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The lichen genus *Porina* in Macaronesia, with descriptions of two new species

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Abstract: Detailed studies on the lichen genus *Porina* in Macaronesia have led to a reappraisal of the genuine identity of *Porina atlantica* (Erichsen) P. M. Jørg., a characteristic species that has previously been confused with *P. guaranitica*, *P. heterospora*, *P. nucula*, *P. mastoidea* or *P. rhodostoma* in the literature, and is here reported from Madeira, the Canary Islands, Ireland, France and Portugal. Two new species are described: *P. effilata* Brand & Sérus. sp. nov. (known from Madeira, the Canary Islands, Great Britain, Ireland and Portugal) and *P. ocoteae* Brand & Sérus. sp. nov. (restricted to La Palma, Canary Islands, and São Jorge in the Azores). *Porina leptospora* Nyl. is recognized at the species level, and *P. isidiata* Kalb & Hafellner is reduced into synonymy with *P. atlantica*. A key to all known species of *Porina* in Macaronesia is provided.

Key words: Azores, Canary Islands, England, France, Gomera, Ireland, La Palma, laurisilva, Los Tilos, Madeira, *Porina effilata*, *Porina ocoteae*, Portugal, rare species, São Jorge, Tenerife, Wales

Introduction

The checklist of lichens occurring in Macaronesia (Hafellner 1995, 1999, 2002) reflects the confusion of authors with regard to the identity of several species of *Porina* in the archipelagos. For example, Hafellner (1995: 74) suspected that earlier reports of *P. mastoidea* (Ach.) A. Massal. and *P. nucula* Ach. referred to *P. isidiata* Kalb & Hafellner; he accepted *P. guaranitica* Malme as a distinct species, with *P. heterospora* (Fink) R. C. Harris as a synonym. For the same group of species, Etayo (1998: 100–101) and McCarthy (2003: 21) accepted only one species, *viz. P. atlantica* (Erichsen) P. M. Jørg., with *P. guaranitica* and *P. heterospora* as synonyms.

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As we now have large collections of *Porina* from Madeira and the Canary Islands as well as some from the Azores, we are able to produce a more detailed taxonomic account of the species present. The large amount of additional relevant data now available (Harris 1995; Lücking & Vězda 1998; McCarthy, 1993, 2000, 2001, 2003) was also critical for this study.

The generic concept

Almost simultaneously, Harris (1995) and Kalb & Hafellner (1995) introduced new generic concepts within the *Porinaceae* (the valid name for the family since the typification of *Porina* Müll. Arg. with *P. nucula* Ach.; see McCarthy 2003: 8), including revisions of the circumscription of the well-known genus *Porina*. The two taxonomic circumscriptions are not consistent with each other and neither has received wide support (see McCarthy & Malcolm 1997 for a discussion), although the genus *Pseudosagedia* (Müll. Arg.) M. Choisy, resurrected by Kalb & Hafellner (1995), is now used in several European checklists. The purpose of

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this paper is to examine the species present in Macaronesia, and, to some extent, those also present in Western Europe and is thus species-dedicated. We have therefore adopted a conservative generic concept and broad delimitation of *Porina*, following McCarthy (2003). We have also suggested that the introduction of new generic concepts should take into account phylogenetic analyses based on multiple gene DNA sequences, when representative species of all groups within the family have been tested (Grube *et al.* 2004*a*; Baloch & Grube, 2006).

Methods

This study is based on collections and observations made by the authors in Macaronesia, western Europe and several tropical regions, as well as on the examination of herbarium material borrowed from institutions and colleagues. The material was examined in tap water, in lactophenol cotton-blue (LCB; FLUKA Chemika 61335) or in Lugol's solution (IKI; Lugol solution SIGMA L-6146). The measurements always refer to material mounted in water. The dimensions of perithecia are those of the perithecia or when present the perithecial warts (enclosing the perithecia s. str.) in herbarium specimens.

The Species

Porina atlantica (Erichsen) P. M. Jørg.

Graphis Scripta **12:** 1 (2000).—*Ocellularia atlantica* Erichsen, *Hedwigia* **66:** 276 (1926); type: Canary Islands, Tenerife, Llano de los Vieijos in Monte Minas de Abajo, on *Laurus canariensis*, 17 iii 1919, *L. Lindiger* (HBG—holotypus, not seen) [material requested but not received].

Porina isidiata Kalb & Hafellner, *Herzogia* **9:** 83 (1992); type: Madeira, An der Levada da Serra do Faial entlang, etwas SW von Santo da Serra in Richtung Camacha, in letzten Resten eines alten, jedoch stark gestörten, NW-exponierten *Eucalyptus*-Waldes, an *Laurus azorica*, 750 m, 13 viii 1990, *K. Kalb* 23484 (hb Kalb—holotypus!, isotypus!).

Porina guaranitica auct. europ. p. p., non Malme, *Ark. Bot.* **23(A):** 13 (1929).

Porina heterospora auct. europ. p. p., non (Fink) R. C. Harris, in Tucker & Harris, *Bryologist* **83:** 12 (1980).

Porina mastoidea auct. europ. p. p., non (Ach.) Müll. Arg., *Bot. Jahrb. Syst.* **6:** 399 (1885).

Porina nucula auct. europ. p. p., non Ach., *Syn. Meth. Lich.*: 112 (1814).

Porina rhodostoma auct. europ., non Müll. Arg., *Bot. Jahrb. Syst.* **6:** 398 (1885).

(Figs 1A & B, 3A–D, 7A)

Thallus epiphloeodal, rather thick (*c.* 0·5 mm) and strongly appressed and adherent to the bark, occasionally overgrowing liverworts and mosses, very rare on rocks, usually not shiny, dark green to pale greyish, in herbarium specimens usually pale with an orange or pinkish tinge, when fresh and alive typically orange-brown to vivid green, rugose to verrucose, sometimes irregularly wrinkled, typically with oxalate crystals deposited in globose agglomerations inside the thallus (crystallocumuli *sensu* Hafellner & Kalb 1995: 163–164), which can usually be seen as translucent dots under high magnification, without a prothallus. *Isidia* absent or locally developed on parts of thalli, or abundant and covering large parts of thalli, simple to coralloid, cylindrical to most commonly globose and constricted several times along their length and thus appearing moniliform, usually brittle and easily removed, concolorous with the thallus or paler, 0·1–0·5(–1·0) mm high.

