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## Re-evaluation of *Radulomyces rickii* and notes on *Radulomyces* and *Phlebiella* (Basidiomycota)

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**Abstract**—Three new collections of a corticioid fungus occurring on *Taxus* and *Juniperus* in NW Iran were compared with the type of *Radulomyces rickii*, and they appeared to be conspecific. SEM pictures of basidiospores were obtained from the type, Iranian material, and *R. confluens* and their spore measurements were compared. Both *R. confluens* and *R. rickii* have smooth and non-smooth basidiospores. An emended description of *R. rickii* is given and possible links between *Radulomyces* and *Phlebiella* with regard to their spore and basidium morphology and recent DNA studies is discussed.

**Key words**—Arasbaran forests, spore dimorphism, taxonomy

### Introduction

In a recent mycological survey in NW Iran by the senior author (MGH), three resupinate corticioid fungi were collected from conifers. Their outer appearance, roundish spores and the presence of hyphidia first reminded us of *Globulicium* Hjortstam. However, the rather thick-walled spores and the shape of apiculus are familiar to *Radulomyces* M.P. Christ. According to literature (Christiansen 1960, Jülich & Stalpers 1980, Boidin et al. 1988) *R. rickii* has subglobose spores, 7–9 × 6–8 µm, similar to those in Iranian collections (see Table 1). Some other characters, like smooth hymenium in *R. rickii* also seemed to fit with our material. However, controversy has existed whether *R. rickii* is a species of its own or an extreme variation of *R. confluens* (Fr.) M.P. Christ. with different spores and hymenial morphology (see Eriksson et al. 1981, Hjortstam & Ryvarden 1986). When Christiansen (1960) introduced the genus *Radulomyces*, he defined *R. rickii* to have separable basidiocarps with loosening margin, characters that were not seen in Iranian material. On the other hand,

Table 1. Basidiospore sizes in *Globulicium hiemale*, *Radulomyces confluens* and *R. rickii*.\*

SPECIES	L VARIATION (µm)	W VARIATION (µm)	L (µm)	W (µm)	Q	Q*
<b><i>Globulicium hiemale</i></b> (90/3)	<b>(10.0-)11.0-14.0(-15.5)</b>	<b>(9.0-)10.5-13.5(-15.5)</b>	<b>12.46</b>	<b>11.82</b>	<b>1.00-1.12(-1.17)</b>	<b>1.05</b>
Kotiranta 21410	(11.7-)12-14	11-13(-13.5)	12.64	11.97	1.00-1.09(-1.11)	1.06
Kotiranta 18841	(10.0-)10.7-14.0(-15.5)	(9.0-)10.5-13.0(-15.0)	12.51	11.95	1.00-1.12(-1.17)	1.05
Kotiranta 18807	(10.7-)11.0-13.5(14.0)	10.0-12.5(-14.0)	12.21	11.54	1.00-1.11(-1.15)	1.06
<b><i>Radulomyces confluens</i></b> (90/3)	<b>6.0-8.6(-9.9)</b>	<b>4.5-6.5(-7.0)</b>	<b>7.32</b>	<b>5.57</b>	<b>1.09-1.51(-1.76)</b>	<b>1.32</b>
Hallenberg 2010	(6.0-) 6.9-8.5(-9.9)	(4.5-) 5.0-6.5(-7.0)	7.78	5.76	1.14-1.65(-1.76)	1.36
Kotiranta 11760	6.0-8.0(-8.5)	4.8-6.1(-6.4)	7.15	5.53	1.09-1.45	1.30
Speirs SA 142	(6.0)6.4-8.0(-8.6)	4.7-6.0(-6.5)	7.02	5.43	1.16-1.40(-1.49)	1.30
<b><i>Radulomyces rickii</i></b> (150/5)	<b>(6.2-) 7.3-9.5 (-9.6)</b>	<b>(5.9-) 6.2-8.6 (-8.9)</b>	<b>7.88</b>	<b>7.18</b>	<b>0.9-1.24 (-1.29)</b>	<b>1.08</b>
TYPUS	(6.5-)7-8(-8.8)	(6.3-)6.6-8(-8.4)	7.5	7.2	1-1.1	1
F15109	(6.2-)6.7-8.1	(6.1-)6.4-7.2	7.1	6.7	0.9-1.1	1
Ghobad-Nejhad 472	(7.0-)7.4-9(-9.5)	6.0-8.1 (-8.9)	8.31	7.21	1.07-1.29	1.15
Ghobad-Nejhad 392	(7.3-)7.9-9.2(-9.6)	(6.2-)6.9-8.9	8.33	7.50	1.04-1.17 (-1.29)	1.11
Ghobad-Nejhad 397	(6.8-) 7.8-9.2 (-9.5)	(5.9-)6.5- 8.2 (-8.6)	8.15	7.30	(1.04-)1.07-1.17(-1.27)	1.12

