 000225-032 (Liwagu River Trail, 1800 m, TNS 766176); Sugawara *et al.* SB2007-37 (Summit Trail, 1950–2130 m, TNS 764850); Sugawara *et al.* SB2007-44 (Summit Trail, 2130–2250 m, TNS 764869); T. Arikawa 277b (Summit Trail, 2200 m, TNS 766186).

Hymenophyllum digitatum (Sw.) Fosberg

Syn. *Microtrichomanes digitatum* (Sw.) Copel.; *Trichomanes flabellatum* Bosch; *Trichomanes dichotomum* Kunze

Specimens examined. Ebihara *et al.* 000224-015 (Summit Trail, 3000 m, TNS 766161); Ebihara *et al.* 000224-016 (Summit Trail, 3000 m, TNS 766162); Ebihara *et al.* 000225-037b (Liwagu River Trail, 1200 m, TNS 766181).

Subgen. 3. ***Mecodium***

Hymenophyllum polyanthos (Sw.) Sw.

Syn. *Mecodium polyanthos* (Sw.) Copel.

Notes. This species is one of the cosmopolitan species, ranging from Mid America (type locality) through South America, Pacific Islands, Australia, Malesia, East Asia and South Asia to Africa. Like other cosmopolitan species, this species shows a broad range of morphological variation symbolized by a large number of synonyms under this species. Molecular phylogeny

based on chloroplast DNA has already suggested this “species” is never a natural (monophyletic) species (Hennequin *et al.*, 2006). My preliminary molecular analysis using material collected by this project (unpublished) suggests that there are multiple lineages (certainly corresponding to biological units) of “*H. polyanthos*” even within the Kinabalu area.

Form 1 (Fig. 1). Frond pale-green, lanceolate, 5–12×1–2.5 cm. Sori on the apices of most of the segments. This form is closely related to south-pacific/southern hemisphere species of subgen. *Mecodium*.

Specimens examined. Sugawara *et al.* SB2007-60 (Masilau, Nepenthes Trail, ca. 2000 m, TNS 766205).

Form 2 (Fig. 2). Frond usually dark-green, ovate, up to 13×7 cm. Sori sparse on the adaxial side of the pinnae. This is apparently the commonest form in the Kinabalu area.

Specimens examined. Sugawara *et al.* SB2007-13 (Summit Trail, 1850–1950 m, TNS 766199); Sugawara *et al.* SB2007-16 (Summit Trail, 1850–1950 m, TNS 766200); Sugawara *et al.* SB2007-92 (Mt. Alabu, 1900 m, TNS 766209); Sugawara *et al.* SB2007-94 (Mt. Alabu, 1900 m, TNS 766210).

Form 3 (Fig. 3). Frond usually dark-green, lanceolate, 2.5–7×0.7–2 cm. Sori on the terminal of segments of the upper half of the fronds.

Specimens examined. Sugawara *et al.* SB2007-52 (Masilau, Nepenthes Trail, ca. 2000 m, TNS 766204); Sugawara *et al.* SB2007-76 (Silau Silau Trail, ca. 1500 m, TNS 766208).

Other specimens examined (no molecular data). Ebihara *et al.* 000225-027 (Liwagu River Trail, 1800 m, TNS 766171); Ebihara *et al.* 000225-033 (Liwagu River Trail, 1800 m, TNS 766177); T. Arikawa 271 (Summit Trail, 2020 m, TNS 766184); T. Arikawa 316A (Summit Trail, 3100 m, TNS 766189); Sugawara *et al.* SB2007-5 (Summit Trail, 1850–1950 m, TNS 766194); Sugawara *et al.* SB2007-8 (Summit Trail, 1850–1950 m, TNS 766195).

Hymenophyllum paniculiflorum C.Presl



Figs. 1–3. Three forms of *Hymenophyllum polyanthos*. 1. Form 1 (TNS 766205). 2. Form 2 (TNS 766199). 3. Form 3 (TNS 766208).

Syn. *Mecodium paniculiflorum* (C.Presl) Copel.

Specimens examined. Ebihara *et al.* 000222-001 (Summit Trail, 2500–3000 m, TNS 766150); Ebihara *et al.* 000224-013 (Summit Trail, 3100 m, TNS 766159); Sugawara *et al.* SB2007-61 (Masilau, Nepenthes Trail, ca. 2000 m, TNS766206).

Notes. This species is easily recognizable by sori assembling on the apices of the fronds. Molecular data (Ebihara, unpublished) suggest that this species is one of the morphologically specialized forms in the *H. polyanthos* complex.

Subgen. 4. *Globosa*

Hymenophyllum emarginatum Sw.

Syn. *Mecodium emarginatum* (Sw.) Copel.

Specimens examined. Ebihara *et al.* 000225-034 (Liwagu River Trail, 1800 m, TNS 766178); Sugawara *et al.* SB2007-53 (Masilau, Nepenthes Trail, ca. 2000 m, TNS 764880); Sugawara *et al.*

SB2007-96 (Mt. Alabu, 1900 m, TNS 764857).

Hymenophyllum javanicum A.Spreng.

Syn. *Mecodium javanicum* (A.Spreng) Copel.

Specimens examined. Ebihara *et al.* 000225-022 (Liwagu River Trail, 1800 m, TNS 766166); Ebihara *et al.* 000225-024 (Liwagu River Trail, 1800 m, TNS 766168); Sugawara *et al.* SB2007-56 (Masilau, Nepenthes Trail, ca. 2000 m, TNS 764883); Sugawara *et al.* SB2007-72 (Silau Silau Trail, ca. 1500 m, TNS 764897).

