

Physisporinus rivulosus, an interesting polypore species

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The polypore *Physisporinus rivulosus* (Berk. & Curt.) Ryv. is reported as new to Finland. It is better known as *Poria albipellucida* Baxter and widely distributed in North America. The Finnish specimen is from *Pinus sylvestris* L. Though *P. rivulosus* is the only known species of *Physisporinus* Karst. with clamp connections, it otherwise fits well with that genus. The macroscopical and microscopical characteristics of *P. rivulosus* are described and illustrated, and the taxonomy is briefly discussed.

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Introduction

Physisporinus rivulosus is widely distributed in North and Central America (Lowe 1966), but records from other parts of the world are few. In external appearance it greatly resembles *Skeletocutis subincarnata* (Peck) Keller and was provisionally determined as that species in the field. However, microscopically it proved to be a monomitic, clamped species with subglobose spores and without the rose-thorn-shaped crystals characteristic of the genus *Skeletocutis* Kotl. & Pouz. (Keller 1979, David 1982, Kotiranta 1984).

Jülich (1984), Ryvarden (1976, 1978) and Ryvarden & Johansen (1980) do not mention any taxon with this combination of characters, but Lowe's (1966) drawings and description of *Poria rivulosa* (Berk. & Curt.) Cooke showed many similarities to my specimen, and David's (1972) paper finally confirmed the identity of the species.

***Physisporinus rivulosus* (Berk. & Curt.) Ryvarden, Mycotaxon 20: 353. 1984.**

Polyporus rivulosus (Berk. & Curt., J. Linn. Soc. 10: 318. 1868. Typus: Cuba, Monte Verde, on dead *Polypori*, C. Wright 154 (S, 'Type', evidently isotype; examined). — *Poria rivulosa* (Berk. & Curt.) Cooke, Grevillea 14: 109. 1886. — *Rigidoporus rivulosus* (Berk. & Curt.) David, Bull. Soc. Mycol. France 87: 418. 1972, nom. inval. (Art. 33).

Poria albipellucida Baxter, Mich. Acad. Sci. Arts Lett. Papers 23: 291. 1938. Typus: Canada, British Columbia, Vancouver, on *Thuja plicata*, D.V. Baxter 23.VIII.1935 (MICH, holotype); examined.

Fruit body annual, resupinate, 13 × 5 cm, composed of small roundish pieces which grow together, pure white when fresh, light cream or ochre with a few dark brown flecks when dry, in part contracting, sterile margin narrow (less than 1 mm), white also in dry condition. Subiculum resinous, hard, tubes brittle when dry.

Pores roundish to angular, thin-walled, 4–6 (–7) per mm. Tubes up to 1.3 mm long, subiculum up to 0.2 mm thick, in part almost lacking.

Hyphal system monomitic. Subicular hyphae parallel to each other and to the substrate, near pore bottom tightly intertwined, branched, clamped, 2–5 μm wide, fairly thick-walled. In sterile margin 2–3.5 μm wide, thin-walled, very often simple-septate and with crystals. Contents mainly staining CB+ (for the reactions see Niemelä 1985). Young subiculum with big crystalline clusters. Tramal hyphae 1.5–2.5 (–3) μm wide, richly branched, intertwined, not very thin-walled. On some hyphae in upper tube almost invisible resinous 'fur'. This resinous matter (in type, S) gives the old tubes a hard consistency and brown colour. In dissepiment edge the hyphae more parallel, slightly wider (3 μm), thin-walled, with or without crystals. Subicular and tramal hyphae CRB lilac. Hymenium composed of clavate, sometimes slightly constricted basidia (15–24 × 6–7 μm) with four thin sterigmata (3–4 μm long) and of very numerous bottle-shaped, thin-walled cystidioles (14–25 × 3.5–6 μm) with narrow apical tips. Both basidia and cystidioles basally clamped and filled with clearly visible, variable, refractive droplets. The contents of basidia and cystidioles CB+. Spores subglobose, hyaline, (4–) 4.5–5 (–5.1) × (3.5–) 3.8–4 (–4.8) μm, with one prominent droplet, thin-walled, IKI–, CB–(contents blue).