Perithecia rare to abundant, hemispherical to subglobose, slightly but distinctly constricted at their base, rarely not, 0·5–0·9 (–1·1) mm diam., typically covered by a thallus layer containing agglomerations of oxalate crystals and thus appearing as if enclosed in a large thalline wart; ostiolar region slightly depressed, usually orange, pinkish, reddish to brownish, rarely dark brown, in young perithecia almost indistinct as the covering thallus layer has not yet got thinner so that the underlying orange involucrellum becomes visible. *Involucrellum* typically pale orange in section and K+ bright orange to reddish, 30–40 µm thick, readily detached from the thallus covering layer in sections and separated from it by a very loose hyphal tissue around the base of mature perithecia. *Excipulum* pale yellow, *c.* 20 µm thick. *Paraphyses* abundant, simple or rarely branched near the base, not inflated at the apices, *c.* 1·5 µm thick. *Asci* cylindrical-clavate, up to 200 × 20–24 µm. *Ascospores* 8/ascus, fusiform, never tapering towards one end, straight or slightly curved, 7–9 (–13)-septate (one spore seen with 15

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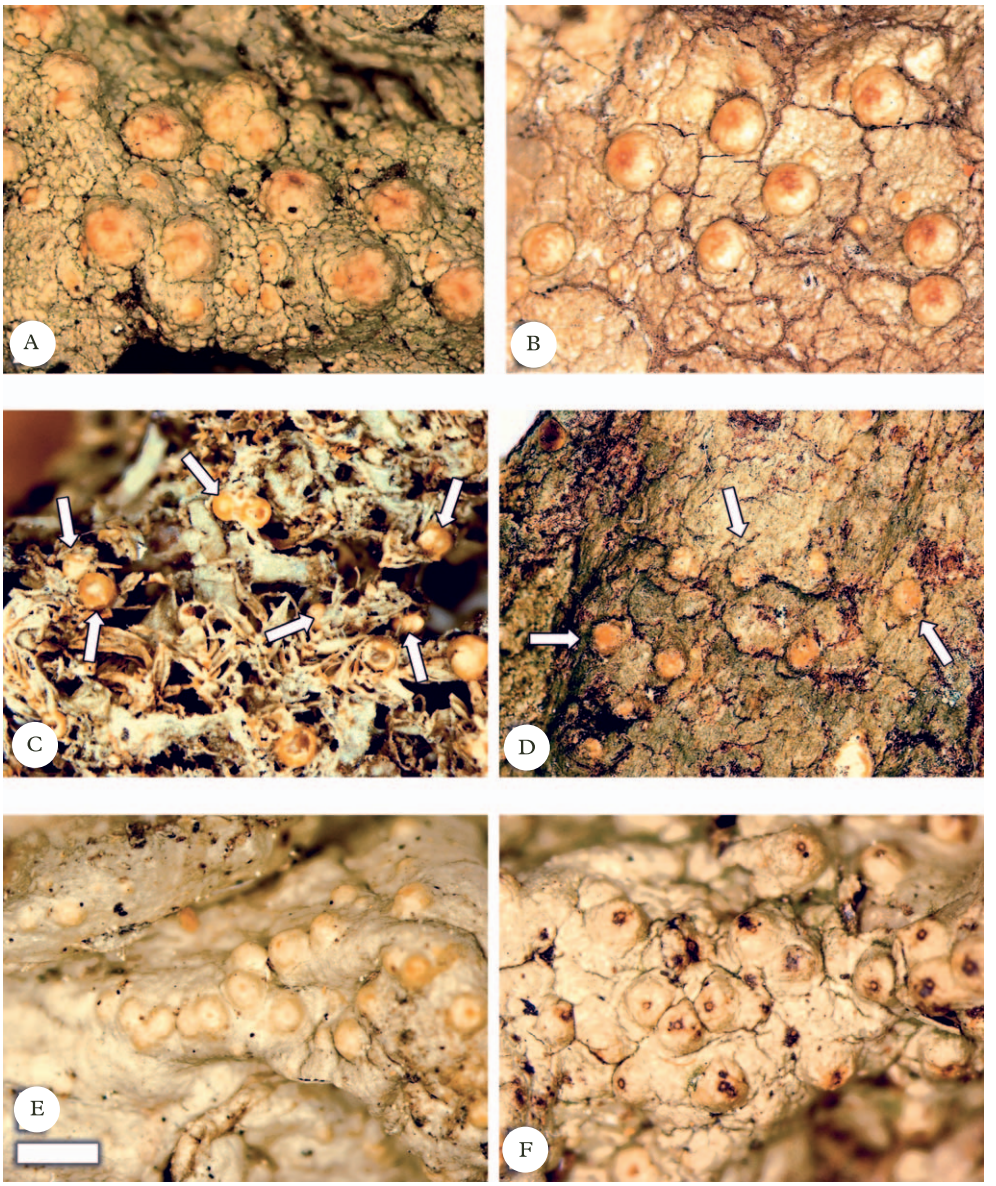

FIG. 1. Morphology of *Porina* species. A & B, *P. atlantica* [La Palma, Barranca Gallegos, iv 2004, *E. Sérusiaux* s. n. (LG)]; C & D, *P. effilata*, arrows point to perithecia and colours electronically exaggerated in C to make the perithecia more conspicuous [C: Ireland, Killarney, 2000, *A. M. Brand* 40242 (hb Brand); D: La Palma, Cubo de la Galga, 3 iv 1986, *A. M. Brand* 13302 (hb Brand)]; E & F, *P. ocoteae*, E, young perithecia; F, mature perithecia [La Palma, Los Tilos, iv 2004, *E. Sérusiaux* s. n. (LG—holotypus)]. Scale = 0·1 mm.

septa), 44–80 × 7–13 µm, plus a distinct, 2–3 µm thick perispore.

Pycnidia rare, usually immersed in the thallus with only the ostioles visible, 0·1–0·3 mm diam., with a hyaline or pale orange, K+ bright orange wall. *Pycnidiospores* ellipsoid, sometimes slightly tapering towards one end, hyaline, simple, 2·5–3·0 × 1·0–1·5 µm.

