

## Two Basidiomycetes New to Indonesia, *Pterygellus armeniacus* and *Rimbachia leucobryi*

O. MIETTINEN<sup>1</sup> AND N. HERNAWATI<sup>2</sup>

<sup>1</sup> Finnish Museum of Natural History, Botanical Museum (H)  
Box 7, FI-00014 University of Helsinki, Finland  
Email: otto.miettinen@helsinki.fi

<sup>2</sup> The Herbarium (ANDA), Universitas Andalas  
Padang, Sumatra Barat, Indonesia 25163

### Abstract

*Rimbachia leucobryi*, a small pleurotoid agaric, is described as new to science. The species grew on living stems of *Leucobryum sanctum* in lowland rainforest. It is characterised by lamellate hymenophore, hymenial cystidia and small, ellipsoid spores. *Pterygellus armeniacus*, a bright-coloured stipitate stereoid species, is reported as new to Indonesia. The two species are illustrated.

### Introduction

Tropical Southeast Asian mycota is one of the most poorly known globally. Only a few mycologists work in the area while deforestation rates in the mycologically most diverse rainforest areas hit all time high. To answer the call to catalogue the vanishing mycological diversity, Herbarium of Andalas University (ANDA, Padang, Indonesia) and Botanical Museum, University of Helsinki (H, Finland) have established cooperation, during which basidiomycete diversity in Sumatra is recorded and described. From the collections made so far, two minute species new to Indonesia are described and reported below.

### Materials and methods

The basic mounting medium used in microscopic studies was Cotton Blue (CB), but also Melzer's reagent (IKI) and 5% KOH. Spore and other measurements were made and illustrations were drawn in CB. Entry CB+ means cyanophily, CB(+) weak but distinct cyanophilous reaction, CB- acyanophily; IKI- means neither amyloid nor dextrinoid reaction; KOH- means that hyphae were left almost unchanged. Measurements were done using ×1000 magnification and phase contrast illumination; eyepiece scale

bar with 1- $\mu$ m-grid was used, and dimensions were estimated subjectively with an accuracy of 0.1  $\mu$ m (see Miettinen et al., 2006 for further detail).

The following symbols are used for spore measurements: L = mean length, W = mean width, Q = L/W, i.e. average length divided by average width, Q' = length/width ratio of individual spores, n = number of spores measured from given number of specimens, for instance 90/3 means 90 spores measured from 3 specimens. In presenting the variation of spore size and Q', the whole range is given in parentheses. The 90% range excluding the extreme 5% of values from both ends is given without parentheses. In case the 5% limit falls between two values, the one further from the median was chosen to represent the 5% tail. Whenever the figures within and outside parentheses are identical, parentheses are omitted.

### Species descriptions

#### *Pterygellus armeniacus* Corner

A monograph of Cantharelloid fungi (1966) 168.

**Basidiocarp** centrally to more rarely laterally stipitate, **cap** irregular, venose, upwards directed, often divided from the base to several separate spathulate lobes, particularly when young, stipe 10-15 mm long, cap 5 mm in diameter, 0.2 mm thick. **Stipe** and upper surface covered with rough, upward-pointing tufts, brownish orange, hymenium paler than rest of the basidiocarp, consistently tough but brittle when dry. Hymenial surface consists of branching, blunt veins. Cap margin irregularly sharp with saw-like pattern, following vein patterns of the cap. **Hyphal system** monomitic. Hyphae homogenous throughout the basidiocarp, slightly thick-walled, clamps absent, CB- but inclusion stained in CB, IKI- but cells with golden yellow content, (2.8-) 3.2-4.3 (-6)  $\mu$ m in cap trama, (3.2-) 4-5.4(-7)  $\mu$ m in stipe context. Hyphal tufts of the upper and stipe surface formed by parallel, tightly arranged hyphae, similar to normal generative hyphae albeit narrower, (2.8-) 3-4.3 (-4.7)  $\mu$ m (measured from the stipe). Hyphae forming the cap surface not different from the tramal hyphae, but slightly projecting, blunt, occasionally slightly swollen hyphal ends present. **Cystidia** absent. **Hymenium**. Basidia with a tapering base, narrowly clavate, occasionally sinuous, often with visible, granular inclusion, 25-65  $\times$  6.5-8.6  $\mu$ m, with (2-)3-5 sterigmata, length 4-7  $\mu$ m. **Basidiospores** broadly ellipsoid to subglobose, CB-, IKI-, slightly thick-walled, smooth, 7.5-9.2 (-9.8)  $\times$  (5.9-) 6.2-7.8 (-7.9)  $\mu$ m, L=8.50  $\mu$ m, W=6.92  $\mu$ m, Q'=1.1-1.3(-1.5), Q=1.23, n=40, apiculus prominent, about 0.8  $\times$  0.8  $\mu$ m. Inclusion granular, without guttules. In some slightly dehydrated spores the spore wall seems to have minute ornamentation in the form of small granules, not unlike the inclusion. **Figs. 1-3.**