\* The figure in brackets following each species name represents n (see Materials and methods); for single specimens n=30/1.

Table 2. Basidium sizes in *Globulicium hiemale*, *Radulomyces confluens*, and *R. rickii*.\*

SPECIES	L VARIATION ( $\mu\text{m}$ )	W VARIATION ( $\mu\text{m}$ )	L ( $\mu\text{m}$ )	W ( $\mu\text{m}$ )	Q*
<i>GLOBULICIUM HIEMALE</i> (30/3)	(30-)36-56	8-15	45.90	12.12	3.81
<i>RADULOMYCES CONFLUENS</i> (30/3)	22-38	5-9	31.40	6.98	4.55
<i>RADULOMYCES RICKII</i> (30/3)	(17-) 23-41	5.5-11	30.70	8.58	3.72

\*The figure in brackets following each species name represents n (see Materials and methods).

Boidin et al. (1988) reported finely spinulose spores in *R. rickii* when seen in SEM, accepting it as a good species, and Larsson et al. (2004) showed that *R. rickii* is distinct from *R. confluens* in a phylogenetic nrDNA tree. However, none of these observations included the study of type material. We examined the type of *R. rickii* (selected by Hjortstam & Ryvarden 1986) and additional material. The specimens from Iran are in accordance with the type, except that they are on decorticated coniferous wood rather than on corticated angiosperm like the type.

This study confirms that *R. rickii* can be separated microscopically from *R. confluens*, since there is a slight but significant difference in spore size and form (FIG 9, Table 1) and also a small difference in basidium size (Table 2). Both species bear ornamented spores, whereas the occurrence of both smooth and ornamented basidiospores in a single specimen has been neglected. The possible link between *Radulomyces* and certain species of *Phlebiella* P. Karst., previously shown by DNA studies (Larsson et al. 2004, Binder et al. 2005), is also discussed.

### Materials and methods

Specimens were studied in 5% potassium hydroxide (KOH), Melzer's reagent (IKI) and Cotton Blue (CB). Measurements and drawings were made in CB and KOH. Drawings were made by using a drawing tube.

Thirty spores per specimen were measured (n=number of spores measured from the given number of specimens, for instance 60/2 means that 60 spores were measured from two specimens). The following abbreviations are used: L=mean length, W=mean width, Q=range of variation in L:W ratio, Q\*=quotient of the mean spore length and mean spore width. The values L and W in Tables 1 and 2 represent at least 90% of the measurements. No measurements derive from spore prints.

SEM pictures were taken from herbarium material. Specimens were fixed in 3% Glutaraldehyde and  $\text{OsO}_4$ , and dehydrated with ascending series of Ethanol, followed by Critical point drying (Bal-Tec CPD 030) using  $\text{CO}_2$ . Dried specimens were coated with Platinum (Agar sputter device), and spores were photographed with Scanning electron microscope (Zeiss DSM 962).

### Redescription of *Radulomyces rickii*

*Radulomyces rickii* (Bres.) M.P. Christ. (1960),

Dansk Bot. Ark. 19(2): 128

FIGS 5, 8.

=*Cerocorticium rickii* (Bres.) Boidin, Gilles & Huguency (1988), Crypt. Mycol. 9(1): 45.

=*Corticium rickii* Bres. (1898), in Rick, Österr. Bot. Z. 48: 136.

Holotype: Austria, Feldkirch, ad truncos Sambuci nigrae, Oct 1897 J. Rick (F15108 in S) (studied).

**Basidiocarp** resupinate, orbicular, in patches, hard and ceraceous when dry, relatively thin, closely adnate, smooth, light cream-coloured with a tint of grey when young, later slightly brownish, at first turning reddish in IKI, but soon fading, turning yellow-brown in KOH; margin mostly distinct, pruinose, very fine fibrils rare (hand lens!).

