

## *Paraethariicola aspiciliae* (Ostropales, *Odontotremataceae*), a new genus and species of lichenicolous fungi

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**Abstract:** The generic name *Paraethariicola* gen. nov. is introduced for a lichenicolous fungus very similar to *Lethariicola*, but differing by the presence of excipular hairs, asci with a hemiamyloid apical ring and a more flattened apex, curved or slightly helicoid ascospores with  $\pm$  pointed ends, and thicker paraphyses. The single species, *Paraethariicola aspiciliae* sp. nov., is lichenicolous on *Aspicilia*, and is known from continental Spain and Sardinia.

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### Introduction

Recent lichenological studies on Buntsandstein (Triassic rocks) in eastern Spain have shown that this substratum hosts a rich and interesting flora of lichens and lichenicolous fungi (Calatayud 1998). Additional fieldwork, including the first survey of several minor outcrops, has increased the number of taxa known in the region (e.g. Calatayud & Etayo 1999). The most interesting discoveries include a lichenicolous fungus parasitic on *Aspicilia contorta*, which cannot be identified with the current literature. It has cleistohymenial apothecia, an exciple with paraphyses and marginal hairs, asci with a thickened hemiamyloid apical wall and a distinct hemiamyloid ring, and hyaline, 3-septate, curved, falcate or slightly helicoid ascospores. Lichenicolous, ostropalean and leotialean genera sharing some of these features have recently been keyed out by Diederich & Etayo (2000),

who further proposed the relocation of the genus *Skyttea* from the Ostropales to the Leotiales. The cleistohymenial, i.e. initially closed, apothecia, and the presence of paraphyses support the inclusion of our fungus in the Ostropales, family *Odontotremataceae* (Sherwood-Pike 1987). It differs from the lichenicolous genus *Lethariicola* Grunemann, and also from the other genera of the family, by a number of important features, and the description of a new genus seems to be appropriate.

### Material and Methods

The material was examined with standard microscopical techniques. Photographs were taken with an Olympus SZH10 stereomicroscope and an Olympus BX50 microscope with DIC. The amyloid reactions were tested with Lugol's reagent, either without (I) or with pre-treatment with KOH (K/I). Microscopical measurements were made in water. The ascospore range (in dead state) was calculated after rejecting manually 10% of the highest and 10% of the lowest values measured; the mean values are given *in italics*, and the extremes within parentheses. Excipular pigments have been studied in water, potassium hydroxide (K) and nitric acid (N).

The comparison with species of *Lethariicola* is based on unpublished results by Diederich, Etayo & Zhurbenko, referring to the complete available material of specimens belonging to this genus.

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### Taxonomy

#### **Paraethariicola Calatayud, Etayo & Diederich gen. nov.**

A genere *Lethariicola* praecipue margine excipuli piloso, ascis annulo hemiamyloideo, ascosporis curvatis, falcatis vel parum helicoideis et paraphysibus latioribus differt.

Typus: *Paraethariicola aspiciliae* Calatayud, Etayo & Diederich

*Ascomata* initially perithecioid and closed, with the disc entirely covered by the exciple, opening by a pore, becoming deeply urceolate when mature. *Exciple* paraplectenchymatous, dark reddish brown in its outer part and hyaline towards the hymenium; excipular pigment extracellular, not granulose, reddish brown, K+ more greyish brown, N+ orange brown; excipular margin with brown hairs (but hyaline or pale brownish in the lower part, close to the hymenium) that are I-, K/I-; periphysoids well developed on the inner excipular surface, developed up to the base of the asci and paraphyses,  $\pm$  perpendicular to the paraphyses, hyaline, septate, branched, I-, K/I- (but plasma I+ reddish). *Hymenium* hyaline, hymenial gel I+ directly red (not bluish, then red), K/I+ blue; subhymenium and epihymenium hyaline. *Paraphyses* simple, septate, apically not or hardly thickened. *Asci* subcylindrical when young, clavate or slightly saccate when mature, basally with a short stipe, apically slightly flattened, wall apically thickened, with a distinct ocular chamber, I+ red, K/I+ blue, except the apical dome which is K/I- or pale blue (similar to the *Lecanora*-type), with a distinct hemiamyloid ring (in some asci difficult to observe). *Ascospores* curved, falcate or slightly helicoid, with more or less pointed ends, transversely septate, smooth-walled, lacking a visible perispore, hyaline. *Anamorph* unknown. *Vegetative hyphae* indistinct.