*Specimens studied:* INDONESIA. Sumatera Barat, Padang, Limau Manis, Andalas University Biology research forest, S 0° 54.61, E 100° 28.36', alt. 430 m, on the ground in a steep slope of natural forest dominated by Dipterocarpaceae and Fagaceae, 13.VII.2008, *O. Miettinen 13004*, field no NOM292 (ANDA, H).

*Habitat and ecology:* The species grew on the ground without any evident connection to decomposing substrate. It is probably ectomycorrhizal, although a root-rotting habit can not be ruled out. Ectomycorrhizal fungi are not uncommon in this forest type dominated with two well-known ectomycorrhizal tree families, Dipterocarpaceae and Fagaceae. *Pterygellus* is traditionally included in Cantharellales, which includes numerous ectomycorrhizal fungi. Verbeken and Walley (1999) report *Pterygellus polymorphus* to be ectomycorrhizal with Euphorbiaceae.

*Distribution:* The type locality of this species is in Singapore, and the new find extends the distribution to Sumatra.

*Notes:* Our specimen fits well with Corner's (1966) description with the exception of the number of sterigmata in each basidium, (3-) 4-6 according to Corner. We studied over 60 basidia, and could not spot any 6-sterigmate (Fig. 3). Peculiarly 5-sterigmate basidia were almost as common as 4-sterigmate, and 3-sterigmate were not rare either.

***Rimbachia leucobryi* Miettinen, sp. nov.**

*Basidioma pileatum, lamellatum, estipitatum, 2-5 mm latum, muscicola. Systema hypharum monomiticum, hyphis fibulatis, inflatis, cystidiis hymenialibus subulatis, basidiosporae ellipsoideae, 5-6 × 3.8-4.8 μm. – Typus:* INDONESIA, Riau, Kabupaten Kampar, Balung, Teratak Baru, N 0° 8.6', E 100° 49.4', alt. 170-250 m, on living stems of *Leucobryum sanctum* (Brid.) Hampe growing on a large, fallen log in a logged-over primary rain forest, 24.XII.2006, *O. Miettinen 11267* (holotype, ANDA; isotypes, H, SING).

**Figs. 4-5.**

**Basidiocarp** pileate, laterally attached or slightly pendant, without stipe, pure white when fresh, drying cream-coloured, 2-5 mm wide when fresh, 1-2 mm when dry, often curving inwards upon drying. Consistency rather fragile. Hymenophore consists of forked lamellae or folds, same colour as the upper surface. **Hyphal system** monomitic. Hyphae thin- to slightly thick-walled, clamps present in nearly all septa, CB-, IKI-. Tramal (and contextual) tissue relatively dense, hyphae inflated, subparallel, (3-)3.8-6.5(-15) μm in diameter. Hyphae at upper surface not differentiated. Sparse,