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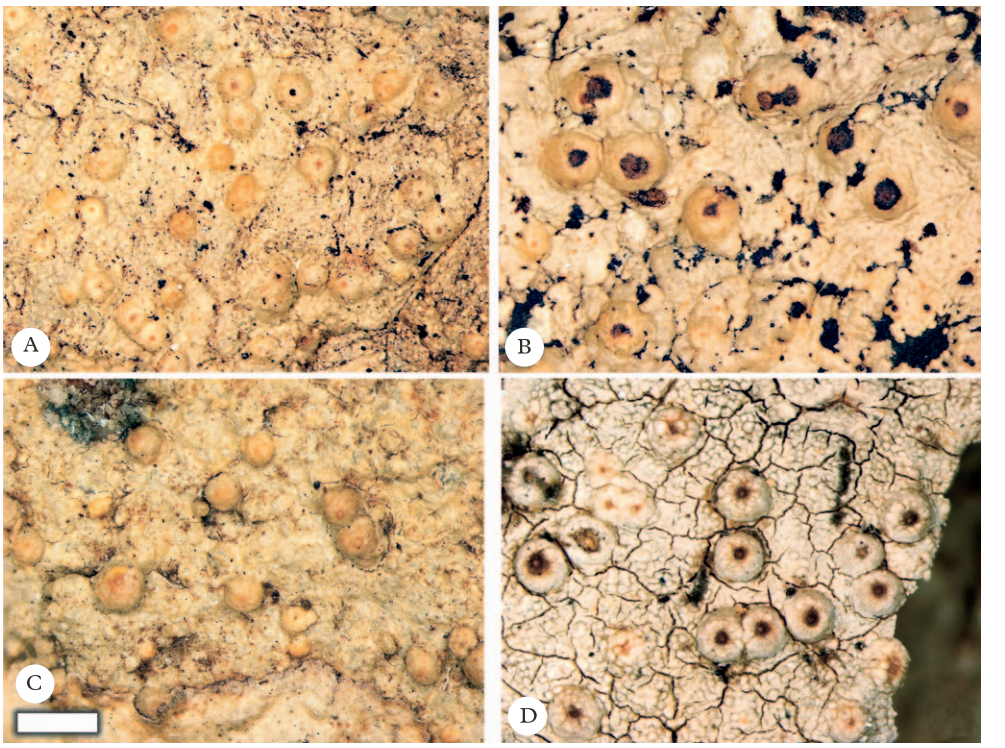

FIG. 2. Morphology of *Porina* species. A, *P. guaranitica* [Paraguay, 1893, *G. O. A. Malme* 1469 (S—holotypus)]; B, *P. mastoidea* [Papua New Guinea, Laing Island, 1992, *P. Diederich* 11644 (hb Diederich)]; C, *P. nucula* [Papua New Guinea, Burbura logging site, 28 vii 1992, *P. Diederich* 11909b (hb Diederich)]; D, *P. rhodostoma* [Dominica, Cabrit National Park, 26 iii 1998, *E. Sérusiaux* s. n. (LG)]. Scale=0·1 mm.

Notes. In Macaronesia, *Porina atlantica* is a distinctive species, easily recognized by its dull, verrucose thallus containing packets of oxalate crystals, large perithecia covered by a thallus layer with an orange to reddish brown periostiolar region, and 7–9(–13)-septate ascospores, 44–80 × 7–13 µm, not tapering towards one end and with a thick perispore. Quite surprisingly, it has been confused with *P. effilata*, newly described in this paper, and which has a non-verrucose thallus (lacking packets of oxalate crystals), smaller perithecia with a smooth or slightly tomentose surface, and ascospores typically effilate (caudate and tapering towards the proximal end), narrower [9–11(–13)-septate, 68–83 × 7–11 µm] and with a much thinner perispore. *Porina atlantica* comes close to *P. nucula* Ach., characterized by a thallus that is strongly appressed and adherent to the bark, verrucose, pale orange to vivid green when fresh and without a prothallus, prominent perithecia covered by a thallus layer with a slightly reddish ostiolar region and broad ascospores, 7-septate and with a thick perispore.

Porina nucula Ach. (Figs 2C, 3E & F) is the type species of the genus, but several, often confused taxa are clearly related. Their taxonomy remains to be clarified, as demonstrated by the preliminary treatment of Harris (1995: 172–175) for Florida (USA). The lectotypification made by Harris (1995: 174) points to a species with perithecia slightly constricted at their base and with ascospores 40–52 × 11–14 µm, with rounded ends. He further demonstrated a considerable variation in ascospore size and septation in the same group, under the informal ‘‘sp. 674’’ [ascospores narrower,

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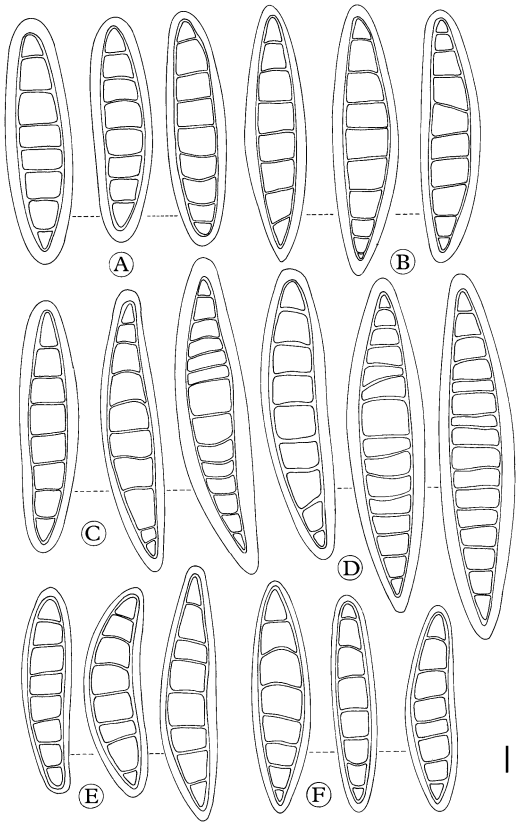

FIG. 3. Ascospores of *Porina* species. A–D, *P. atlantica* [A, Ireland, West Cork, 20 ix 1982, *P. W. James* s. n. (BM); B, La Palma, Los Tilos, iv 2004, *E. Sérusiaux* s. n. (LG); C, Madeira, Chão da Ribeira, vii 2003, *E. Sérusiaux* s. n. (LG); D, France, Ste Engrâce, *P. van den Boom* 12821 (hb van den Boom)]; E & F, *P. nucula* [E, Papua New Guinea, *P. Diederich* 11489 (LG, hb Diederich); F, Papua New Guinea, *P. Diederich* 11909b (LG, hb Diederich)]. Scale: = 10 μm.

with pointed ends, 42–53(–61) × (7–) 8–11(–12) μm], ''sp. 6'' [ascospores with ends pointed, ± evenly tapering at both ends, 60–75 × 10–13(–15) μm; perithecial warts large, *c.* 0·6 mm in diam.], and ''sp. 30308'' (ascospores 25–33 × 5–6 μm; perithecial warts small, *c.* 0·3 mm in diam.). The matter is indeed unresolved, and our own experience with tropical material confirms that a great deal of variation is present and that further taxa are most probably involved. We therefore decided to adopt the ''finely cut'' circumscription of Harris (1995: 174) and Lücking & Vězda (1998: 213–214). R. Lücking kindly provided us with data on the lectotypes designated by R. C. Harris in H and NY. The delimitation of the species by McCarthy (1994: 400; 2001: 140) is broader and would question the circumscription adopted here for *P. atlantica*. Until more data become available from tropical areas, we distinguish these two species mainly by the size of the perithecia: in *P. altantica*, as circumscribed here, mature perithecia are 0·5–0·9(–1·1) mm in diameter, while they never exceed 0·7 mm in *P. nucula*.

