Revisiones Generum Obscurorum Hyphomycetum: *Exosporina* Oudem.*

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The anamorph genus *Exosporina* is considered a *nomen dubium* based on the examination of holotype and isotype specimens of the type species, *E. laricis*. The specimens appear to be stromata of a member of the Dothideales with a *Hormonema*-like anamorph, but are immature and therefore the fungus cannot be adequately characterized. The status of the three other species described in *Exosporina* is reviewed.

Exosporina Oudem., Proc. K. Akad. Wetensch. Amsterdam 6: 501. 1904. non Arnaud 1921.

Type.– *E. laricis* Oudem., l.c.

Holotype specimen.– NETHERLANDS, Nunspeet, (estate "de Groote Bunte"), on needles of *Larix decidua* Mill., leg. C. A. G. Beins, 11 June 1903. (L, herb. Oudemans). Isotypes: same location, host and collector, 17 June 1903, Dec. 1903 (x 2), 19 Dec. 1903, 12 Feb. 1904 (L, herb. Oudemans).

Oudemans (1904) described *Exosporina laricis* Oudem. as the cause of a needle disease of *Larix decidua* based on several specimens collected in 1903. Scattered, superficial, black spots, 100–150 µm wide, were present on the surface of the needles, which were still attached to the twigs (Fig. 1A). These were interpreted by Oudemans as sporodochia comprised of columns of brownish cells

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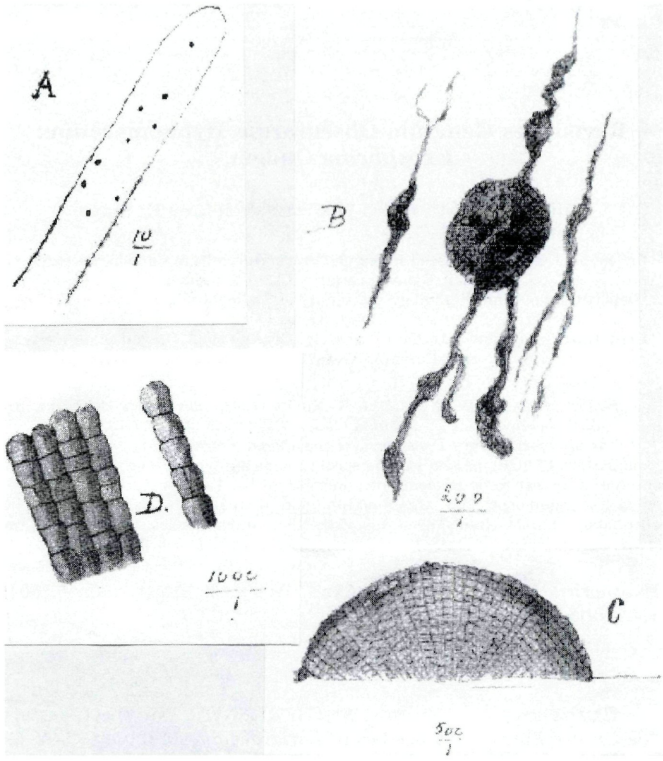
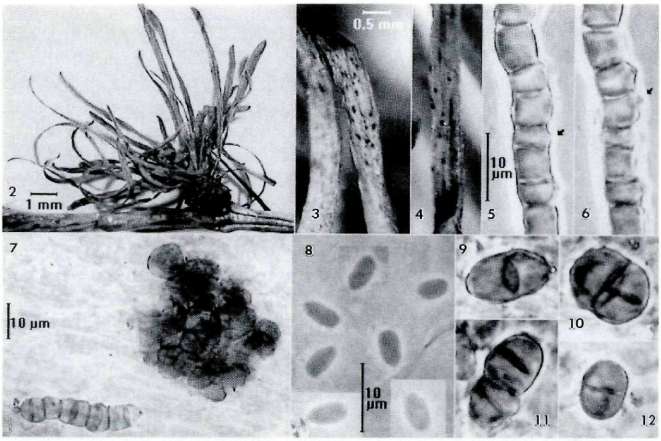


Fig. 1. – *Exosporina laricis*, drawings (rearranged) prepared by C. J. Koning accompanying the holotype specimen (L).– A. Leaf spots.– B. Appearance of stromata in leaf tissue.– C. Cross section of stroma.– D. Chains of conidia.