*Etymology.* From para- (Greek, similar to) and *Lethariicola*, its most closely related genus.

#### **Paraethariicola aspiciliae Calatayud, Etayo & Diederich sp. nov.**

*Paraethariicola insignis* ascomatibus 200–500  $\mu$ m diam., ascis 8-sporis, 40–55  $\times$  9–11  $\mu$ m, et ascosporis

3-septatis, (21–)22–27(–31)  $\times$  3–3.5  $\mu$ m. In thallo lichenum generis *Aspicilia* crescens.

Typus: Spain, Region of Aragón, Prov. Teruel, between Puebla de Arenoso and Olba, close to Los Lucas, beside the main road, c. 2 km E of Olba, c. 40°8'N, 0°37'W, alt. c. 700 m, on *Aspicilia contorta* subsp. *hoffmanniana*, on slightly carbonated sandstone, 14 iii 1999, V. Calatayud s. n. (MA-Fungi 49914—holotypus; hb. Calatayud 67, hb. Diederich and hb. Etayo—isotypi).

(Figs 1 & 2)

*Ascomata* initially immersed, later erumpent, mostly closed and with a small central pore when dry, but opening to become urceolate and exposing the disc when moist, arising singly or in groups, sometimes confluent, dark reddish brown, the oldest with a margin markedly striate, 200–500  $\mu$ m diam.; pore irregular or rounded. *Exciple* laterally dark reddish brown in its uppermost and outer part, hyaline towards the hymenium, 50–65  $\mu$ m thick, basally dark reddish brown, 20–35  $\mu$ m; excipular cells  $\pm$  polygonal or somewhat elongate, 4–7  $\mu$ m diam.; excipular hairs c. 10–25  $\times$  3–4  $\mu$ m; inner part of the lateral exciple provided with abundant, short and hyaline periphysoids, 6–12  $\times$  2–2.5  $\mu$ m. *Hymenium* 60–75  $\mu$ m high; subhymenium 10–15  $\mu$ m high. *Paraphyses* 2–3(–4)  $\mu$ m thick. *Asci* 8-spored, 40–55  $\times$  9–11  $\mu$ m. *Ascospores* twisted within the asci, 3-septate, with a relatively small number of minuscule guttules (observed in K), I-, KI-, (21–)22–24.8–27(–31)  $\times$  3–3.5  $\mu$ m, length/width ratio (6.3–)7.0–8.0–9.0(–10.3) [ $n=36$ ].

*Hosts.* On the thallus of *Aspicilia contorta* subsp. *hoffmanniana* and of an unidentified *Aspicilia* species. The infected parts are bleached and partly destroyed by the fungus (appearing as if they had been grazed by insects), which makes it easy to find in the field.

*Etymology.* The epithet '*aspiciliae*' refers to the host genus.

*Ecology and distribution.* *Paraethariicola aspiciliae* is known from two Mediterranean localities. The type was gathered in a locality

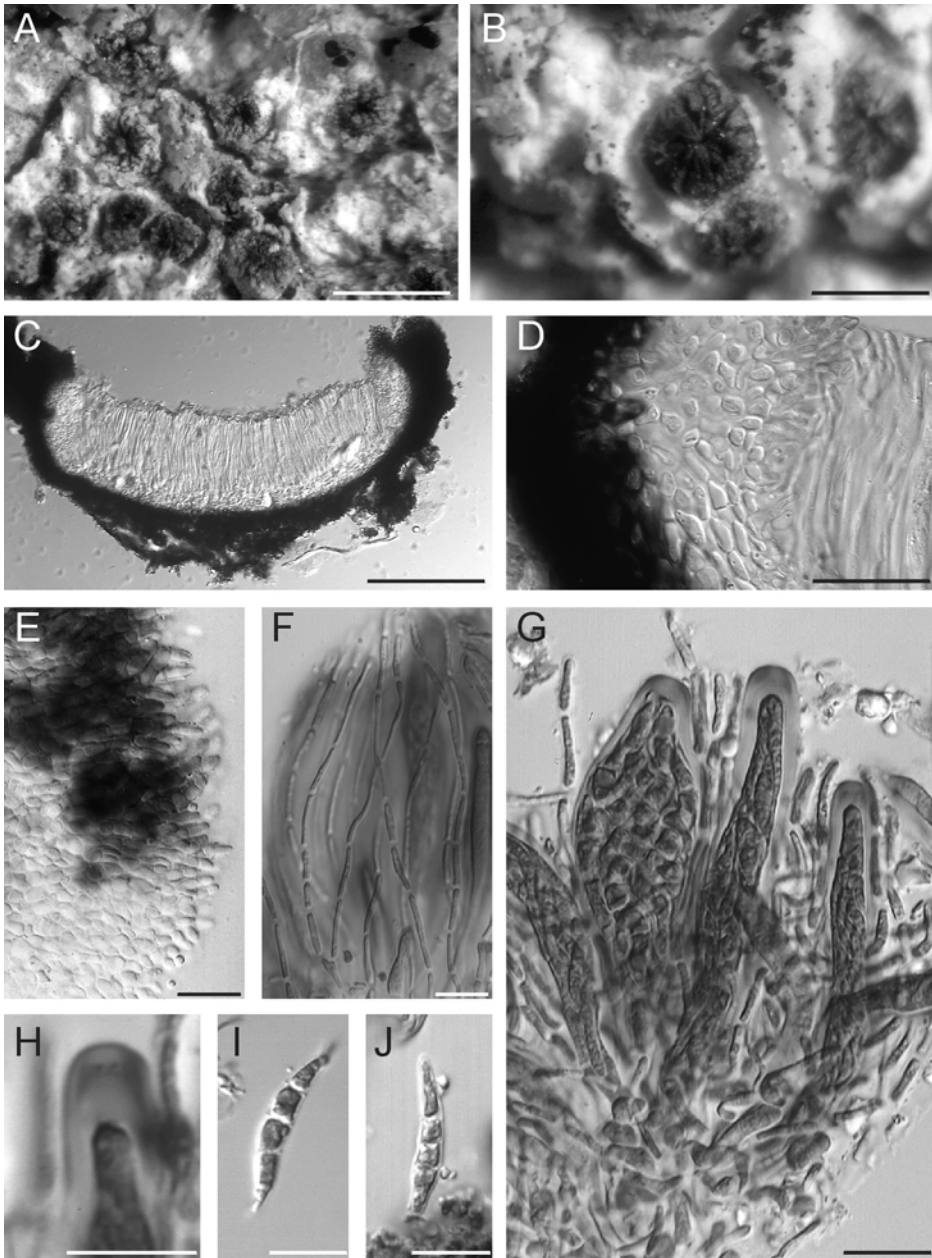


FIG. 1. *Paraethariicola aspiciilae* (holotype). A, habitus; B, closer view of an ascoma, showing the striate margin; C, section through an ascoma; D, exciple; E, periphysoids (lower part, hyaline) and hairs (upper part, brown), observed in K; F, paraphyses in K/I; G, asci in K/I; H, detail of ascus apex in K/I; I & J, ascospores in I. Scales: A=1 mm; B=0.5 mm; C=100 µm; D=25 µm; E–J=10 µm.

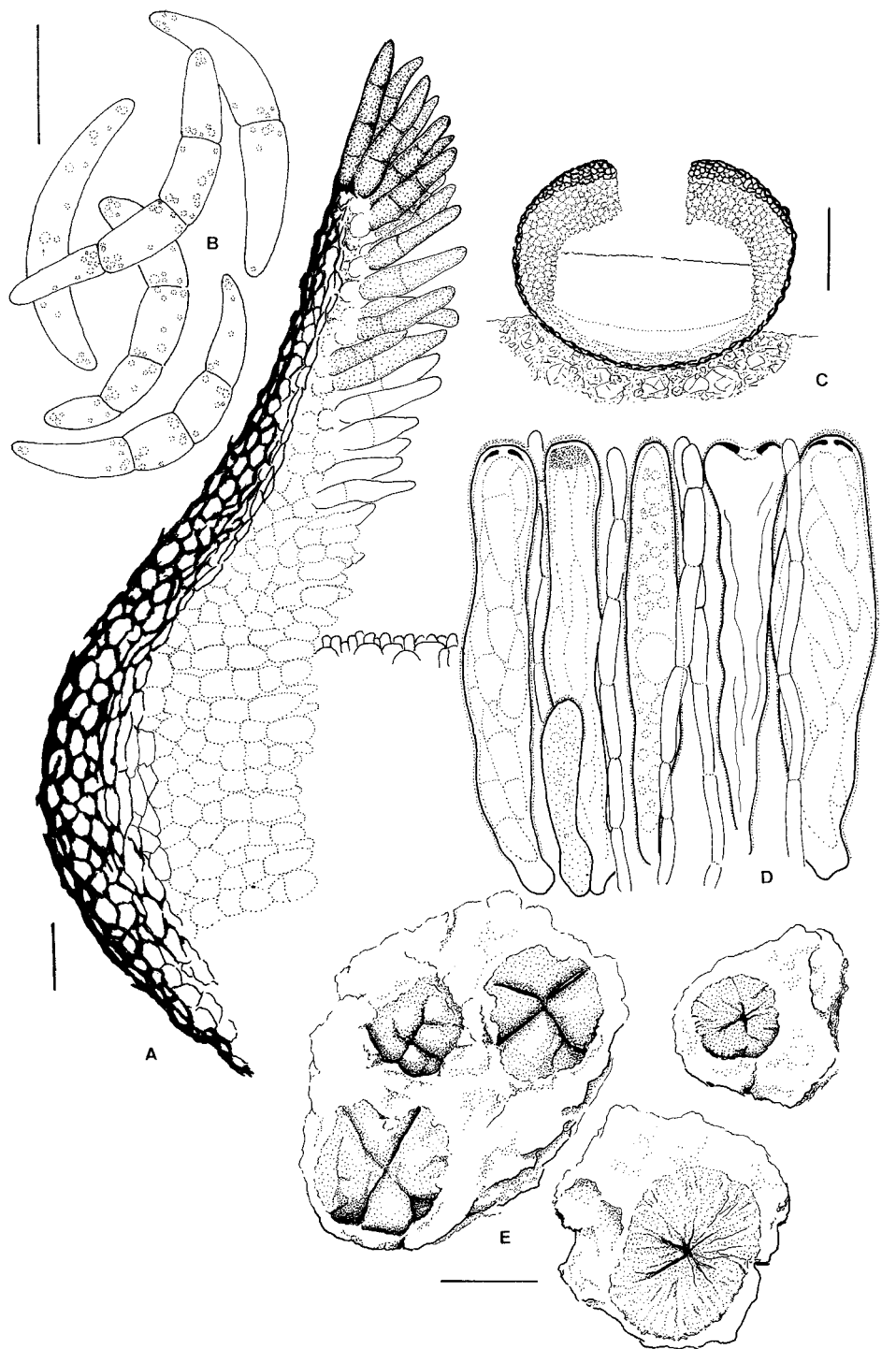


FIG. 2. *Paralethariicola aspiciilae* (holotype). A, section through the exciple of a mature ascoma, with periphysoids (inner part) and hairs (apical part, brown); B, ascospores; C, transverse section through a young ascoma, still without excipular hairs; A, B & C observed in water; D, hymenium with asci in several developing stages, observed in K/I; E, several ascomata, the youngest with radial fissures and the most mature ones striate and more flattened. Scales: A, B & D=10  $\mu$ m; C=50  $\mu$ m; E=0.25 mm.



in central-eastern Spain (region of Aragón, Prov. Teruel), on a relatively small outgrowth of slightly carbonated red sandstone, completely surrounded by calcareous rocks. The second specimen is from Sardinia; this sample was published as *Pleospilis* sp. and as *Skyttea* sp. by Nimis & Poelt (1987: 184 & 222).

*Additional material examined. Italy: Sardinia.* Prov. Sàssari, Valle dei Nuraghi, 1.5 km SE der Bahnstation von Torralba, c. 350 m, beweidete, frühjahrsfeuchte Rasen, Gräben, Wegränder, Mauern, vereinzelt niedere Silikatblöcke, 1986, H. Mayrhofer 6091 (GZU).

### Discussion

The new fungus strongly resembles species of the lichenicolous genus *Lethariicola* (Lumbsch & Hawksworth 1990; Diederich, Etayo & Zhurbenko, unpublished data). Both share similar cleistohymenial ascomata, a similar excipular structure, the same excipular pigments, hyaline, transversely septate (in *Lethariicola* rarely submuriform), multiguttulate ascospores, and similar periphysoids, paraphyses and asci. Species of *Lethariicola* are distinguished by the absence of excipular hairs and the absence of a hemiamyloid apical ring in the ascus wall (the ascus wall is either K/I – or pale bluish, but never with any special apical structures visible by light microscopy). Furthermore, ascospores in *Lethariicola* are generally ellipsoid, rarely narrowly ellipsoid, but never bent or helicoid, and usually with a rounded apex; the asci in *Lethariicola* are apically more rounded, whilst those in *Paraethariicola aspiciliae* have a distinctly flattened apex; finally the paraphyses in species of *Lethariicola* are rarely over 1.5 µm in diameter, exceptionally up to 2 µm, whilst those of *P. aspiciliae* are distinctly thicker, 2–3(–4) µm in diameter.

For a long time we hesitated between the inclusion of *P. aspiciliae* within *Lethariicola* and the description of a distinct genus. Ontogenetically, the ascomata of *Paraethariicola* are similar to those of *Lethariicola*, with the excipular hairs in *Paraethariicola* developing only at a later stage (see Fig. 2C); also the excipular pigment is the same in

both taxa. This clearly indicates a close phylogenetic relationship. On the other hand, genera within the *Odontotremataceae* are often separated by minor differences. If *P. aspiciliae* was included in an enlarged concept of *Lethariicola*, then several other genera within the family would logically also have to be united. In our opinion, all the differences enumerated above strongly support the distinction of two distinct genera, at least as long as narrow generic concepts are used within the whole family.

The genus *Phragmiticola* Sherwood was the only hitherto recognized member of the *Odontotremataceae* in which asci have an amyloid apical ring. Because of this character Sherwood-Pike (1987) hesitated to include the genus in the Ostropales, but, following Baral (pers. comm.), the monotypic genus is a typical member of this order. Furthermore, the exciple of *Phragmiticola* presents verrucose marginal hairs (Baral, pers. comm.). We believe that *Paraethariicola aspiciliae* should nevertheless not be included in *Phragmiticola*, as in the latter: the hymenium and the ascus wall (except that of apical ring) are non-amyloid; the apical ring is euamyloid (fide Baral, pers. comm., versus hemiamyloid in *Paraethariicola*); the excipular structure, especially near the margin, is not exactly the same; the excipular hairs are verrucose; the ascospores have a distinct, thick perispore; the asci have a narrower, conical apex, with a narrower apical ring; and the ecology is different, the only known species of *Phragmiticola* being saprophytic on *Phragmites* (Sherwood-Pike 1987; Baral, pers. comm.).

The genera *Skyttea* Sherwood, D. Hawksw. & Coppins and *Spirographa* Zahlbr. (syn. *Pleospilis* Clem.), under which the Sardinian specimen has initially been published (Nimis & Poelt 1987) are very distinct (see Diederich & Etayo 2000).

*Paraethariicola aspiciliae* also shows some common features with the lichen genus *Ramonia* Stizenb. As described by Sherwood (1977), this genus is characterized by having pinkish or light-coloured, immersed ascomata and a two-layered margin, with an exciple of 'textura angularis' with, on the

inner surface a layer of periphysoids. A dark coloured species, *R. nigra* Coppins, was eventually described by Coppins (1987). This author pointed out that at least two taxa, *R. nigra* and *R. chrysophaea* (Pers.) Vězda, have an amyloid ring-like structure in the ascus apex. *Paraethariicola* differs from *Ramonia* by its hairy exciple and hemiamyloid asci (they are non-amyloid in species of *Ramonia*), and by its curved, transversely septate ascospores. Although the shape, septation and ascospore number are very variable within the genus *Ramonia*, species with curved or helicoid ascospores have not been reported so far. The ecology is also different, since the genus *Ramonia* includes only lichenized species, most of them epiphytic. In spite of these differences, there are remarkable similarities between both genera, and the systematic position of *Ramonia* should be reconsidered to establish if it definitely belongs to the Ostropales, rather than to the Gyalectales (e.g. Purvis *et al.* 1992; see also the discussion by Coppins 1987).

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