Specimens examined

Canada. British Columbia: Vancouver, *Tsuga heterophylla*, 13.IX.1933 Baxter (MICH); *Thuja plicata*, 23.VIII.1935 Baxter (MICH, holotype of *Poria albipellucida*); *T. heterophylla*, 13.IX.1935 Baxter (MICH); Vancouver, Stanley park, on much rotted coniferous log, 8.III.1932 Mounce (MICH). Cuba. See type of *Polyporus rivulosus*.

Finland. Pohjois-Häme: Saarijärvi, Pyhä-Häkki National Park, corticated, strongly decayed *Pinus sylvestris* on ground in dry pine — *Calluna vulgaris* heath, Grid 27° E 697:42;

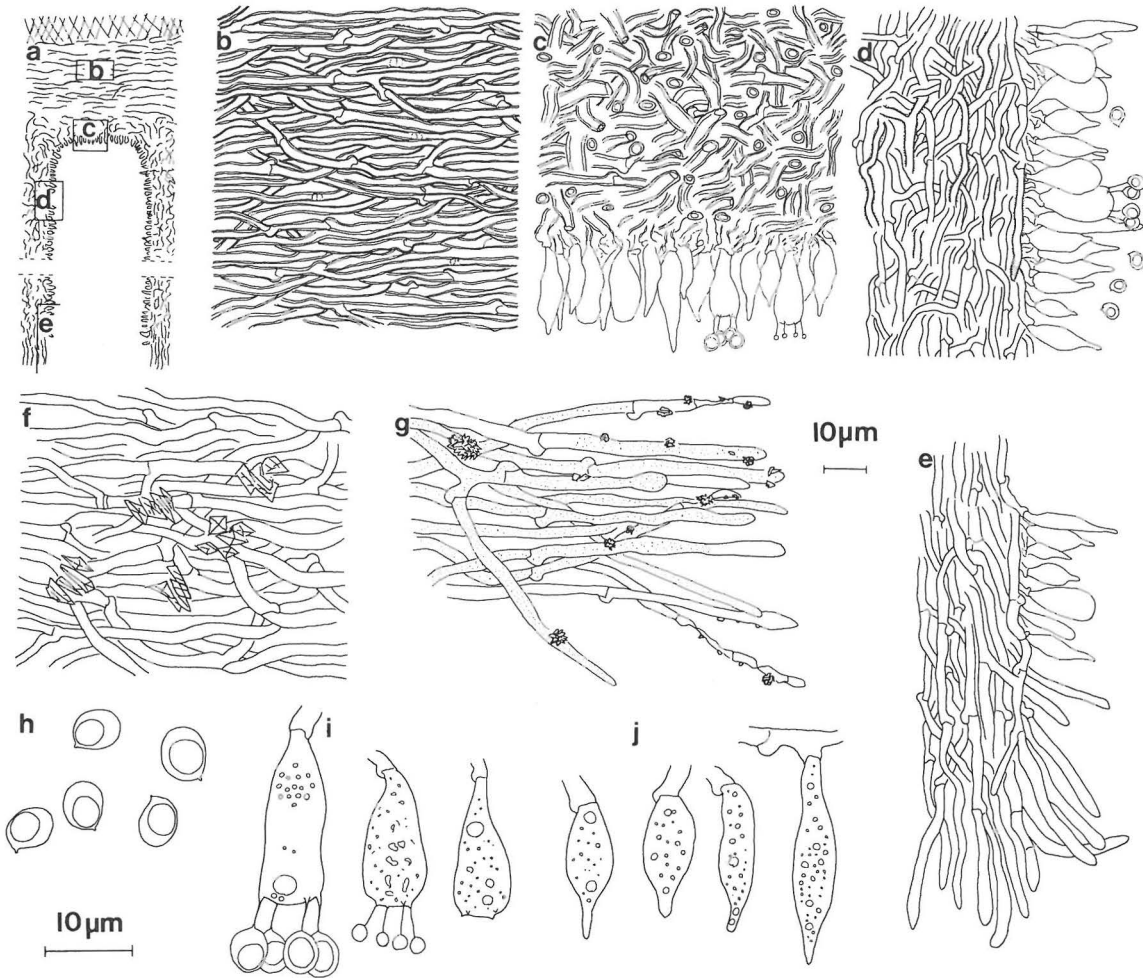


Fig. 1. *Physisporinus rivulosus*. a) section through fruit body, b) subiculum, c) tube bottom, d) upper tube, e) young dissepiment edge, f) young subiculum with crystals, g) sterile margin, h) spores, i) basidia, j) cystidioles (Kotiranta 5420).

4.IX.1984 Kotiranta 5420 (H, Hb. Kotiranta). U.S.A. California: Prairie Creek Park, charred *Sequoia sempervirens*, 28.XI.1937 Baxter (MICH); Trinidad, burned *S. sempervirens*, 3.XII.1956 Smith 56250 (MICH), burned *S. sempervirens*, 6.XII.1956 Smith 56396 (MICH). Idaho: Deception Creek, Coeur d'Alene National Forest, conifer, 900 m, 18.IX.1956 Lowe 6987 & Gilbertson (MICH); Priest River, *Pinus monticola*, IX.1915 Weir (MICH); Washington: Clallam Co., Hot Springs, Olympic National Park, *T. heterophylla* 12.IX.1936 Baxter (MICH, paratype of *Poria albipellucida*); Olympic Peninsula, Queets River, on charred conifer, 90 m, 3.IX.1957 Lowe 8136, Gilbertson & Griffin (MICH); Verlot, *T. heterophylla*, 5.X.1937 Englerth (MICH).

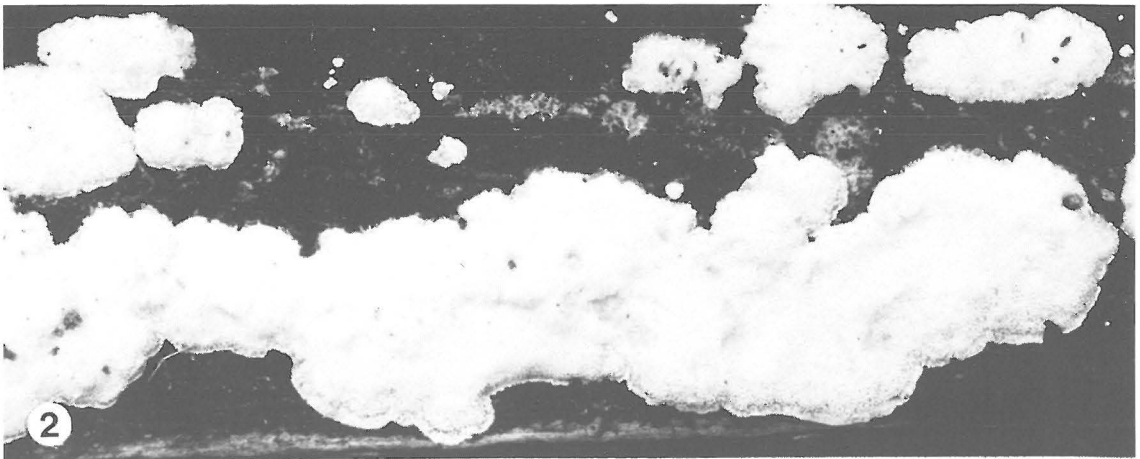
[Addendum: Finland. Uusimaa: Helsinki, Vanhakaupunki, Annala, on thick, decorticated, strongly decayed trunk of *Pinus sylvestris*, beside a camp fire place, Grid 27° E 6679:387, 11.IX.1985 Saarenoksa 39585, 6.X.1985 Saarenoksa 51485 (H, Hb. Kotiranta, Hb. Niemelä). — This is the second find of *P. rivulosus* in Finland. It was collected

after this paper already was in press and is therefore not treated in detail. It is macroscopically as well as microscopically very similar to my specimen. However, there are some differences in the abundance of clamps. The clamps are few, especially in the trama, and the hyphae are mostly simple-septate, thus resembling those seen in other species of *Physisporinus*. I am grateful to Mr Reima Saarenoksa, who gave these new collections at my disposal.]

Distribution and ecology

P. rivulosus is already known from Cuba (Berkeley & Curtis 1868), Canada (Buckland 1946), the United States (Baxter 1938, Cooke 1942, Lowe 1966) and France (David 1972). The first record in Fennoscandia is from Central Finland, northern Lake District (see Niemelä 1982).

Finland lies almost wholly in the Boreal zone (Hämet-Ahti 1981) and the new locality in the Pyhä-Häkki National Park is situated in the transitional



Figs. 2—3. *Physisporinus rivulosus*. Note the pure white, narrow, sterile margin, and partly contracting hymenophore. — 2: Fresh specimen (Saarenoksa 39585, $\times 1.5$). — 3: Dried specimen (Kotiranta 5420, $\times 3$).

area between the Southern and Middle boreal subzones (for these subzones see the map in Niemelä 1982). The forests in this area are composed of spruce, pine, birch and aspen trees. The Pyhä-Häkki National Park is mainly in a virgin state and *Picea abies* is dominant, being the climax tree. In dry sites, however, *Pinus sylvestris* is dominant.

The Finnish specimen of *Physisporinus rivulosus* was collected on corticated, strongly decayed, fallen *Pinus sylvestris*; no other polypore species were noted on the same trunk. The locality is dry *Calluna vulgaris* - *Pinus sylvestris* woodland. The other European collections, made in France, are also from pine (David 1972). Baxter (1938), Cooke (1942), Kimmey and Lightle (1955) and Kimmey (1958) report several additional hosts from North America (*Tsuga heterophylla*, *Thuja plicata*, *Pseudotsuga menziesii*, *Sequoia sempervirens*, *Alnus oregana*).

The rot in the Finnish material is more or less fibrous, light brown, and seems to be a white-rot. The white mycelial flecks between the laminae of decayed wood mentioned by Buckland (1946) and Kimmey and Lightle (1955) are clearly seen in the Finnish collection. According to Buckland (1946), *P. rivulosus* causes white ring rot (white-rot; Nobles 1948) and is one of the main heart-rotting fungi of living western red cedars in British Columbia and also a very significant decomposer of redwood in the western United States (Kimmey & Lightle 1955, Kimmey 1958).

Four of the North American collections examined by me are from charred wood, and two of these are mixed samples (Baxter 28.XI.1937 and Smith 56250). In both cases the other polypore species is *Oligoporus sericeomollis* (Rom.) Pouz., in Finland found mostly on charred pine stumps.

There is also one collection from Alaska: Wrangell,



which was collected on 9 September 1935 and determined by D.V. Baxter as *Poria albipellucida* (= *Physisporinus rivulosus*). This collection is provided with Baxter's notes: 'Snow white when fresh' and 'Badly eaten by worms and so not typical'. The specimen is in fact eaten by nematodes, but in my opinion it does not represent *P. rivulosus*. It is much softer, the border is rhizomorphic and the hyphae are wider and thicker-walled than in *P. rivulosus*. The hymenium has been eaten and is also infected by moulds, so that I could not find any basidiospores.

Discussion

The systematic position of *P. rivulosus* has long been unclear. David's (1972) proposed inclusion of *P. rivulosus* in *Rigidoporus* has not generally been accepted (and is nomenclaturally invalid) and Mme A. David (in litt.) herself was not entirely satisfied with the decision.

Jülich (1984) re-established the genus *Physisporinus* Karst., which had long been neglected and regarded as synonymous with *Rigidoporus*. The type species of *Physisporinus* is *Poria vitrea* Pers.: Fr., which is annual, resupinate, soft when fresh, contracting in dry condition, has cystidioles, crystals on the hyphae and subglobose spores. These characters all belong to *P. rivulosus* as well, and the present species also closely agrees with the other *Physisporinus* species in its general appearance.

It seems that *Physisporinus* should be regarded as a genus which includes both species with simple septa and species with clamp connections. In this broader sense the genus is characterized by species with annual fruit bodies, a monomitic hyphal system, cystidioles, simple-septate or clamped hyphae and subglobose spores. This solution would separate *Poria vitrea* (incl. *Polyporus undatus* Pers.) from the species of the genus *Rigidoporus* Murr. In fact, *Physisporinus* differs from the corky, perennial species of *Rigidoporus* s.str., e.g. *Rigidoporus nigrescens* (Bres.) Donk and *R. ulmarius* (Sow.: Fr.) Imazeki, in being soft and annual.

The species of *Oxyporus* Donk are either annual or perennial, corky and simple-septate, having spores that are broadly ellipsoid to subglobose. These characters so closely resemble those seen in *Rigidoporus* s.str. that it is not surprising that these two genera are considered congeneric by some authors (Pouzar 1966, Kotlaba 1984).

Though *P. rivulosus* is the only *Physisporinus* species with clamp connections, I agree with Ryvarde's (1984) inclusion of *Polyporus rivulosus* Berk. & Curt. (*Poria rivulosa* (Berk. & Curt.) Cooke) in *Physisporinus*.

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