(Fig. 1C). He assumed that the columns of cells represented chains of conidia, which were cuboidal near the base of the chain and rounded towards the apex (Fig. 1D). After secession, the 'conidia' were aseptate or septate, 5–6 × 5 µm, and light brown in colour. In cleared needles, he also observed dark 'articulated' hyphae growing through parts of the leaf tissue (Fig. 1B). The sporodochial conidiomata, dark chains of conidia and apparent pathogenicity to trees led Oudemans to compare his fungus with species of *Trimmatostroma* Corda.

On the presumed holotype specimen, most of the needles are still attached to the twigs (Fig. 2). Some of the needles have round to el-



Figs 2–12. *Exosporina laricis* (holotype).– 2. Necrotic cluster of infected *Larix* needles. – 3, 4. Dark stromata of the fungus on individual needles. – 5, 6. *Hormonema*-like anamorph, the same hypha in two focus planes, the arrows showing conidiogenous loci. – 7. Small stroma and *Hormonema*-like chain of cells in the cleared tissue of a needle. – 8. Ellipsoidal, hyaline spores presumed to be conidia of the *Hormonema*-like fungus. – 9–12. Loose, dematiaceous structures on the leaf surface that are assumed to represent disarticulated conidiophores of the *Hormonema*-like fungus.

liptical black stromata about 50–125 µm diam. (Figs. 3, 4) that are evidently the structures described and figured by Oudemans (1904, see Fig. 1). Squash mounts of the stromata revealed that they are composed of globose to ellipsoidal dematiaceous cells about 5–8 µm diam. (Fig. 7), but they are not as regularly palisade-like as figured by Oudemans (Fig. 1C). Disarticulated 'conidia' 9–14 × 6.5–10 µm, usually with 1 lateral septum, sometimes 3-septate or dictyoseptate, were associated with the stromata (Figs. 9–12). Dematiaceous hyphae were visible in the leaf tissue, comprising short, angular cells, mostly 3–8 µm long × 5.5–11 µm wide, evidently the 'articulated hyphae' referred to in the protologue. Careful observation of some of these hyphae dissected out of the needle revealed minute discontinuities in the outer wall, sometimes penetrated by a hyaline denticle (Figs. 5, 6). Hyaline, thin-walled ellipsoidal conidia 5.5–6.5 × 3–3.5 µm are also associated with the stromata (Fig. 8), although they were not proven to be part of the same fungus. Subhyaline, 1-septate spores reminiscent of *Mycosphaerella* ascospores were also observed on the specimen.

The combination of monilioid dematiaceous hyphae with minute, hyaline, lateral conidiogenous apertures and hyaline ellipsoidal conidia suggest that *Exosporina laricis* is a 'black yeast' similar to species of *Hormonema* Lagerb. & Melin or *Aureobasidium* Viala & Boyer (Hermanides-Nijhof, 1977). These two anamorph genera have been distinguished by their modes of conidium ontogeny, synchronous in *Aureobasidium* and percurrent in *Hormonema*, but these distinctions are not always unequivocal (de Hoog & Yurlova, 1994). *Hormonema dematioides* Lagerb. & Melin is considered an aggregate anamorph species, representing the indistinguishable cultural states of several foliar and stem fungi on conifers, such as *Sclerophoma pithyophila* (Corda) Höhn., *Kabatina juniperi* R. Schnied. & Arx and *Rhizosphaera kalkhoffii* Bubák (Funk, 1981, 1985). It is relatively commonly isolated as a foliar endophyte of a number of plants, particularly conifers (Legault & al., 1989) including *Larix* (Stone, pers. obs.). However, no stromatic structures are associated with the leaf tissue giving rise to endophytic isolates.

Several known conifer pathogens classified in the Dothideales have black yeast anamorphs when grown on agar media, including species of *Discosphaerina* Höhn., *Dothiora* Fr., *Pringsheimia* Schulzer, *Sydowia* Bres. and *Xenomeris* Syd. (Sivanesan, 1984; de Hoog & Yurlova, 1994); many of these fungi also have pycnidial or acervular coelomycete anamorphs. The stromatic material on the holotype of *Exosporina* is probably immature ascomata or pycnidia of one of the above dothideaceous pathogens but no sporulating ascomycete or coelomycete stage is visible. The *Hormonema*-like conidiogenous cells and conidia may be an anamorph (or synanamorph) of the putative, immature, stromatic, ascomycetous fungus. We must emphasize, however, that the connection between the stromatic structures and the black yeast like structures on the specimens of *E. laricis* is not proven. *Hormonema* was explicitly described as a cultural phenotype (see Hermanides-Nijhof, 1977: p. 142) and rarely has been observed directly in nature, although *H. merioides* Funk & al. (see Funk, 1985) was described from direct observation of conifer needles. Given that specific identification of black yeasts requires cultural and physiological data, or knowledge of other morphs, it is impossible to unequivocally correlate the name *E. laricis* with any of the known fungi with *Hormonema* or *Aureobasidium* anamorphs. Therefore, because the fungus cannot be adequately characterized from the type and supplementary specimens examined, we recommend that *Exosporina* be regarded a *nomen dubium*, with a recognition that its affinities probably lie with the black yeasts.

Oudemans' (1904) original comparison of *Exosporina* with *Trimmatostroma*, a genus now used for saprobic, corticolous or li-

chenicolous, sporodochial anamorphs that have basipetal chains of dark phragmoconidia or dictyoconidia (Ellis, 1971, 1976; Hawksworth, 1979), was not well founded. We saw no evidence of basipetal chain formation in the specimens of *E. laricis* that we examined. Furthermore, the structures comprising the chains in *Trimmatostroma* species are clearly conidia, rather than stromatic cells or conidiogenous cells, as seems to be the case in *E. laricis*.

Exosporina predates *Hormonema* by 23 years, and also predates some of the coelomycete genera that have *Hormonema* synanamorphs. Nomenclatural stability would not be served by the arbitrary adoption of the generic name *Exosporina* for any of these anamorphs.

After the description of *Exosporina* Oudem., Arnaud (1921) created a later homonym by describing *Exosporina* Arnaud with *E. manaosensis* Arnaud as the type. This genus was renamed twice, as *Arnaudina* Trotter in Saccardo (1931) and as *Exosporinella* Bender (1932). It is based on the presumed *Septoideum*-like anamorph of *Parodiellina manaosensis* (P. Henn.) Arnaud (von Arx & Müller, 1975).

Other species of *Exosporina* Oudem.

Exosporina fawcettii Wilson, Hilgardia 17: 427. 1947.

This was considered a synonym of *Scytalidium dimidiatum* (Penz.) Sutton & Dyko, the anamorph of *Nattarassia mangiferae* (H. Sydow & Sydow) Sutton & Dyko (commonly known as *Hendersonula toruloidea* Nattrass) by Sutton and Dyko (1989), who examined authentic material.

Exosporina fructicola (Sacc.) Oudemans, Verl. Kon. Akad. Wetensch. Amsterdam XII, 2: 747. 1904.
≡ *Exosporium fructicola* Sacc., Michelia 1: 82. 1877.
≡ *Trimmatostroma fructicola* (Sacc.) Sacc., Sylloge Fungorum IV: 757. 1886.

We have not seen material of this species, which has not been considered in modern treatments of *Trimmatostroma*.

Exosporina mali Newodowski, Tiflis. Jard. Bot. Viestnik (Monit.) 21: 13. 1912.

We have not seen material of this species. The protologue describes an apparently acervular fungus with a palisade of brown, catenate spores growing on twigs of *Pyrus malus* L. The illustration

is not diagnostic and the species is best considered a *nomen dubium*, until authentic material can be examined.

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