Within the populations here assigned to *P. atlantica*, septation and size of ascospores can vary considerably: several specimens from Macaronesia and Ireland (Fig. 3A & B) consistently have 7-septate ascospores measuring 44–60 × 7–11 μm, while in others the spores are more septate and longer. The most divergent specimens are 'Madeira, Chão da Ribeira, vii 2003, *E. Sérusiaux* s. n.' which has 9–13-septate ascospores measuring 60–71 × 10–13 μm (Fig. 3C), and 'SW France, Ste Engrâce, *P. van den Boom* 12821' which has 9–11(–15)-septate ascospores measuring 72–80 × 11–13 μm (Fig. 3D). As the variation covers the whole distributional range (as studied in this paper) of the species and is not correlated with any other characters, it has been included in the general description provided above.

Examination of the species names formerly used for the species in the area of study. Tavares (1952: 320) used the name ''*Porina mastoidea* (Ach.) Mass.'' for specimens of this species collected in Madeira, although he had not seen the type. However, he did examine the type of *Ocellularia atlantica* Erichsen, described from Tenerife, and he was ''inclined to think that the Tenerife lichen is only a variant of *Porina mastoidea*''. The description provided by Erichsen (1926: 276) reads as follows: ''Thallus (. . .) verruculoso-inaequalis, interdum aliquid rimosus, (. . .). Apothecia solitaria in verrucis. Verrucae fertiles subglobosae, basi non constrictae, numerosae sed non confertae,

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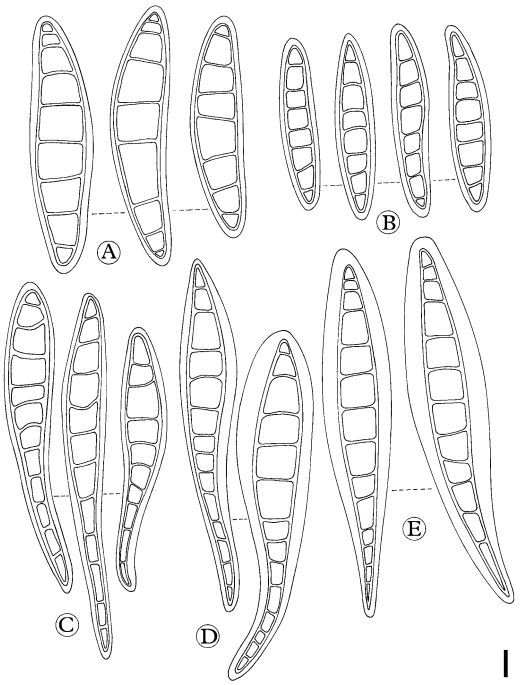

FIG. 4. Ascospores of *Porina* species. A & B, *P. mastoidea* [A, Papua New Guinea, *P. Diederich* 11491 (LG, hb Diederich); B, Papua New Guinea, *P. Diederich* 11644 (LG, hb Diederich)]; C–E, *P. heterospora* [C, USA, Florida, *E. Sérusiaux* 1765 (LG); D, USA, Louisiana, *S. C. Tucker* 18481 (E); E, Guatemala, *P. van den Boom* 33491 (LG, hb van den Boom)]. Scale = 10 µm.

0·6–1 mm latae. (. . .) Sporae octonae, decoloratae, fusiformes, 5–11 septatae, 0·062–70 mm longae et 0·018–21 mm crassae, episporio 0·003–4 mm crasso.'' It is a rather accurate description of the taxon dealt with here. Although the type collection was not available for this study, we accept this epithet.

Porina mastoidea (Ach.) Müll. Arg. is a different species with a rather smooth, shiny, thick thallus which readily peels and becomes detached from the substratum, and forms bullate portions, with a well-developed black prothallus. Its perithecia are usually applanate and rarely constricted at their base, typically have a conspicuous black ostiole, and the ascospores are 7-septate, 32–66 × 6–13 µm, with a 1·5–3·5 µm thick perispore (ascospore characters following McCarthy 2001: 137; Figs 2B, 4A & B). Although the ascospores are quite similar to those of *P. nucula* and *P. atlantica*, *P. mastoidea* probably belongs to a different taxonomic group, which corresponds to *Clathroporina* Müll. Arg. *sensu* Harris (1995: 171–172). *Porina africana* Müll. Arg., *P. tetracerae* (Ach.) Müll. Arg. and *P. ocoteae* Brand & Sérus., newly described in this paper, also belong to that latter group.

No material of *P. atlantica* was available to Swinscow when he published his outstanding revision of the genus in the British Isles (Swinscow 1962): indeed, both collections he mentioned under *P. nucula* Ach. from Ireland belong to *P. effilata* (pp. 47–49; both collections seen in BM: Aug. 1935, *D. A. Jones* s. n. and June 26, 1961, *P. W. James* & *T. D. V. Swinscow* s. n.; see below, under *P. effilata*). The drawings of ascospores (within the ascus or standing alone) in Swinscow's fig. 12 are typical for *P. effilata*, but his section of a perithecium is misleading as well as part of his description of the perithecial wall: indeed, he records that perithecia are ''largely covered by a thalline layer'' and adds the puzzling ''loculi containing plaques of refractile material sometimes present in thalline covering layer''. This is never the case with *P. effilata* nor in the material from Ireland he had at hand. We suggest that Swinscow had extracted these data on the perithecia from other specimens he had examined, apparently from tropical areas and belonging to the genuine *P. nucula* or other species, possibly the genuine *P. heterospora* [see his sentence (p. 48): ''The description is based on the examination of five specimens from the southern United States of America, two from Cuba, and three from south-west Ireland'']. He may have seen caudate and multi-septate ascospores from material belonging to *P. heterospora* from the US (Fig. 4C–E) and these are indeed close to the Irish material of *P. effilata* he had on his table. The drawing of the perithecial section in Swinscow's fig. 12 is a further clue to the confusion of species as the ascospores it contains are not at all caudate and mostly 7-septate, and thus cannot belong to either of the Irish specimens he was studying. This mixture of data is

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suspected to be the source of the confusion for further workers examining material of *P. atlantica* and *P. effilata*.