**Hyphal system** monomitic, hyphae hyaline, clamped; subiculum thin, about 15–30  $\mu\text{m}$  thick, hyphae thin-walled, 3–3.5  $\mu\text{m}$  wide, gelatinized, difficult to see; subhymenial hyphae thin-walled, often inflated, slightly CB+, 2–3  $\mu\text{m}$  wide, densely intricate and very difficult to discern.

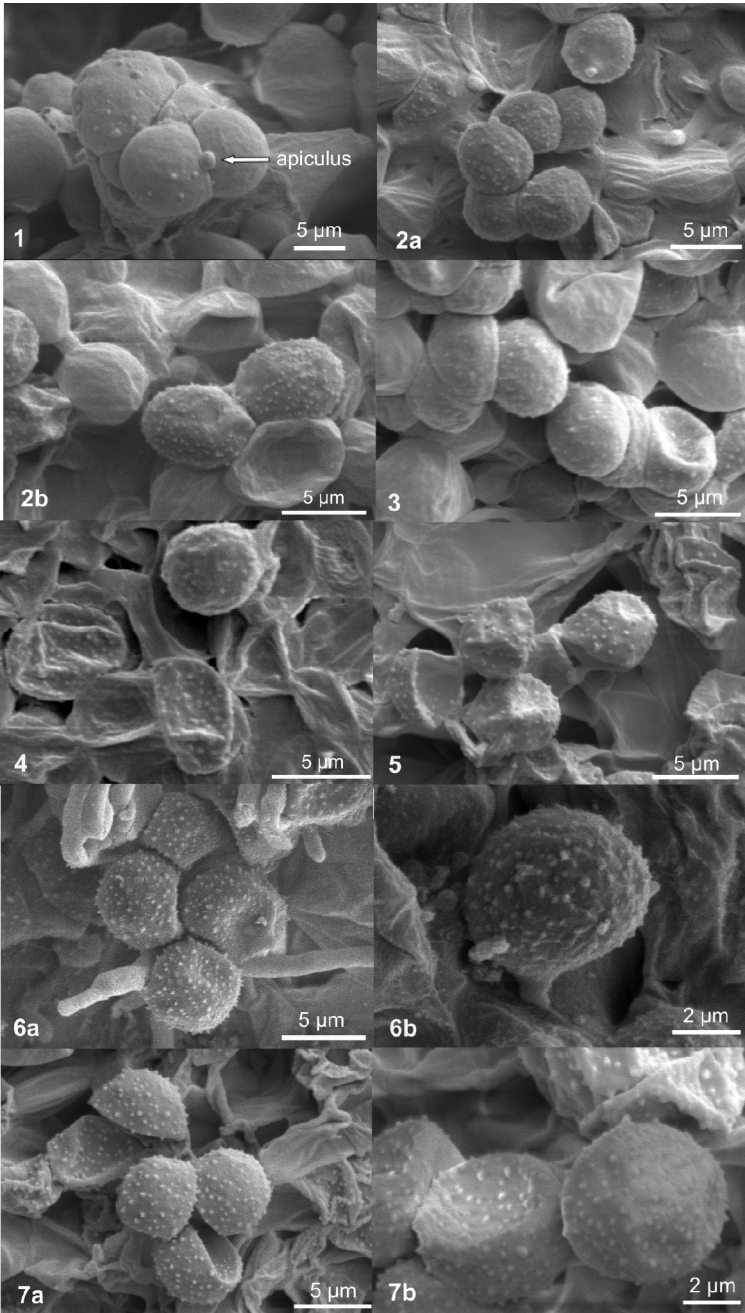
**Cystidia** absent.

**Hyphidia (paraphysoid hyphae)** sparse to fairly abundant, clamped, exceeding the hymenial surface, 20–60  $\times$  2–2.3  $\mu\text{m}$ , usually thin-walled, sometimes slightly thick-walled, often with protuberances and branches; apex obtuse, bluish in CB (contents); no crystals seen.