Hymenophyllum treubii Racib.

Syn. *Mecodium treubii* (Racib.) Copel.

Specimens examined. Ebihara *et al.* 000221-003A (head quarter, 1500 m, TNS 766148); Sugawara *et al.* SB2007-71 (Silau Silau Trail, ca. 1500 m, TNS 764896).

Subgen. 5. *Pleuromanès*

Hymenophyllum pallidum (Blume) Ebihara *et*

K.Iwats.

Syn. *Pleuromanes pallidum* (Blume) C.Presl;
Trichomanes album Blume

Specimens examined. Sugawara *et al.* SB2007-10 (Summit Trail, 1850–1950 m, TNS 764824); Sugawara *et al.* SB2007-11 (Summit Trail, 1850–1950 m, TNS 764825); Sugawara *et al.* SB2007-38 (Summit Trail, 1950–2130 m, TNS 764851); T. Arikawa 277a (Summit Trail, 2200 m, TNS 766185).

Genus 2: *Crepidomanes*

Subgen. 1. *Crepidomanes*

Sect. 1. *Crepidomanes*

Crepidomanes bipunctatum (Poir.) Copel.

Syn. *Trichomanes bipunctatum* Poir.

Specimens examined. Ebihara *et al.* 000225-020 (Liwagu River Trail, 1800 m, TNS 766164); Sugawara *et al.* SB2007-51 (Masilau, Nepenthes Trail, ca. 2000 m, TNS 764879); Sugawara *et al.* SB2007-55 (Masilau, Nepenthes Trail, ca. 2000 m, TNS 764882).

Crepidomanes christii (Copel.) Copel.

Syn. *Trichomanes christii* Copel.

Specimens examined. Ebihara *et al.* 000226-038 (Poring, 700 m, TNS 766182).

Sect. 2. *Gonocormus*

Crepidomanes minutum (Blume) K.Iwats.

Syn. *Gonocormus minutus* (Blume) Bosch; *Trichomanes proliferum* Blume; *Trichomanes alagense* H.Christ.

Specimens examined. Ebihara *et al.* 000221-001 (around Head Quarter), 1800 m, TNS 766146; Ebihara *et al.* 000223-007 (Summit Trail, 3400 m, TNS 766153); Ebihara *et al.* 000223-012 (Summit Trail, 3400 m, TNS 766158); Ebihara *et al.* 000224-014 (Summit Trail, 3000 m, TNS 766160); Ebihara *et al.* 000225-021 (Liwagu River Trail, 1800 m, TNS 766165); T. Arikawa 316B (Summit Trail, 3100 m, TNS 766190); Sugawara *et al.* SB2007-68 (Silau Silau Trail, ca. 1500 m; TNS 764893); Sugawara *et al.* SB2007-70 (Silau Silau Trail, ca. 1500 m, TNS 764895); Sugawara *et al.* SB2007-

75 (Silau Silau Trail, ca. 1500 m, TNS 764900); Sugawara *et al.* SB2007-90 (Mt. Alabu, 1900 m, TNS 764853); Sugawara *et al.* SB2007-98 (Mt. Alabu, 1900 m, TNS 764859).

Genus 3: *Vandenboschia*

Vandenboschia maxima (Blume) Copel.

Syn. *Trichomanes maximum* Blume; *Crepidomanes maximum* (Blume) K.Iwats.

Specimens examined. Ebihara *et al.* 000225-026 (Liwagu River Trail, 1800 m, TNS 766170).

Genus 4: *Abrodictyum*

Subgen. 1. *Abrodictyum*

Abrodictyum pluma (Hook.) Ebihara & K.Iwats.

Syn. *Macroglena meifolia* (Bory ex Willd.) Copel. auct for Asian plants.

Specimens examined. Sugawara *et al.* SB2007-77 (Silau Silau Trail, ca. 1500 m, TNS 764901); Sugawara *et al.* SB2007-97 (Mt. Alabu, 1900 m, TNS 764858).

Notes. “*Macroglena (Trichomanes) meifolia*” was originally described from Africa, and our molecular phylogenetic evidence (Ebihara *et al.*, 2007) suggested “true” African *M. meifolia* and Asian *M. meifolia* do not form a monophyletic group. Therefore the name for the Asian plants were changed to “*Abrodictyum pluma*”.

Subgen. 2. *Pachychaetum*

Abrodictyum obscurum (Blume) Ebihara & K.Iwats.

Syn. *Trichomanes obscurum* Blume; *Selendesmium obscurum* (Blume) Copel.

Specimens examined. Ebihara *et al.* 000225-025 (Liwagu River Trail, 1800 m, TNS 766169); Sugawara *et al.* SB2007-66 (Masilau, Kogopon Trail, ca. 2000 m, TNS 764891).

Acknowledgements

The author thanks K. Iwatsuki, T. Arikawa, A. Sugawara, I. Said, R. Jaman, Y. Yatabe, S. Matsumoto, T. Nakamura for supporting collection of specimens. This study is partly supported by “Biodiversity inventory in the Western Pacific re-

gion”, a project of the National Museum of Nature and Science.

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キナバル山で2000年と2007年に採集されたコケシノブ科植物

海老原 淳

筆者らによる2000, 2007年の現地調査等によって採集された, マレーシア・キナバル山周辺に生育するコケシノブ科植物を, 筆者らが2006年に発表した新分類体系に基づいて目録化し, 4属24種が記録された. 特に, 広域分布種であるホソバコケシノブについては, キナバル山周辺においても豊富な形態変異が観察されたが, それらは予備的な分子系統解析の結果と形態形質の比較から, 少なくとも3系統が認識できることが示唆された.