Swinscow (1962: 47–49) assigned the two collections from Ireland he was studying to *P. nucula* Ach., a widespread pantropical species (McCarthy 2003: 73–74). The differentiation of this species from *P. atlantica* is quite difficult and has been discussed above, the main conspicuous difference being the size of mature perithecia.

The use of the epithet *nucula* was accepted by Poelt & Vězda (1977: 195, 201) for ''Ireland and Portugal'' and by Champion (1976: 30) for a collection from ''Anaga'' on Tenerife in the Canary Islands. Both *P. atlantica* and *P. effilata* are now recognized in Ireland and Portugal, while only *P. atlantica* is known in the Sierra de Anaga in Tenerife.

Following the suggestion by Harris (1975: 173), the name *P. heterospora* (Fink) R. C. Harris (=''*P. nucula* auct. brit., non Ach.'') was adopted in the *The Lichen Flora of Great Britain and Ireland* (Purvis *et al.* 1992: 491). However, it is clear from the description provided that the authors of the Flora were working with material of both *P. atlantica* and *P. effilata*. Indeed, meanwhile *P. atlantica* had been found in SW Ireland (collections made in 1982 by P. W. James and P. M. Jørgensen) and its conspicuous and large perithecia were noted by these lichenologists. The description of thallus and perithecia published in Purvis *et al.* (1992) reads as follows and was clearly inspired by Swinscow's drawing (1962: 47): ''Thallus (. . .) coarsely granular to verrucose, sometimes ± corrugate-wrinkled. Perithecia 0·5–0·9 mm diam., (. . .) largely covered by a thalline exciple containing locules with plaque-like crystals, immersed in thalline warts with only apex exposed''; it perfectly matches *P. atlantica*. The description of ascospores (''Ascospores 40–80 × 8–12 µm, 7–14-septate, fusiform-clavate'') refers to *P. effilata* and was also inspired by Swinscow's drawing.

The epithet *heterospora* was introduced in the lichen flora of Macaronesia by González *et al.* (1990: 106) for Tenerife and by Kalb & Hafellner (1992: 82) for Madeira. The area studied by González *et al.* is a part of the Sierra de Anaga where *P. atlantica* occurs, and the species is also common in all laurel forests of Madeira.

Kalb & Hafellner (1992: 83) described *P. isidiata* Kalb & Hafellner as the isidiate counterpart of specimens they referred to *P. heterospora* but are obviously identical with *P. atlantica*. We suggest that *P. isidiata* is merely a form of *P. atlantica* of no taxonomic value. Isidiate specimens of *P. atlantica* have been observed in all localities sampled in Macaronesia, as well as in European material. The isidia are globose to cylindrical and sometimes form coralloid proliferations on the thallus surface; they can be sparse and present only on parts of the thalli and seem to develop into coralloid outgrowths in specimens under stress. The distinction between abnormal outgrowths of the photobiont and genuine isidia in *Porina* is a difficult matter: the experience of McCarthy (1993: 16) suggests ''these structures are manifestations of rampant growth by the photobiont'', an opinion shared by Harris (1995: 171). However, the latter author described the new *Clathroporina isidiifera* on the basis for example of its ''true isidia, constricted at the base with an organization similar to that of the thallus''. It can indeed be suggested that two different types of ''isidia'' can be found in the genus, one being genuine isidia and acting as diaspores, and the other being ''adaptations to enhance gas exchange in a permanently humid environment'' (Grube *et al.* 2004*b*: 1161). A similar situation is found within populations of another species found mainly in La Palma (*P. ocoteae*; see below): many individuals do not produce such isidioid outgrowths, but those in apparently stressed conditions or growing in less suitable habitats do produce them; moreover, such thalli do not produce perithecia. In these cases (isidioid thalli in *P. atlantica* and *P. ocoteae*), we are convinced that the production of ''isidia'' does not represent a diagnostic criterion for taxonomic purposes. Otherwise, the collections referred to *P. isidiata* are identical with *P. atlantica*.

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Jørgensen (2000*a*) examined the type of *Ocellularia atlantica* Erichsen and found it to be identical with the populations named *P. heterospora* ''distributed from SW Ireland to Macaronesia''. The photograph provided of the type clearly indicates that it represents the species dealt with here as *P. atlantica*. However, the only collection made by Jørgensen in SW Ireland and with a hand-written identification label as *P. atlantica* seen by us (*P. M. Jørgensen* no. 9121, BG!) is typical *P. effilata*. He also examined (Jørgensen 2000*b*) an isidiate specimen he also had collected in SW Ireland during the same field trip in 1982 (*P. M. Jørgensen* no. 9126, BG!) and accepted the epithet *isidiata* for it. This specimen has a few isidia and definitely belongs to the isidiate form of *P. atlantica*.

In his revision of the saxicolous *Porina* in the Southern Hemisphere, McCarthy (1993: 49) reduced *P. heterospora* (Fink) R. C. Harris into synonymy with *P. guaranitica* Malme, described from rocks in Paraguay. This opinion was adopted by van den Boom *et al.* (1995: 278) for a collection from SW France, but was questioned by Harris (1995: 173). McCarthy (2003: 21) confirmed this view in his remarkable Catalogue of the *Porinaceae*, and further accepted the older epithet *atlantica* for the species. We believe that McCarthy adopted a broad species concept for this group, which includes *P. guaranitica* from S America, the *P. heterospora* group as studied in detail by Harris (1995: 172–175) for the south-eastern United States, *P. atlantica* as circumscribed here and the newly described *P. effilata*.

The type collection of *P. guaranitica* has been examined (Paraguay, Paraguaría, on basalt, 27 vi 1893, *G. O. A. Malme* 1469, S—lectotype). It grows on rock, its perithecia (immersed in thalline verrucae; see McCarthy 1993: 50, fig. 50) do not exceed 0·5 mm in diam. and have a pale orange periostiolar region; its ascospores are elongate-fusiform, slightly but distinctly tapering towards one end, 10–16-septate, 74–87 × 9–10 µm (plus a perispore 2 µm thick; Fig. 2A, 5A). Harris (1995: 173) also saw the type but gave different data on spore septation and size: ⩽9·5 septa⩾ and 57–71 µm long for ten spores examined. The specimens named *P. atlantica* here usually have larger perithecia with a larger and darker periostiolar region, and ascospores usually with fewer septa, and never tapering towards one end. Although we have not studied any other specimen from South America, we suggest that these differences might be worth recognition at the species rank. However, even if the populations from South America are to be considered as conspecific with those from Macaronesia, *atlantica* is the older epithet and can be used for the populations found in Macaronesia and Western Europe.