**Basidia** basally clamped, with numerous oil drops in plasma, at least at the beginning pleural, later clavate to cylindrical, sometimes slightly constricted, often stalked, (17–) 23–41  $\times$  5.5–11  $\mu\text{m}$ , L=30.7  $\mu\text{m}$ , W=8.6  $\mu\text{m}$ , (n=30/3), with four, at first rather prominent, later almost needle-like, only up to 5  $\mu\text{m}$  long sterigmata, which fade quickly after the sporulation.

**Basidiospores** globose or subglobose, with oil drops, smooth or minutely warted, warts seen especially in KOH, (6.5–)7–8(–8.8)  $\times$  (6.3–)6.6–8(–8.4)  $\mu\text{m}$ , L=7.5  $\mu\text{m}$ , W=7.2  $\mu\text{m}$ , Q=1–1.1, Q\*=1 (TYPE, F15108, S), (6.2–)6.7–8.1  $\times$  (6.1–) 6.4–7.2  $\mu\text{m}$ , L=7.1  $\mu\text{m}$ , W=6.7  $\mu\text{m}$ , Q=0.9–1.1, Q\*=1 (F15109, S), thin- to slightly thick-walled, CB+, IKI-, KOH-, with a sharp apiculus and sometimes with a pointed lateral germ pore (biapiculate!).

Figs 1–7. SEM pictures of basidiospores. Fig. 1. *Globulicium hiemale* (Kotiranta 21410). Figs 2a–b. *Radulomyces confluens* (Hallenberg 2010). Fig. 3. *R. confluens* (Kotiranta 11760). Fig. 4. *R. confluens* (Speirs SA 142). Fig. 5. *Radulomyces rickii* (type). Figs 6a–b. *R. rickii* (Ghobad-Nejhad 472). Figs 7a–b. *R. rickii* (F15109).



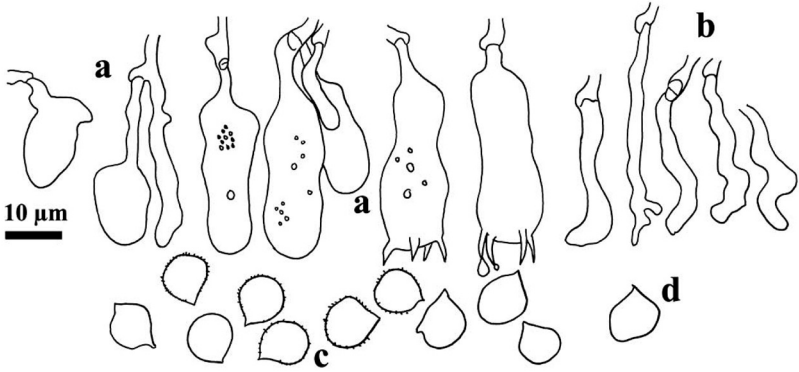


Fig. 8. *Radulomyces rickii* (type, F15108, S).  
a) Basidia at different stages of development, b) hyphidia,  
c) basidiospores, d) characteristically collapsed basidiospore.

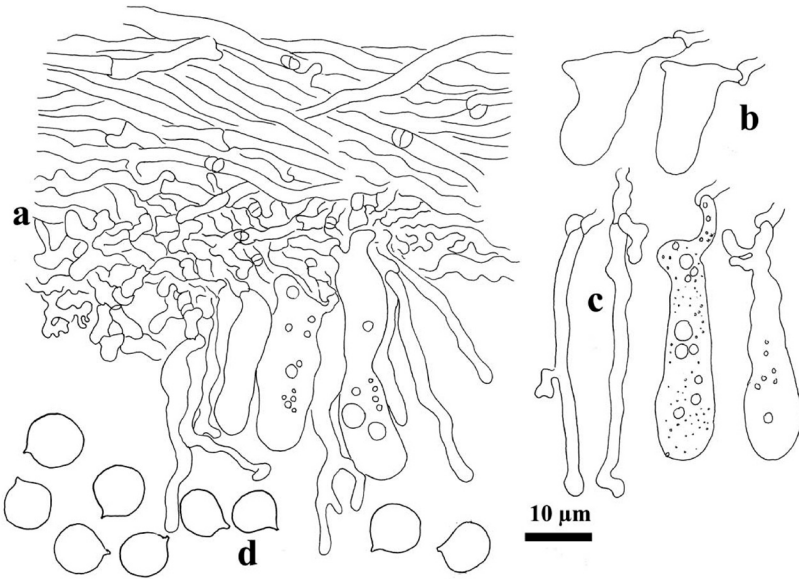


Fig. 9. *Radulomyces rickii*, Ghobad-Nejhad 472.  
a) Section through basidiocarp, b) basidia, c) hyphidia, d) basidiospores.

**Ecology and distribution**—*R. rickii* grows on corticated or decorticated wood of both gymnosperms and angiosperms and is widely distributed but everywhere relatively rare. Bourdot & Galzin (1928) mention it from France from *Buxus*, *Clematis*, *Prunus* and *Calluna* and Boidin et al. (1988) add *Arbutus unedo*, *Atriplex halimus*, *Hortensia*, *Magnolia*, *Philadelphus*, *Physocarpus opulifolius* and *Sambucus nigra*. Christiansen (1960) reports it on *Pinus* in Denmark, Gorjón et al (2006) on *Arbutus unedo* in Italy, Schultheis & Tholl (2003) from Luxembourg, Cunningham (1963) on *Podocarpus totara* (gymnosperm), and *Coprosma grandifolia*, *Coriaria sarmentosa*, *Hakea saligna*, *Nothofagus fusca* (angiosperms) from New Zealand; and from Australia on *Acacia* and *Eucalyptus*, and Malençon (1952) on *Juniperus thurifera* in Morocco. In the United Kingdom it is known from different hardwoods as well as *Taxus* (Legon et al. 2005), and according to Hjortstam & Ryvarden (2007) *R. rickii* is known from Argentina, Brazil and Colombia as well.

All three Iranian specimens were collected in rather dry mixed deciduous forests in Arasbaran area, East Azerbaijan province in NW Iran, in forests dominated by *Acer* spp., *Carpinus betulus*, *Cornus mas*, *Lonicera* spp., and *Quercus* spp., at 1200–1350 m above sea level. The specimens were found on decorticated, dead but still hard, standing stumps of *Juniperus communis* and on an attached root of *Taxus baccata*. Herbarium material of *R. confluens* should be restudied before the comprehensive distribution area and the habitat preferences of *R. rickii* are clear.

### Additional notes

The microstructure of *R. rickii* (FIG 9) shows densely intricate hyphae that are very difficult to discern, resembling the same structure seen in *Phlebiella*. Even in outer appearance, *R. rickii* (particularly when growing on decorticated coniferous wood like the Iranian specimens) greatly resembles *Aphanobasidium pseudotsugae* (Burt) Boidin & Gilles (= *Phlebiella pseudotsugae* (Burt) K.H. Larss. & Hjortstam).

Moreover, Boidin & Gilles (1989) mention very similar traits for *Aphanobasidium* aff. *canariense* (Manjón & G. Moreno) Boidin & H. Michel (= *A.* aff. *sphaerosporum* Boidin & Gilles) from Reunion — so similar that we first thought our specimens represented *Phlebiella*. Because microscopical similarities undoubtedly occur, we also studied some species of *Phlebiella* s.l.

The genus *Phlebiella* is characterized by pleural basidia and all the species are without cystidia. Otherwise it is morphologically very variable, including species with basidiospores ranging from allantoid to globose, warted to smooth, and amyloid to inamyloid. Therefore it is not surprising that *Phlebiella* has been divided into several genera or subgenera. The concept of Oberwinkler's (1965) genus *Xenasmateella* (separated into subg. *Xenasmateella*

and subg. *Amyloenasma* Oberw.) is approximately the same as *Phlebiella*, used by Hjortstam et al. (1988). Jülich (1979) separated the genus *Aphanobasidium* for amyloid or inamyloid, smooth-spored species. *Aphanobasidium* was accepted by Boidin & Gilles (1989) but divided in subg. *Aphanobasidium* for non-amyloid species and subg. *Amyloenasma* for amyloid ones. Hjortstam & Larsson (1987) kept *Phlebiella* in a wide sense, dividing it into three subgenera, viz. subg. *Aphanobasidium*, subg. *Amyloenasma*, and subg. *Phlebiella* with the same delimitation of taxa as suggested by Boidin & Gilles (1989). Subg. *Amyloenasma* was later raised to generic level (Hjortstam & Ryvarden 2005). All the above cited classifications reserve *Phlebiella* s. str. for species with soft, fibrillose basidiocarps and ornamented spores.

As had Larsson et al. (2004), Binder et al. (2005) observed that *Radulomyces* and *Phlebiella* are nested together but questioned this grouping since “other than their corticioid habit, there are no obvious characters that suggest a close relationship among *Radulomyces*, *Phlebiella* ...”. Larsson later (2007) hypothesized a connection between *Aphanobasidium* and *Radulomyces* based on their affinity to pterulaceous fungi cultivated by ants. Moreover, as illustrated by Oberwinkler (1965: plate 12), young basidia of *R. confluens* can be pleural and there are also a few hyphidia. Except for the small and needle-like sterigmata, in neither *R. confluens* nor *R. rickii* (FIGS 8–9) do fully grown basidia resemble those of *Phlebiella*. Oberwinkler (1965) introduced the term “podobasidia” for pleural basidia that take a clavate form when mature.

**Spore dimorphism** — FIGS 1-7 illustrate the occurrence of both smooth and non-smooth spores in a single specimen in *Globulicium hiemale* (Laurila) Hjortstam (FIG 1), *Radulomyces confluens* (FIGS 2-4), and *R. rickii* (FIGS 5-7). Such spore dimorphism might have arisen from different stages of spore development. We also examined *Radulomyces molaris* (Chaillat ex Fr.) M.P. Christ. and selected specimens of smooth-spored *Phlebiella* s.l. species (see specimens examined). We could see smooth and non-smooth spores in all of them using  $\times 2000$  magnification in phase contrast microscope, or  $\times 1000$  light microscope with careful observation.

Not much can be said about the indication of the granulate spores in *Globulicium hiemale* (FIG 1). *Corticium hiemale* Laurila has been transferred to several genera including *Aleurodiscus* J. Schröt., *Cerocorticium* Henn. and *Radulomyces*. However, recent phylogenetic studies (Larsson et al. 2006, Larsson 2007) reveal that *G. hiemale* nests neither in *Radulomyces* nor *Aleurodiscus*, but falls rather in a subclade of the *Rickenella* clade within *Hymenochaetales*.

In the type material of *R. rickii* relatively many spores are biapiculate (see FIG 8). We do not know whether this is normal (not seen in the Iranian material) or only some kind of anomaly. Boidin et al. (2004) described *Aphanobasidium*



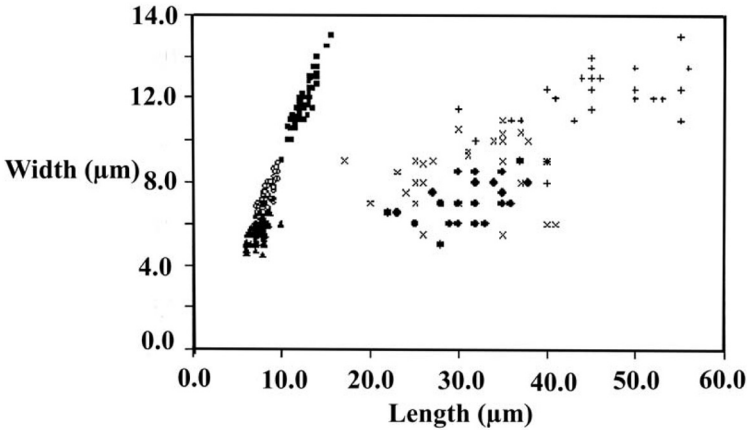


Fig. 10. Spore and basidium sizes of *Globulicium hiemale*, *Radulomyces confluens* and *Radulomyces rickii*. Each symbol represents a single spore (left) or basidium (right). Spore symbols: *G. hiemale* (■), *R. confluens* (▲), *R. rickii* (△). Basidium symbols: *G. hiemale* (+), *R. rickii* (×), *R. confluens* (●).

*biapiculatum* Boidin & Gilles when they encountered such spores in specimens from Réunion

The morphological links between *Radulomyces* and *Aphanobasidium* (*Phlebiella*) can be found in spore ornamentation, pleural basidia, at least when young, small sterigmata and intricate hyphal structure.

**SPECIMENS EXAMINED**—*Amyloxyasma grisellum*. **Finland**. Uusimaa: Helsinki, decorticated fallen log of *Populus tremula* or *Salix caprea*, 03.V.1992 Saarenoksa 00792 (H).

*Aphanobasidium pseudotsugae*. **Finland**. Uusimaa: Tammisaari, Gullö, Edesbacka, poor *Pinus sylvestris* dominated bog, on small corticated *Pinus*, 27.IX.2001 Kotiranta 18886 & Saarenoksa (H.K.), and Kotiranta 18880 & Saarenoksa (H); Uusimaa: Inkoo, on conifer timber, 25.V.1989 Kotiranta 7321 (H). **Russia**. Sverdlovsk region, on corticated *Picea*, N61°29': E59°38', alt. 490m, 12.VIII.2005 Kotiranta 20914 (H).

*Globulicium hiemale*. **Finland**. Etelä-Häme: Padasjoki, Vesijako Strict Nat. Res., *Picea* twig at 1.8m high, 13.IX.2001 Kotiranta 18807 (H); Varsinais-Suomi: Tammisaari, Tenhola, Lökudden Nat. Res., decorticated *Thuja* branch, 11.X.2006 Kotiranta 21410 & Saarenoksa (H); Uusimaa: Tammisaari, Gullö, Edesbacka, dead *Picea abies* branches at 1.8 m height, 27.IX.2001 Kotiranta 18841 & Saarenoksa (H).

*Radulomyces confluens*. **Iran**. Golestan: Golestan National Park, fallen log of *Quercus*, 26.IV.–8.V.1978 Hallenberg 2010 (GB). **Russia**. Sverdlovsk obl., Ekaterinburg, Biol. Sta., dead *Prunus* in thicket, 16.IX.1994, Kotiranta 11760 (H). **Canada**. Ontario, Ottawa, Falowfield, *Acer saccharum*, 5.X.1954 Speirs SA 142 (H).

*Radulomyces molaris*. **England**. Richmond, fallen branch of *Quercus robur*, 13.IX.1992 Niemelä 5599 (H). **Iran**. East Azerbaijan: Jolfa, Missan village, fallen branch of *Acer monspessulanum*, N38°86': E46°44', alt. 820m, 29.IX.2006 Ghobad-Nejhad 302 and Vaighan village Ghobad-Nejhad 404 (H, MGH ref. herb). **Yugoslavia**. Zagreb, Žumberačko, on *Quercus cerris*, 7.VII.1974 M. & S. Tortić 37-74 (H).

*Radulomyces rickii* (see type) and **Austria**. Feldkirch, ad corticem Sambuci nigrae, Nov. 1897 J. Rick (F15109 in S), and ad ramos Pruni spinosae, (F15110 in S). **Iran**. East Azerbaijan: W Kaleibar, 15 km from Asheqloo, Vaighan village, dead attached root of *Juniperus communis*, N38°52'40": E 46°49'30" alt. 1350m, 2.X.2006 Ghobad-Nejhad 392 and 397 & Sohrabi (H, MGH ref. herb.); Kaleibar, 4 km from the road of Khodafarin to Jolfa, Kalale village, N38°56'12": E46°45'52", alt. 1200 m, dead standing stump of *Taxus baccata*, 6.X.2006 Ghobad-Nejhad 472 & Sohrabi (H, MGH ref. herb).

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Nils Hallenberg and Karl-Henrik Larsson (both from Gothenburg) reviewed the manuscript and are warmly thanked. K-H Larsson is also appreciated for drawing our attention towards *R. rickii* and its type in S. The curator of herbarium S kindly provided us with loans. A research grant from Societas pro Fauna et Flora Fennica to MGH is acknowledged and the Ministry of the Environment (Finland) is thanked for a research grant (YM 132/5512/2005) to the co-author.

### Literature cited

- Binder M, Hibbett DS, Larsson K-H, Larsson E, Langer E, Langer G. 2005. The phylogenetic distribution of resupinate forms across the major clades of mushroom-forming fungi (*Homobasidiomycetes*). *Syst. Biodivers.* 3: 113–157.
- Boidin J, Gilles G, Huguency R. 1988. Réhabilitation du *Corticium rickii* Bres. (*Basidiomycotina*). *Crypt. Mycol.* 9(1): 43–46.
- Boidin J, Gilles G. 1989. Les Corticiés Pleurobasidiés (*Basidiomycotina*) en France. *Crypt. Bot.* 1: 70–79.
- Boidin J, Gilles G, Gerard M. 2004. Contribution à la connaissance des espèces d'*Aphanobasidium* Jülich subgenus *Aphanobasidium* (*Basidiomycètes, Aphyllophorales*). *Crypt. Mycol.* 25: 29–41.
- Bourdot H, Galzin A. 1928. Hyménomycètes de France 1. Hétérobasidiés-Homobasidiés Gymnocarpes. Marcel Bry, Sceaux.
- Cunningham GH. 1963. The *Thelephoraceae* of Australia and New Zealand. New Zealand Dep. Sci. Ind. Res., Bull. 145. 359 pp.
- Christiansen MP. 1960. Danish resupinate fungi. II. *Homobasidiomycetes*. *Dansk Bot. Ark.* 19(2): 57–388.
- Eriksson J, Hjortstam K, Ryvarden L. 1981. The *Corticaceae* of North Europe. Vol.6. *Phlebia-Sarcodontia*. Fungiflora, Oslo.
- Gorjón SP, Bernicchia A, Gibertoni TB. 2006. Aphyllophoraceous wood-inhabiting fungi on *Arbutus unedo* in Italy. *Mycotaxon* 98: 159–162.
- Hjortstam K, Larsson K-H. 1987. Additions to *Phlebiella* (*Corticaceae, Basidiomycetes*), with notes on *Xenasma* and *Sistotrema*. *Mycotaxon* 29: 315–319.
- Hjortstam K, Larsson K-H, Ryvarden L, Eriksson J. 1988. The *Corticaceae* of North Europe. Vol. 8. *Phlebiella, Thanatephorus-Ypsilonidium*. Fungiflora, Oslo.

- Hjortstam K, Ryvarden L. 1986. Some new and noteworthy fungi (*Aphylophorales*, *Basidiomycetes*) from Iguazu, Argentina. *Mycotaxon* 25: 539–567.
- Hjortstam K, Ryvarden L. 2005. New taxa and new combinations in tropical corticioid fungi (*Basidiomycetes*, *Aphylophorales*). *Synopsis Fungorum* 20: 33–41. Fungiflora, Oslo.
- Hjortstam K, Ryvarden L. 2007. Checklist of corticioid fungi (*Basidiomycotina*) from the tropics, subtropics and the southern hemisphere. *Synopsis Fungorum* 22: 27–146. Fungiflora, Oslo.
- Jülich W. 1979. Studies in resupinate *Basidiomycetes* VI. *Persoonia* 10: 325–336.
- Jülich W, Stalpers JA. 1980. The resupinate non-poroid *Aphylophorales* of the temperate northern hemisphere. *Verh. Konink. Ned. Akad. Wetensch., Afd. Naturkunde, Tweede Reeks* 74. 335 PP.
- Larsson K-H. 2007. Re-thinking the classification of corticioid fungi. *Myc. Res.*, in press.
- Larsson K-H, Larsson E, Køljalg U. 2004. High phylogenetic diversity among corticioid homobasidiomycetes. *Mycol. Res.* 108: 983–1002.
- Larsson K-H, Parmasto E, Fischer M, Langer E, Nakasone KK, Redhead SA. 2006. *Hymenochaetales*: a molecular phylogeny for the hymenochaetoid clade. *Mycologia* 98: 926–936.
- Legon NW, Henrici A, Roberts PJ, Spooner BM, Watling R. 2005. Checklist of the British and Irish Basidiomycota. Royal Botanic Gardens, Kew, UK.
- Malençon G. 1952. Prodrome d'une flore mycologique du Moyen-Atlas. 1ère contribution. *Bull. Soc. Mycol. France* 68: 297–326.
- Oberwinkler F. 1965. Primitive Basidiomyceten. Revision einiger Formenkreise von Basidienpilzen mit plastischer Basidie. *Sydowia, Ann. Mycol. Ser.* 2, 19: 1–72.
- Pennycook SR, Galloway DJ. 2004. Checklist of New Zealand fungi. *Fungi of New Zealand. Nga Harore o Aotearoa* 1: 401–488. Fungal Diversity Press. Hong Kong.
- Schultheis B, Tholl MT. 2003. Journées luxembourgeoises de mycologie vernale 2001. *Bull. Soc. Nat. Luxemb.* 104: 21–39.