loose, inconspicuous hyaline, shiny granules or encrustation present in all parts of the basidiocarp in CB; in IKI scanty golden encrustation seen along hyphae. **Cystidia** thin-walled, projecting above hymenium, subulate, occasionally branched, arising from subhymenium just as other hymenial cells,  $20-44 \times 4.4-5.8 \mu\text{m}$ . **Hymenium**. Basidia cylindrical to clavate, with (2-) 4 sterigmata,  $18-23.5 \times 5-6.8 \mu\text{m}$ , sterigmata up to  $3.5 \mu\text{m}$  long. **Basidiospores** ellipsoid to subglobose, often pip-shaped, thin- to very slightly thick-walled, smooth, CB-, IKI-,  $(4.8-)$   $5-6(-6.1) \times 3.8-4.8(-5.0)$ ,  $L=5.36$ ,  $W=4.28$ ,  $Q'=1.1-1.4$ ,  $Q=1.25$ ,  $n=50$ , with a prominent apiculus, typically  $1.5 \times 1.5 \mu\text{m}$ .

*Habitat and ecology*: Evidently the species has a close connection to its bryophyte host. Whether the relationship is parasitic, saprobic or symbiotic, we can not judge at present. All the host stems and the moss colony in general seem to be in good condition.

*Distribution*: The only find comes from lowland rainforest in central Sumatra. The host species, *L. sanctum*, has a wide distribution in tropical Asia from India and China to Papua New Guinea and is found throughout this area in natural forests, being common in at least insular Southeast Asia (Enroth, 1990; Yamaguchi, 1993). Other similar moss-inhabiting fungi are not species specific. Thus the species could potentially be found anywhere in tropical Asia.

*Etymology*: Named after the host plant species, *Leucobryum sanctum*

*Notes*: In search of the name for the present species, all species validly combined in the genera *Arrhenia*, *Cheimonophyllum*, *Cyphallostereum*, *Leptoglossum*, *Mniopetalum*, *Pleuromyconula*, *Pseudocratarellus*, *Pterygellus*, *Rhodoarrhenia*, and *Rimbachia* were compared using Mycobank (2009) and literature. The most suitable genus according to the key of Singer (1986) seems to be either *Pleuromyconula* or *Mniopetalum*, both included by Redhead (1984) in *Rimbachia*.

The current species fits best in *Mniopetalum* or *Rimbachia* being astipitate, pleurally attached, small, pale-coloured, moss-inhabiting and gilled, with clamped, inflated tramal hyphae, inamyloid, hyaline spores and lacking differentiated pileipellis. The hymenial hyphoid cystidia are the only deviating character.

DNA-based analysis would be needed to sort out relationships between the minute-sized agarics that lack clear spore and cystidial characters. No DNA sequence data exist currently in Genbank for the type - or any other - species of *Rimbachia*, *Flabellimycena*, *Mniopetalum*, or *Pleuromyconula*. Redhead *et al.* (2002a, b) did not include any members of these genera in their DNA-based phylogenetic analysis. For these reasons

we follow Redhead's (1984) broad concept of *Rimbachia* here, inclusive of *Mniopetalum*.

The genus *Cheimonophyllum* includes small pleurotoid species with cheilocystidia warranting generic comparison. The three species currently included in the genus are all lignicolous. The type species, *Cheimonophyllum candidissimum* (Berk. & M.A. Curtis) Singer, has non-inflated hyphae of rather small diameter in contrast to inflated hyphae in *Rimbachia* (based on literature and studied Finnish material in H). The cystidia in the type species are long, branching and restricted to the gill edge, and not simple and hymenial (pleurocystidia) as in *R. leucobryi*. Considering the ecology, hyphal structure and even cystidial characters, *Rimbachia* seems a more natural placement for the new species.

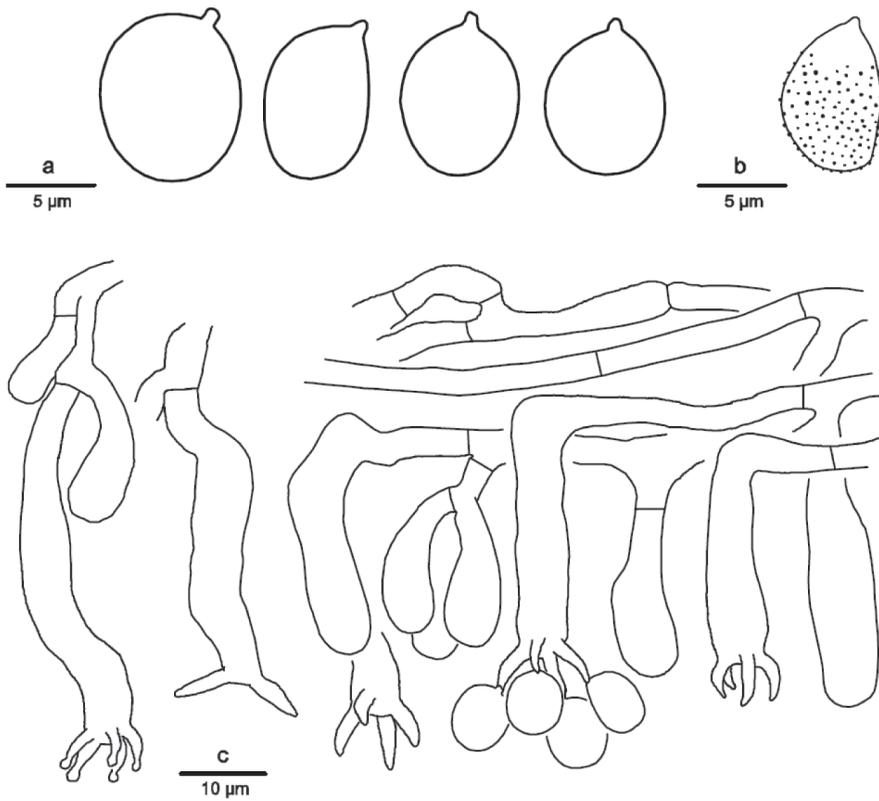
At the species level, *Rimbachia bryophila* (Pers.) Redhead is externally and ecologically very similar to *R. leucobryi*. However, according to Kuyper (1995) and Senn-Irlet and Moreau (2003) based on European material, its spores are clearly larger,  $6-8.5 \times 5-6.5 \mu\text{m}$ . Redhead (1984:878) reported slightly smaller spores for American material,  $5-7 \times 4.5-7 \mu\text{m}$ , but these are still larger than those of *R. leucobryi*. Same applies to *Leptoglossum subbryophilum* Singer (spores  $6.5-8.5 \times 5.5-8 \mu\text{m}$ , Singer, 1931: 521), *Mniopetalum flabelliforme* M. Zang and *Mniopetalum miniatum* M. Zang (spores  $7-10 \times 5-6 \mu\text{m}$  for both, see Zang, 1986).

*Rimbachia furfuracea* (Petch) Redhead and *Mniopetalum distinctum* Horak (considered a synonym of the first-mentioned by Redhead, 1984) are also quite similar. We rely on the detailed descriptions of Corner (1966: 76), Horak (1980: 100), and Pegler (1986: 95). Basidiocarps of *Rimbachia furfuracea* are spatulate and bear a short lateral stipe; the basidiocarps are terrestrial or growing on mosses, 5-25 mm in size, the gills are thick, blunt, shallow and frequently anastomosing. The spore size is  $5-6.5 \times 3.2-4$ ,  $L=6$ ,  $W=3.5$  (Pegler, 1986), or  $4.5-6 \times 3-4$  (Horak, 1980, for *Mniopetalum distinctum*), hyphae 3-15  $\mu\text{m}$  wide and inflated. The microscopic characters agree with *R. leucobryi*, except that no cystidia are mentioned. The ecology and macroscopic characters (shallow gills and larger basidiocarps, stipe) are clearly different from *R. leucobryi*.

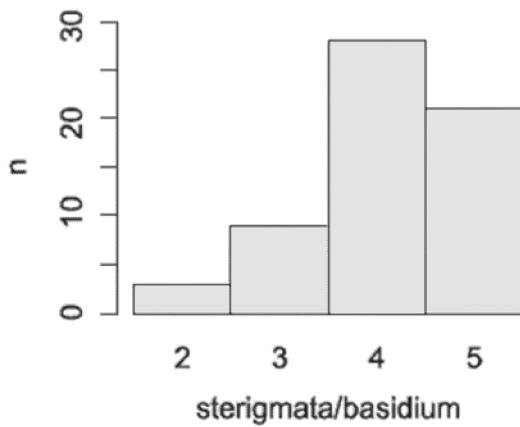
*Rimbachia cyphelloides* Lloyd (= *Rhodoarrhenia cyphelloides* (Lloyd) Singer) from Brazil has a reticulate hymenium and a short stipe. Its spores are also larger,  $8 \times 6 \mu\text{m}$  (Lloyd 1918: 802) or  $5.5 - 7-4 \times 3.5-5.4 \mu\text{m}$  (Singer, 1963: 143). *Rimbachia ellipsoidea* (Singer) Redhead from Mexico produces small, white basidiocarps with a venose hymenium, growing on mosses. The original description (Singer, 1973: 27) states that the spores measure  $6.2-7.5 \times 3.5-4.5 \mu\text{m}$ , clearly longer than in *R. leucobryi*. Redhead (1984) reports that the type is in bad condition. None of the above-mentioned species is reported to bear hymenial cystidia as does *R. leucobryi*.



**Figure 1.** *Pterygellus armeniacus* (Miettinen 13004), photographed when fresh.



**Figure 2.** *Pterygellus armeniacus* (Miettinen 13004). Normal spores (a), a dehydrated, “ornamented” spore (b), and hyphenium (c).



**Figure 3.** Number of sterigmata per basidium in *Pterygellus armeniacus* (based on Miettinen 13004). Total number of basidia included is 61.



Figure 4. *Rimbachia leucobryi*, based on fresh type material.

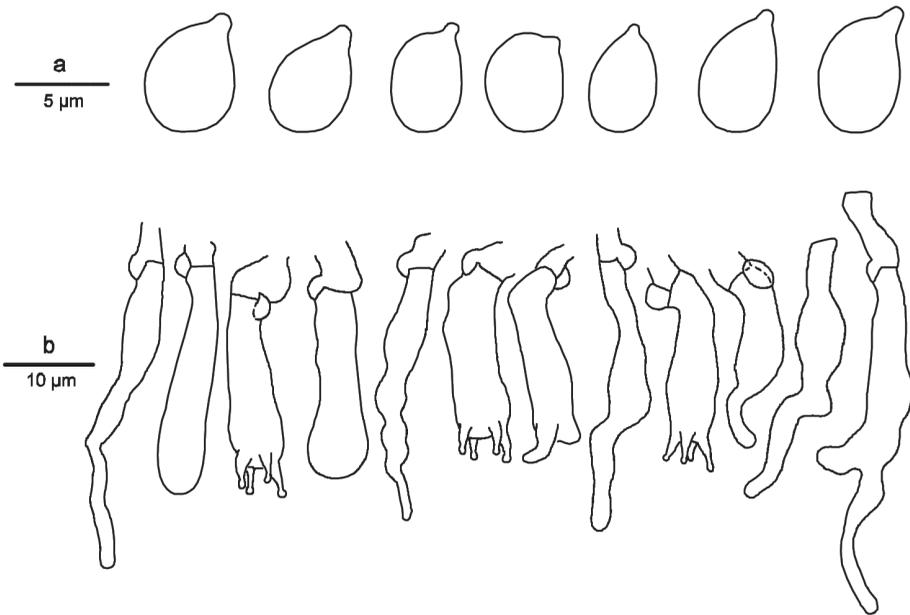


Figure 5. *Rimbachia leucobryi*, holotype: spores (a) and hymental cells (b).

## Acknowledgements

We express our gratitude to Dr. Arbinis Arbain, Prof. Dr. Syamsurdi, Dr. Rusdji Tamin, all our friends at the Herbarium of Andalas University, and Prof. P. Uotila (H) for providing generous assistance to this project. We also thank Dr. J. Enroth (H) for identifying the bryophytes, Prof. T. Ahti (H) for revising the Latin description, and Dr. T. Niemelä (H) for his comments on the manuscript.

## References

- Corner E.J.H. 1966. Monograp of cantharelloid fungi. *Annals of Botany Memoir* **2**: 1-255, + 5 pls.
- Enroth, J. 1990. Bryophyte flora of the Huon Peninsula, Papua New Guinea 36. Leucobryaceae (Musci). *Acta Botanica Fennica* **139**: 65-120.
- Horak E. 1980. Indian Boletales and Agaricales revisions and new taxa. *Sydowia* **33**: 88-110.
- Kuyper, T.W. 1995. *Rimbachia*, pp. 134-135. In: Bas, C., Kyper, T.W., Noordeloos, M.E. & Vellinga, E.C. (eds). *Flora Agaricina Neerlandica 3. Tricholomataceae*.
- Lloyd, C.G. 1918. *Mycological notes* **56**: 798-812.
- Mycobank. 2009. <http://www.mycobank.org/mycotaxo.aspx> [23 March 2009]
- Miettinen, O., T. Niemelä and W. Spirin. 2006. Northern *Antrodiella* species: the identity of *A. semisupina*, and type studies of related taxa. *Mycotaxon* **96**: 211-239.
- Pegler, D.N. 1986. Agaric flora of Sri Lanka. *Kew Bulletin, Additional Series* **12**: 1-519.
- Redhead, S.A. 1984. *Arrhenia* and *Rimbachia* expanded generic concept, and reevaluation of *Léptoglossum* with emphasis on muscicolous Noth American taxa. *Canadian Journal of Botany* **62**: 865-892

- Redhead, S.A., F. Lutzoni, J.M. Moncalvo and R. Vilgalys. 2002a. Phylogeny of agarics: partial systematics solutions for bryophilous omphalinoid agarics outside of the Agaricales (euagarics). *Mycotaxon* **82**: 151-168.
- Redhead, S.A., F. Lutzoni, J.M. Moncalvo and R. Vilgalys. 2002b. Phylogeny of agarics: partial systematics solutions of core omphalinoid genera in the Agaricales (euagarics). *Mycotaxon* **83**: 19-57.
- Senn-Irlet, B. and P.-A. Moreau. 2003. Notes on three *Rimbachia* species from the Alps. *Czech Mycology* **54**: 145-154.
- Singer, R. 1931. Pilze aus dem Kaukasus 2. Ein Beitrag zur Flora Swanetiens und einiger angrenzender Täler. *Beihefte zum Botanischen Centralblatt* **48**: 513-542.
- Singer, R. 1963. New genera of fungi 13. *Rhodoarrhenia*. *Sydowia* **17**: 142-145.
- Singer, R 1973. Diagnoses fungorum novorum Agaricalium 3. *Beihefte zur Sydowia* **7**: 1-106.
- Singer, R. 1986. The Agaricales in modern taxonomy, 4th revised edition. Koenigstein, Koelz Scientific Books. 981 pp + 88 pls.
- Verbeken, A. and N. Walley. 1999. Is *Pterygellus* mycorrhizal with a euphorbia? *Mycologist* **13**: 37.
- Yamaguchi, T. 1993. A revision of the genus *Leucobryum* in Asia. *Journal of Hattori Botanical Laboratory* **73**:1-123.
- Zang, M. 1986. New or interesting species of the genus *Mniopetalum* from the Eastern Himalayas. *Mycotaxon* **26**: 297-307.