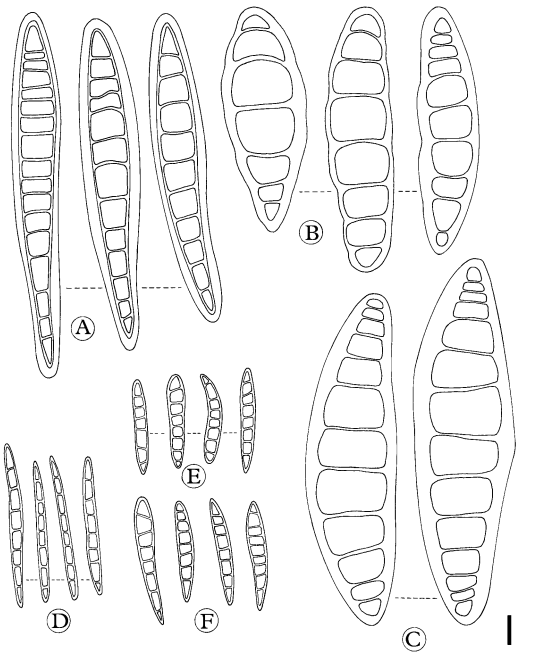

FIG. 5. Ascospores of *Porina* species. A, *P. guaranitica* [Paraguay, *G. O. A. Malme* 1469 (S—lectotype)]; B & C, *P. rhodostoma* [B, Cuba, *C. Wright*, (G—holotype); C, Dominica, 26 iii 1998, *E. Sérusiaux* s. n. (LG)]; D, *P. leptospora* [Azores, *F. Berger* 15974 (hb Berger)]; E & F, *P. borreri* [E, France, Ste Engrâce, 10 vii 1989, *E. Sérusiaux* s. n. (LG); F, Belgium, Furfooz, *P. van den Boom* 13835 (LG)]. Scale=10 µm.

In his study of the *Trichotheliaceae* from Florida (USA), Harris (1995: 172–175) described *P. heterospora* (Fink) R. C. Harris with clavate spores having a long tapering

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tail, (9–)11–13-septate, 85–110 × 12–14 µm. We can confirm such a description on the basis of specimens from SE USA and Guatemala (see list below; Fig. 4C–E). Such shape, septation and size are completely different from either species dealt with here (*P. atlantica* or *P. effilata*) and the epithet *heterospora* can thus be excluded from the flora of Europe and Macaronesia. *Porina heterospora* is said (Harris 1995: 173) to be common in the southern coastal plain of SE USA, as well as Cuba and Venezuela.

McCarthy & Malcolm (1996: 549) introduced the epithet "aff. *rubrostoma* Müll. Arg." (a mispelling of *rhodostoma* Müll. Arg.) for a collection from Tenerife (Las Montañas de Anaga). The corresponding specimen has not been examined but we assume it belongs to *P. atlantica*, as two specimens have been seen from the very same area in Tenerife. McCarthy (2003: 84) has also used the epithet *rhodostoma* for the specimen from SW Ireland named *isidiata* by Jørgensen (2000*b*), which we here refer to *P. atlantica* (see above). The epithet now appears in the *Checklist of Great Britain and Ireland* (Coppins 2002: 47; see also http://users.argonet.co.uk/users/jmgray/checklist.html, visited on Dec. 29th, 2004, no longer in use and replaced by http://www.thebls.org.uk/checklist.html#P, visited on July 31th, 2006). Besides the type collection and these other two specimens, *P. rhodostoma* has never been cited elsewhere in the literature (McCarthy 2003: 84).

The type collection of *P. rhodostoma* was also examined (Cuba, *C. Wright* "Ser. II, 539, G—holotype). It grows on bark, has a rugulose to verrucose thallus, large and rather flattened perithecia immersed in thallus verrucae (up to 0·8 mm diam.), with a conspicuous, large, typically dark red (dark red to red-brown) periostiolar region. The original description states that the ascospores are "fusiformes, 65–80 µm longae et 10–12 µm latae, 7–11-septatae, loculi 2 intermedii reliquis longiores". Two perithecia have been sectioned and the ascospores found outside the asci are rather badly preserved; they are largely fusiform, with rounded ends, not tapering towards one end, 5–9-septate, 41–64 × 13–17 µm (plus a 3 µm thick perispore; Fig. 5B). We have seen no collection from Macaronesia that could match such characteristics.

A healthy, recently collected specimen from Dominica, West Indies (Fig. 2D; see below), is referred to the same species; its thallus and perithecia are identical, its ascospores have the same shape but are 11–13-septate and measure 74–89 × 21–26 µm (plus a 2–3 µm thick perispore; Fig. 5C). If further collections can confirm these observations, it would mean that the ascospores studied in the type are not yet fully mature. We suggest that these two collections represent a different taxon from *P. atlantica*, differing mainly by the typically dark red and large periostiolar region and by the size and septation of the ascospores.

Ecology and distribution. Porina atlantica occurs in all stands of the laurisilva studied in Madeira (where it can be common) and the Canary Islands; so far, no specimens have been collected in the Azores. It usually grows on bark in rather shaded places and has been recorded on basalt boulders in La Palma, inside well-preserved laurisilva where the species is rather common on trees. It is also known from several localities along the Atlantic coast of western Europe where it seems to be very rare: SW Ireland in two localities, France (Brittany and the western Pyrenees), and Portugal (Sintra). In Brittany, the thallus of the only collection available is typical (isidioid outgrowths are also present), but no mature perithecia could be seen. It must also be noted that all European localities are well-known for their well-developed lichen flora comprising several typical atlantic species.

Specimens examined. **France:** *Dépt. Finistère*: 26 km W of Huelgoat, forêt de Cranou, near St-Conval, on old *Quercus*, 175 m, 1996, *A. M. Brand* 34439 (hb Brand). *Dépt. Pyrénées Atlantiques*: Ste Engrâce, near entrance of Gorges of Kakouetta, shaded wood, on *Buxus*, 510 m, 1992, *P. van den Boom* 12821 (hb van den Boom).—**Ireland: V. C. H2**, North Kerry: Cromaglown bridge, on *Quercus*, 1982, *P. M. Jørgensen* 9126 (BG—L/48004, mentioned as *P. isidiata* by Jørgensen 2000*b*); Killarney, Meeting of the Waters, N of old Weir Bridge, on old sheltered *Quercus* at shore, 2000, *A. M. Brand* 40241

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(hb Brand). **V. C. H3**, West Cork: Glengarriff woods, shaded side of old *Quercus*, 20 ix 1982, *P. W. James* s. n. (BM).—**Portugal:** W of Lisboa, Sintra, near Capuchos monastery, on old *Cupressus*, 250 m, 2003, *A. M. Brand* 49770 (hb Brand).—**Canary Islands:** *Gomera*: Parque Nacional de Garajonay, El Cedro, chemin depuis le village jusqu'à l'Ermita, le long du barranco del Cedro, laurisylve de fond de vallée, avec *Persea indica*, 900–950 m, 26 vii 1994, *E. Sérusiaux* s. n. (LG, 2 collections). *La Palma*: 8·5 km N of Santa Cruz, Bco la Galga, Cubo de la Galga, laurisilva forest in cleft, 550 m, 1999, *P. van den Boom* 22430 (hb van den Boom); *ibid.*, on basalt boulder inside the forest, 580 m, 1986, *A. M. Brand* 13313 (hb Brand); Los Tilos (W de Las Lomados), laurisilve riche en *Hedera canariensis* et en fougères (dont *Woodwardia radicans*), on bark, 800–850 m, vii 1997, *E. Sérusiaux* s. n. (LG); *ibid.*, 600–700 m, iv 2004, *E. Sérusiaux* s. n. (LG); *ibid.*, near picnic place, on old *Octoea*, 450 m, 1986, *A. M. Brand* 13558 (hb Brand); Barranco Gallegos, croisement de la route Barlovento-Roque Faro par la laguna de Barlovento, rochers de basalte en sous-bois, 900 m, iv 2004, *E. Sérusiaux* s. n. (LG). *Tenerife*: Laurisilva, head of San Andres Valley near El Bailadero, Sierra de Anaga, 1964, *H. A. & F. H. Imshaug* 35802 (LG); Las Mercedes, on trees, 600–700 m, xii 1984, *C. Hdez Padrón* (E).—**Madeira:** Ribeiro Frio, Hänge SW oberhalb der Fischzuchtanstalt, in Lorbeerwald mit einzelnen Kastanienbäumen, aus *Laurus azorica*, 950 m, 1990, *K. & A. Kalb* 23710 (hb Kalb); Ribeiro Frio, le long de la Levada de Portela, laurisylve ± dégradée, 850 m, ii 1988, *E. Sérusiaux* s. n. (LG); S de Seixal, Chão da Ribeira, début du chemin montant vers Fanal, laurisylve peu perturbée, 500 m, vii 2003, *E. Sérusiaux* s. n. (LG); Rabaçal, entre les maisons de Rabaçal et la Cascata do Risco, fourrés d'*Erica* en bordure de la levada, 1050 m, vii 2003, *E. Sérusiaux* s. n. (LG); Fanal (le long de la route Ribeira de Janela vers Paul da Serra), vieux *Ocotea foetens* dans un pâturage, 1100 m, vii 2003, *E. Sérusiaux* s. n. (LG); Route Ribeira Brava/São Vicente, un peu au N de Boca de Encumeada, fourrés du Fayal-Brezal avec quelques fûts, 900 m, vii 2003, *E. Sérusiaux* s. n. (LG); Casa das Queimadas, promenade vers Caldeirão Verde, fourrés d'*Erica* en bordure de la levada et arbres plantés, 900 m, vii 2003, *E. Sérusiaux* s. n. (LG).

Selected specimens examined for other species mentioned.

Porina heterospora (Fink) R. C. Harris: **USA:** *Florida*: along road no. 361 between Adams Beach and the highway ALT27, Spring Warrio creek, on *Cupressus* by a swamp, 5 m, 1976, *E. Sérusiaux* 1765 (LG). *Louisiana*: East Feliciana Parish, Idlewild Experimental Farm, *c.* 3 miles SE of Clinton, 30°48′N 90°45′W, on *Quercus* in downed hardwoods, 1979, *S. C. Tucker* 18481 (E).—**Guatemala:** *Dept. Alta Verapaz*: NW of Coban, "Las Victorias" forest in the national park, 15°28.4′N 90°22.8′W, on trunk of small tree, 1320 m, 2004, *P. van den Boom* 33491 (hb van den Boom, LG).

Porina nucula Ach.: **Papua New Guinea:** *Madang prov.*: near Bogia, along road Bogia-Josephstaal, 4°27′S 144°56′E, on trunk of felled trees among gardens, 330 m, 1992, *P. Diederich* 11489 (LG, hb Diederich); Burbura logging site, c. 30 km NNW of Madang, 4°50′S 145°38′E, on tree in virgin rainforest on low hills, 70 m, 1992, *P. Diederich* 11901 & 11909b (LG, hb Diederich).

Porina mastoidea (Ach.) Müll. Arg.: **Papua New Guinea:** *Madang prov.*: near Bogia, along road Bogia–Josephstaal, 4°27′S 144°56′E, on trunk of felled trees among gardens, 330 m, 1992, *P. Diederich* 11491 (LG, hb Diederich); near Bogia, Laing Island in Hansa Bay, 4°10′S 144°52′E, corticolous in coastal forest on coral island, 1 m, 1992, *P. Diederich* 11644 (LG, hb Diederich).

Porina rhodostoma Müll. Arg.: **West Indies:** *Dominica*: Cabrit National Park, disturbed dry forest, on tree, c. 100 m, 26 iii 1998, *E. Sérusiaux* s. n. (LG).

Porina effilata Brand & Sérus. sp. nov.

A speciebus generis in Europa et Macaronesia differt a sporis caudatibus, (7–)9–11(–13)-septatis, (65–)68–83(–85) × 7–11 µm.

Typus: Canary Islands, Gomera, Parque Nacional de Garajonay, El Cedro, chemin depuis le village jusqu'à l'Ermita, le long du barranco del Cedro, laurisilve de fond de vallée, avec *Persea indica*, sur tronc, 900–950 m, 26 July 1994, *E. Sérusiaux* s. n. (LG—holotypus).

Porina atlantica auct. europ. p. p., non (Erichsen) P. M. Jørg., *Graphis Scripta* **12:** 1 (2000).

Porina guaranitica auct. europ. p. p., non Malme, *Ark. Bot.* **23(A):** 13 (1929).

Porina heterospora auct. europ. p. p., non (Fink) R. C. Harris, in Tucker & Harris, *Bryologist* **83:** 12 (1980).

Porina nucula auct. europ. p. p., non Ach., *Syn. Meth. Lich.*: 112 (1814).

(Figs 1C & D, 6A–C, 7B)

Thallus mainly epiphloeodal, able to overgrow corticolous liverworts and mosses, crustose and rather thin, green to dark green or pale beige and ± pinkish, sometimes with a tinge of blue, rather matt, rarely shiny, not containing large oxalate crystals, without a prothallus. *Isidia* very rare (seen only on parts of thalli in a few collections from Ireland), simple, almost globose, *c.* 0·1 mm high, not glossy and usually almost powdery, easily detached from the thallus.

Perithecia rare or abundant, at first immersed in the thallus and occasionally remaining so for a long time (and therefore hardly visible), or protuberant and sessile, not included in thallus-dominated verrucae, sometimes remaining hidden in cracks of the bark or under bryophytes, subglobose, 0·3–0·45(–0·5) mm diam.; perithecia initially

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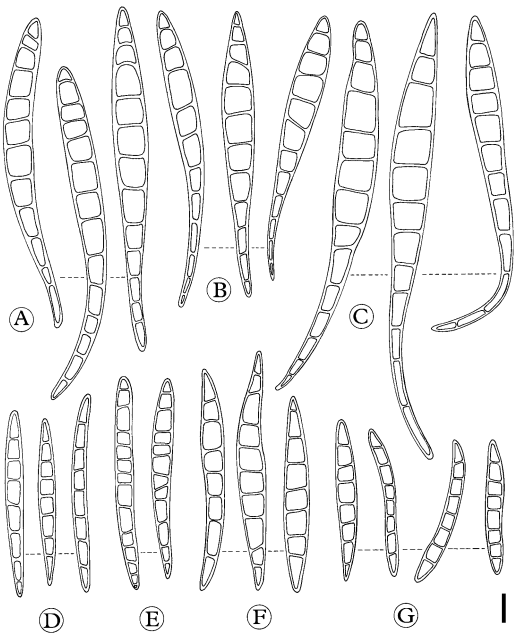

FIG. 6. Ascospores of *Porina* species. A–C, *P. effilata* [A, Gomera, El Cedro, 26 vii 1994, *E. Sérusiaux* s. n. (LG—holotypus); B, La Palma, Bco la Galga, *A. M. Brand* 13302 (hb Brand); C, Ireland, West Cork, Glengarriff, 11 viii 1966, *P. W. James* s. n. (BM)]; D & E, *P. ocoteae* [D, La Palma, Los Tilos, iv 2004, *E. Sérusiaux* s. n. (LG—holotypus); E, La Palma, Los Tilos, *P. van den Boom* 22174 (hb van den Boom)]; F, *P. africana* [Guatemala, *P. van den Boom* 33423 (hb van den Boom, LG)]; G, *P. tetracerae* [Rwanda, 30 iii 2005, *E. Sérusiaux* s. n. (LG)]. Scale = 10 μm.

covered by a thin, greenish thallus layer that can remain for a long time around the base, pale orange to orange, sometimes pinkish, rarely almost translucent, K+ bright orange to deep red, sometimes distinctly and finely greyish-whitish tomentose in the upper half, rarely slightly verruculose, with a central ostiole appearing as a pale or translucent dot or as a hole. *Involucrellum* well-developed, especially in upper parts, separated from the excipulum in old and overmature perithecia, especially near the base, *c.* 20–25 μm thick. *Excipulum* pale orange, *c.* 15–20 μm thick. *Paraphyses* usually abundant, simple or rarely branched near the base, not inflated at the apices, 1–1·5 μm thick. *Asci* cylindrical-clavate, up to 180 × 20 μm when fully mature. *Ascospores* 8/ascus, narrowly fusiform, slightly but distinctly inflated in the upper half and tapering towards the proximal end, straight or usually slightly curved, (7–)9–11(–13)-septate, (65–)68–83(–85) × 7–11 μm, with a thin but distinct perispore.

Pycnidia very rare, ± immersed in the thallus with only the ostioles visible, 0·1–0·2 mm diam., with a pale orange, K+ bright orange wall. *Pycnidiospores* cylindrical, straight or slightly curved, with rounded ends, hyaline, simple, 15–17(–18) × *c.* 1 μm.

Notes. This new species is easily distinguished by its pale orange, sometimes pinkish, and rather small perithecia, not included in thallus warts (albeit sometimes remaining immersed in the thallus and thus hardly visible, or sometimes covered by a thin thallus layer in young stages that can remain around their base), sometimes with a distinct tomentum in their upper half, and by its long, distinctly tapering, mainly 9–11-septate ascospores. Its thallus never contains agglomerations of large oxalate crystals. It does not belong to the same group as *P. atlantica* with which it has been confused; we suggest it comes close or even belongs to *Segestria* Fr. *sensu* Harris (1995: 175–176) or to the *Porina rufula* group *sensu* Lücking (2004: 410, 416–417).

No close relative has been found in the literature. *Porina sylvatica* McCarthy & Kantvilas, known from SE Australia (McCarthy & Kantvilas 1993: 144–145), has larger (0·43–0·72 mm diam.), smooth and orange-brown to reddish brown perithecia and its ascospores are narrower (6·5–9·5 μm), not tapering towards their proximal ends. *Porina speciosa* McCarthy & Malcolm, from New Zealand (McCarthy & Malcolm 1996), has larger (0·56–1·01 mm diam.), smooth perithecia and much larger ascospores (65–122 × 15–22 μm) with a thick perispore.

As explained above under *P. atlantica*, *Porina effilata* has been mentioned in the European literature under many different epithets: *P. nucula* (Swinscow 1962: 47–49), *P. heterospora* (Purvis *et al.* 1992: 491), *P. guaranitica* (McCarthy 1993: 49–54), and *P.*

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atlantica (Jørgensen 2000*a*). None of these epithets match this species. The most obvious difference between all these species and *P. effilata* is the presence of large oxalate crystals (crystallocumuli) in their thalli and in the thallus layer covering the perithecia; indeed, all these species belong to *Porina* s. str. *sensu* Harris (1995: 170, 172–175) or to the *Porina nucula* group *sensu* