

## Notes on three *Rimbachia* species from the Alps

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*Rimbachia neckerae* is reported from several localities in the Alps. A description is given and the spore size of all *Rimbachia* species hitherto reported from Central Europe is critically reviewed. Special attention is given to the host plants, i.e. pleurocarpous and acrocarpous mosses.

**Key words:** Basidiomycetes, Agaricales, *Rimbachia*, taxonomy, ecology, distribution, Central Europe, moss-inhabiting fungi

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Z několika lokalit v Alpách je uveden druh *Rimbachia neckerae*. Je podán popis tohoto druhu a kriticky je vyhodnocena velikost výtrusů všech druhů rodu *Rimbachia* dosud uváděných ze střední Evropy. Zvláštní pozornost je věnována hostitelským rostlinám, to jest pleurokarpním a akrokarpním mechům.

### INTRODUCTION

Minute agaricoid species without lamellae and stipe, so-called cyphelloid species, often grow gregariously on mosses, especially in humid places. Despite the small size and sporocarps without any pigments, several species and genera can be recognised based on microscopical characters.

*Rimbachia* is such a genus with small pleurotoid to cyphelloid sporocarps. According to an emended description of the genus by Redhead (1984) a combination of the following characters is distinctive: the spores are subglobose to broadly subcylindrical, obpyriform or ellipsoid, thin-walled, inamyloid, smooth, and with a prominent apiculus. The trama consists of loosely to compactly arranged, subregular, i.e. slightly interwoven hyphae with clamp connections. Pileipellis a cutis with a transition towards a trichoderm, i.e. often with erect undifferentiated terminal cells. World-wide at least six species are recognised.

Keys in current use for continental and nordic Europe (e.g. Moser 1983, Høiland in Hansen et Knudsen 1992, Kuyper in Bas et al. 1995) list two species, *R. bryophila* and *R. arachnoidea*, whereas Watling & Gregory (1989) report the presence of *R. bryophila* and *R. neckerae* from the British Isles.

We report here the presence of all three *Rimbachia* species from several localities with a high air humidity from the Alps (central Europe) growing on various mosses.

#### MATERIAL AND METHODS

The study is based on the examination of 17 collections. Fresh carpophores were in most cases documented with colour slides and morphological descriptions. For microscopic study the material was prepared with 5 % ammonia and Congo Red in 1% ammonia. Drawings were made with the aid of a drawing tube. Computations and illustrations of statistical analyses were performed with Microsoft-Excel 97. Mosses were identified using Frahm & Frey (1992) and Smith & Smith (1980).

#### RESULTS AND DISCUSSION

##### Key

1. hymenophore consisting of lamellae-like folds or veins, spores  $6-7 \times 5-6 \mu\text{m}$ , globose to subglobose, on pleurocarpous mosses ... *R. bryophila*
- 1\* hymenophore smooth, without any veins ... 2
2. spores  $4-5 (-6.5) \times 4-5 (-5.5) \mu\text{m}$ , globose to subglobose, on acrocarpous mosses ... *R. arachnoidea*
- 2\* spores  $7.5-11(-13) \times 5-7 \mu\text{m}$ , ellipsoid to lacrymoid, on pleurocarpous mosses ... *R. neckerae*

The main distinguishing features to separate the species within the genus *Rimbachia* are the development of the hymenophore (without any lamellae or with lamellae-like folds), and the spore size and shape respectively. Figure 1 illustrates the spore size and the spore shape of 15 collections examined. Clearly two groups can be separated: one group with small, subglobose spores and one with larger, more ellipsoid spores. The first one includes two species, *R. arachnoidea* with slightly smaller spores than *R. bryophila*. In addition *R. arachnoidea* shows a widely observed type of spore variation within fungi: longer spores are also broader, the mean values forming a rotation ellipsoid (linear regression,  $r^2 = 0.98$ , see Fig. 1). On the other hand the greater variability of the spore size of the larger-spored taxon (linear regression,  $r^2 = 0.3$ ) is more difficult to interpret. Is it due to phenotypic plasticity dependent on microclimatic conditions or is it due to a genetic variability? In the latter case even an additional species may be hidden.

##### Ecological remark

In most collections sporocarps are produced at the apex of the host moss. Under a binocular lens the mycelium of *Rimbachia bryophila* and *R. neckerae* can usually

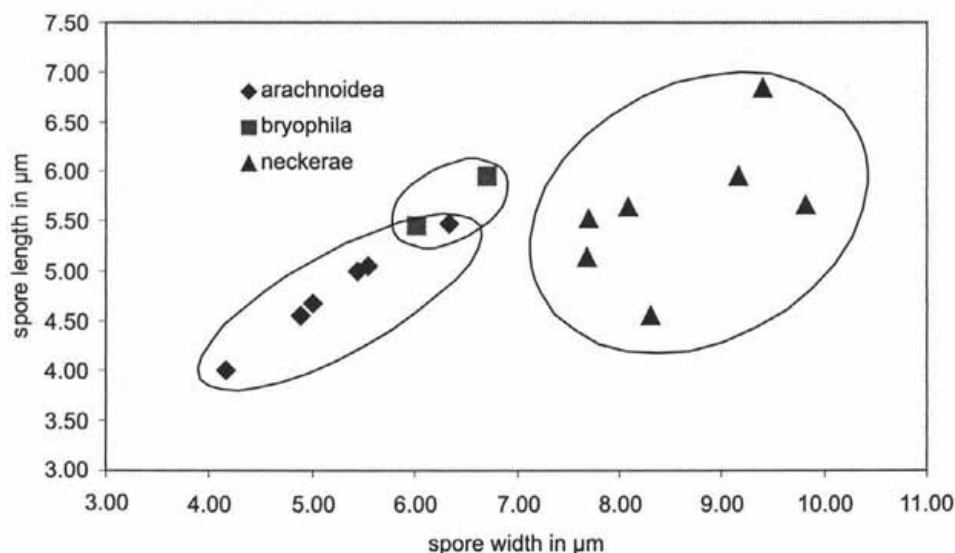


Fig. 1. Spores sizes (mean values) of *Rimbachia* collections from the Alps.

be traced back deep into the moss carpet. Attacked moss plants sometimes show yellowish colours, signs of a distinct parasitism by the fungus.

#### Notes on the species

##### *Rimbachia arachnoidea* (Peck) Redhead

Fig. 2

*Rimbachia arachnoidea* (Peck) Redhead in Can. J. Bot. 62: 878. 1984.

*Cyphella arachnoidea* Peck in Ann. Rep. N. Y. State Mus. 44: 134. 1891.

*Mniopetalum globisporum* Donk in Persoonia 2: 332. 1962.

Sporocarps 0.5–3 mm, cupulate, more rarely tubular, soon disciform with small involute margin, at first circular later often lobed and irregular in outline, not hygrophanous, pendant, centrally attached, in late stages at times confluent. Surface felted to silky, white. Hymenophore smooth or at times with some indistinct veins, white, soon cream. When dry firm and brittle, hymenophore pale buff.

Spores 4–5(–6.5) × 4–5(–5.5) μm (see Table 1), globose to subglobose, with truncate, sometimes elongate apiculus. Basidia 18–22 × 7–8.5 μm, (2–3)4-spored, cylindrical, clamped. Subhymenium ramose, dense, with hyphae 10–12 × 4.5–6 μm. Pileipellis a trichoderm, in young stages with long, slender hairs, with equally to

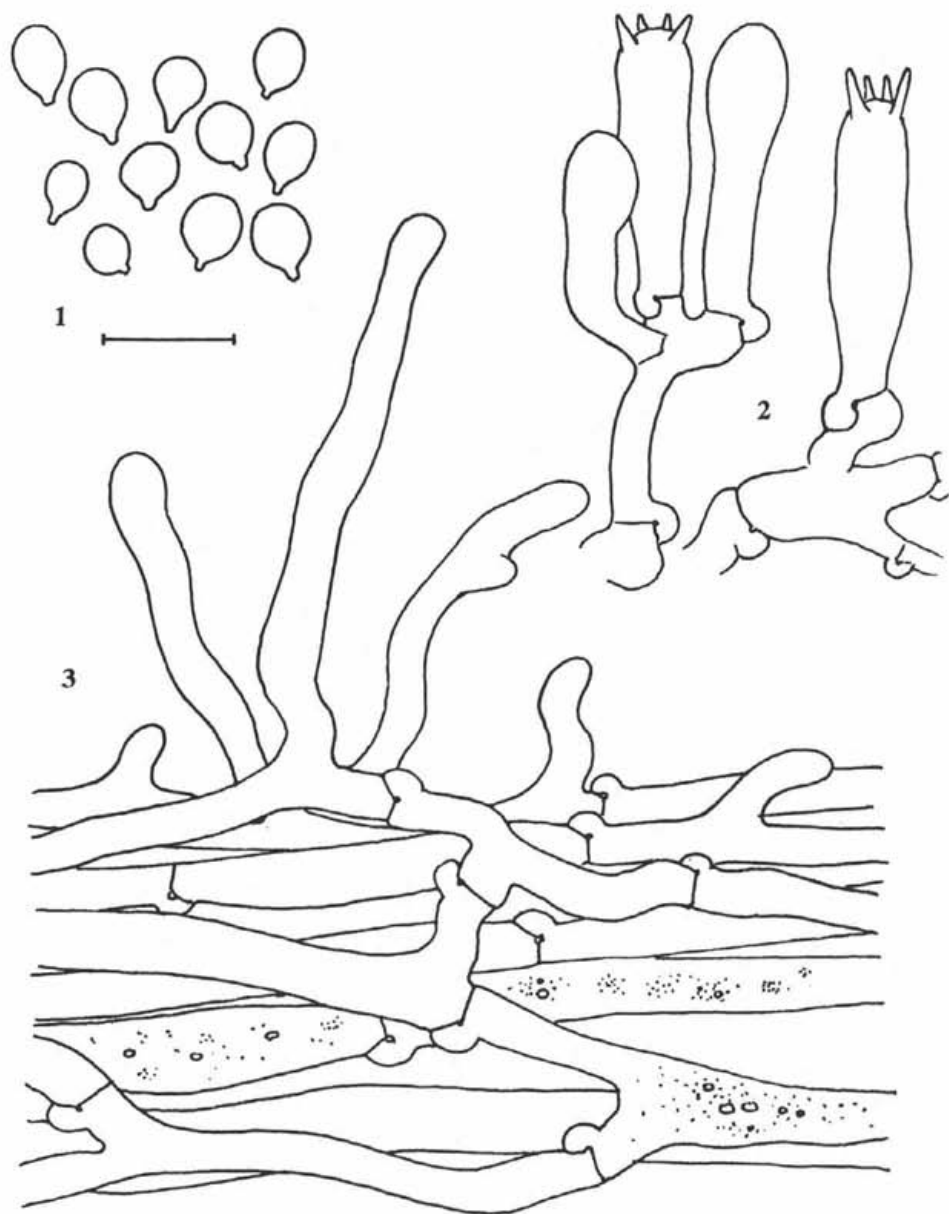


Fig. 2. *Rimbachia arachnoidea*: spores (1), basidia (2), and pileipellis from a young sporocarp (3).  
Bar = 10  $\mu$ m

slightly inflated apex, at times ramose,  $60\text{--}130 \times 3\text{--}4.5 \mu\text{m}$ ; often broken with age; repent superficial hyphae subparallel, hyaline,  $2.5\text{--}5 \mu\text{m}$  wide. Trama with  $3.5\text{--}6 \mu\text{m}$  wide hyphae, often inflated up to  $15 \mu\text{m}$  at ramifications, hyaline or with refringent content. Mycelium repent on moss leaves, similar to pileipellis, with  $3.5\text{--}6 \mu\text{m}$  hyphae with many free ends similar to the hair-like terminal cells of the pileipellis or shorter. Clamps present at all septae.

Habitat: Pure coniferous and mixed coniferous-deciduous woods, with predominantly herbaceous vegetation or forbs mixed with mosses in the lowest vegetation layer. From the lowlands to the subalpine zone.

Two collections on epiphytic mosses along a road verge.

A population may consist of 10 to over a hundred sporocarps on gametophytes of various acrocarpous mosses.

Collections studied: Germany: Mecklenburg-Vorpommern, Greifswald, Jarmshagen, 21 October 1996, leg. R. Doll (Herb. Doll), 10 November 1996, leg. R. Doll (Herb. Doll).

Switzerland: canton Bern, Wahlern, Dorfwald, 890 m, 12 October 1989, leg. B. Senn-Irlet (Herb. BSI 89/244); canton Fribourg, Charmey, Les Grottes, 980 m, 4 September 1994, leg. B. Senn-Irlet, (Herb. BSI 94/55); canton Jura, Vendincourt, 450 m, 11 October 1997, leg. B. Senn-Irlet (Herb. BSI 97/192); canton Schwyz, Muothatal, Bödmerenwald, 2 October 1991, leg. B. Senn-Irlet (Herb. BSI 91/160).

Recent descriptions and notes on its distribution are scarce. Kuyper in Bas et al. (1995) suggests primarily *Mnium* species as host plants for the Netherlands. In alpine regions the fungus seems to display a much broader host range. Yet, only acrocarpous mosses have been found attacked (Table 1).

Table 1. Spore sizes (mean values) of *Rimbachia arachnoidea*

Coll.	l	w	Q	N	Host plant
DollOct	4.16	4.01	1.04	14	<i>Mnium hornum</i>
DollNov	4.89	4.55	1.07	13	<i>Mnium hornum</i>
BSI91/160	5.00	4.68	1.07	8	<i>Mnium undulatum</i>
BSI89/244	5.45	5.00	1.09	13	<i>Polytrichum attenuatum</i>
BSI94/55	5.55	5.05	1.10	11	<i>Orthotrichum affine</i>
BSI97/192	6.34	5.48	1.16	12	<i>Tortula virescens</i>

l = length, w = width, Q = length/width ratio, N = number of measurements

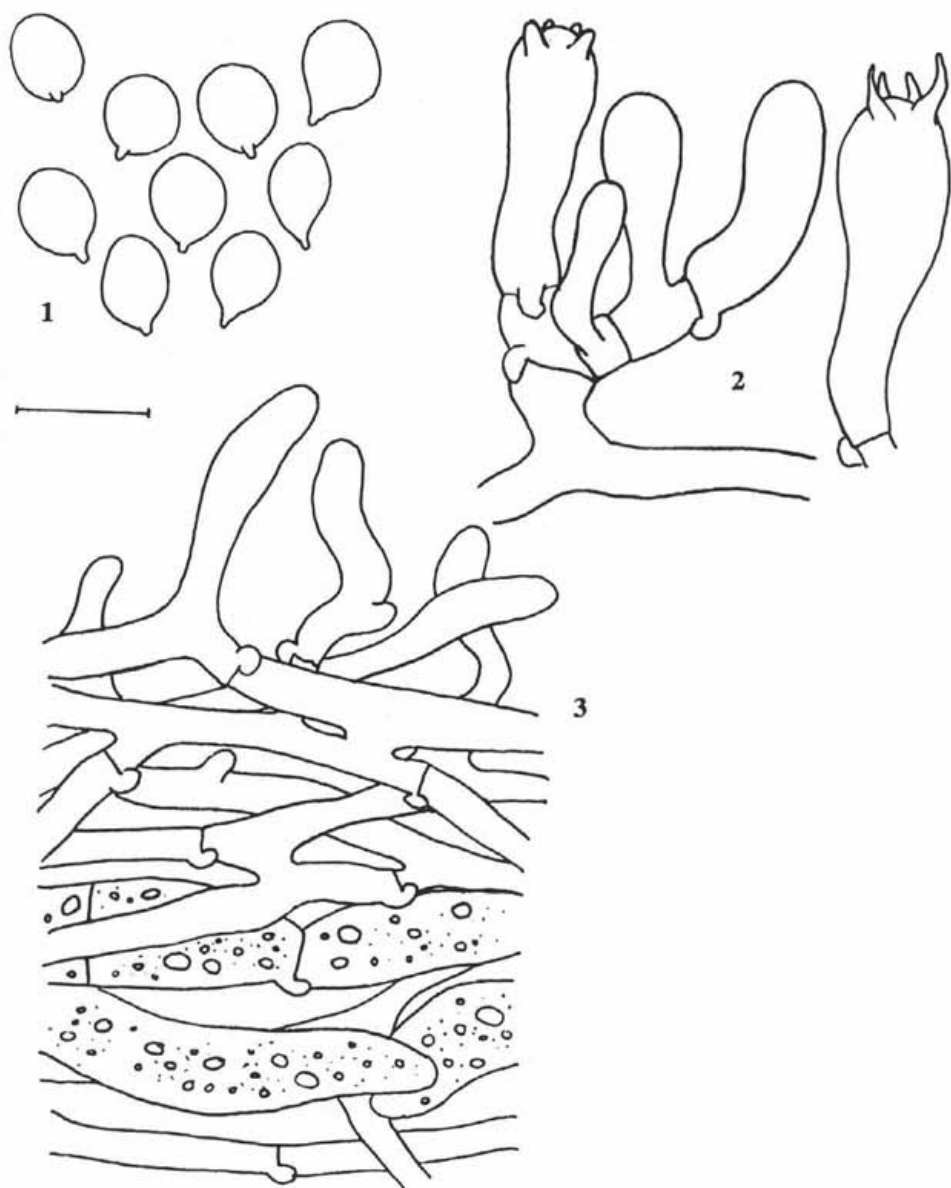


Fig. 3. *Rimbachia bryophila*: spores (1), basidia (2), and pileipellis (3). Bar = 10  $\mu$ m

**Rimbachia bryophila** (Pers.) Redhead

Fig. 3

*Rimbachia bryophila* (Pers.) Redhead in Can. J. Bot. 62: 878. 1984.*Agaricus bryophilus* Pers.: 8. 1796.*Mniopetalum bryophilum* (Pers.) Donk in Persoonia 2: 335. 1962.

Sporocarps up to 5 mm in diam., first cupulate-disciform then conchoid-flabelliform, milk white, with minutely pubescent upper surface; hymenium thinly wrinkled in youngest stage, then vein-like, even with distant lamellae-like folds, concolorous, apricot-cream when dry. Hymenophore facing downwards.

Spores  $6-7.5 \times 5-6 \mu\text{m}$  (see Table 2), with truncate apiculus up to  $2.5 \mu\text{m}$  long. Basidia  $20-25 \times 7-7.5 \mu\text{m}$ , 4-spored, clavate, clamped. Subhymenium  $10-15 \mu\text{m}$  thick, rather compact, pseudoparenchymatous. Pileipellis a trichoderm especially in young stages, built up of interwoven slender hyphae, with cylindrical to vermiform protruding hairs of  $30-40 \times 4-5.5 \mu\text{m}$ . Trama rather regular, with slender hyphae mixed with long and shorter hyphae of  $7-11 \mu\text{m}$  diam., with a diffuse, oily-like content. Thin-walled hyphae throughout. Clamps present at all septa. Pigment absent in all tissues.

Habitat: Pure coniferous and mixed coniferous-deciduous woods, with predominantly herbaceous vegetation and forbs mixed with mosses in the lowest vegetation layer; also on wet saxicolous mosses. From the montane to the subalpine zone. Rather humid to moist microsites.

Collections studied: Switzerland: Canton Bern, Wattenwil, Forst, 620 m, 27 August 1994, leg. B. Senn-Irlet (Herb. BSI 94/41). Canton Luzern, Flüehli, Beichlen, 1500 m, 16 October 1985, leg. B. Senn-Irlet (Herb. BSI 85/266). France: Department Vosges, Rothried, 28 September 1997, leg. G. Corriol (herb. GC 97092815).

Recent descriptions and notes on its distribution are scarce. Kuyper in Bas et al. (1995) suggests primarily *Mnium*-species as host plants, an observation not confirmed with our collections (see Table 2). Only pleurocarpous mosses were found by us as host plants in agreement with observations from Scandinavia by Høiland in Hansen et Knudsen (1992). In collection 85/266 sporocarps were also found attached to litter debris.

Table 2. Spore sizes (mean value) of *Rimbachia bryophila*

Coll.	l	w	Q	N	Host plant
BSI85/266	6.71	5.95	1.11	18	<i>Rhynchostegium confertum</i>
BSI94/41	6.02	5.44	1.13	18	<i>Rhynchostegium megapolitanum</i>

l = length, w = width, Q = length/width ratio, N = number of measurements

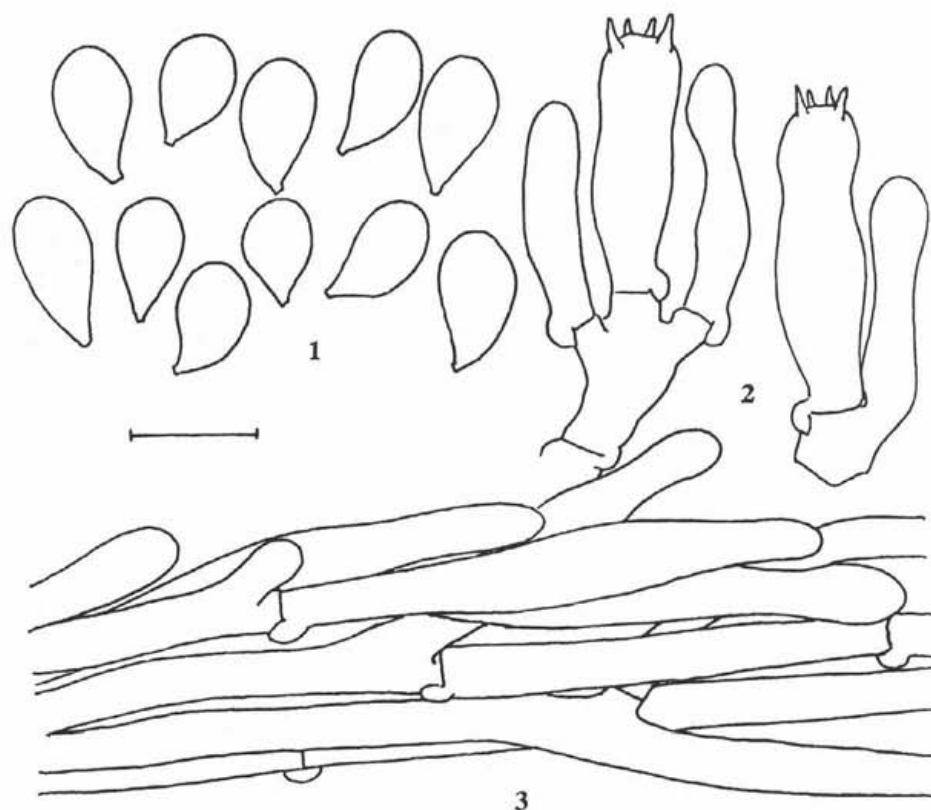


Fig. 4. *Rimbachia neckerae*: spores (1), basidia (2), and pileipellis from a young sporocarp (3). Bar = 10  $\mu$ m

*Rimbachia neckerae* (Fr.) Redhead

Figs. 4-5

*Cyphella muscicola* var. *neckerae* Fr.: 202. 1823.

*Cyphella neckerae* (Fr.) Fr.: 558. 1838.

*Leptoglossum candidum* Reid in Trans. Br. Mycol. Soc. 48: 514. 1965.

Sporocarps 1-3 mm, at first almost tubular, later cup- to helmet-shaped, circular or irregular in outline, thin-fleshed, not hygrophanous. Surface white, silky, felty under a hand lens, with even, later often undulate, involute margin. Hymenophore smooth, white, chalk-white, later cream-pale buff. Point of attachment dorsal, in young stages with short stipe, later sessile.

Spores 7.5-11 (-13)  $\times$  5-7  $\mu$ m (see Table 3), ellipsoid, hyaline, inamyloid, acyanophilous (however cytoplasm strongly blue in cotton blue), smooth, with





Fig. 5. *Rimbachia neckerae*: coll. PAM95082311, coloured picture (based on a scan).

Table 3. Spore size (mean values) of *Rimbachia neckerae*

Coll.	l	w	Q	N	Host plant
BSI92/52	7.70	5.52	1.50	20	<i>Ctenidium molluscum</i>
BSI00/14	9.40	6.85	1.39	20	<i>Ctenidium molluscum</i>
BSI01/72	8.30	4.60	1.43	24	<i>Pseudoleskea incurvata</i>
PAM95082311	9.17	5.95	1.82	6	<i>Hylocomium splendens</i> , <i>Scapania spec.</i>
PAM99042401	9.83	5.66	1.54	16	<i>Hylocomium splendens</i>
BSI97/127	8.08	5.63	1.37	12	<i>Hylocomium splendens</i>
BSI97/27	7.68	5.13	1.74	16	<i>Sharpiella seligeri</i>
PAM 01100301	8.80	5.78	1.67	16	<i>Ptilium crista-castrensis</i>

l = length, w = width, Q = length/width ratio, N = number of measurements

prominent apiculus, in one collection germinating spores with 1–2 germ tubes frequent.

Basidia 34–42 × 6–7.5 µm, 4-spored, cylindrical, clamped. Subhymenium shortly ramose, 10–12 µm thick. Pileipellis a loose cutis with ascending often interwoven hyphae with undifferentiated terminal cells. Pigment not observed. Clamps connections present in all tissues.

Habitat: Calciphilous deciduous wood dominated by beech and oak, green alder shrubs, alpine forb vegetation with larger pebbles or rocks covered with mosses; also on limestone cliffs and mossy rocks close to rivulets. From colline to alpine zones. Humid to wet microsites.

Collections studied: France: Department Savoie, La Motte-Servolex, 450 m, 24 April 1999, leg. P.-A. Moreau (Herb. PAM 99042401); id., 3 October 2001, leg. P.-A. Moreau (Herb. PAM 01100301); Crest-Voland, 1550 m, 23 August 1995, leg. P.-A. Moreau (Herb. PAM 95082311).

Italy: Province Alto-Adige, Pflerschthal, 1140 m, 10 September 1997, leg. B. Senn-Irlet (Herb. BSI 97/127).

Switzerland: Canton Bern, Brienz, Giessbachfälle, 800 m, 20 June 1992, leg. B. Senn-Irlet (Herb BSI 92/52); canton Neuchâtel, Les Brenets, along the Doubs river, 720 m, 20 May 2001, leg. B. Senn-Irlet (Herb BSI 01/14), canton Uri, Unterschächen, Steinboden, 1550 m, 5 August 1997, leg. B. Senn-Irlet (Herb. BSI 97/27); Spiringen, Kinzigpass, 2070 m, 19 August 2001, leg. B. Senn-Irlet & R. Mürner (Herb. BSI 01/72).

This species seems to have been overlooked in Central Europe or not correctly separated from *R. bryophila*. First record for Switzerland.

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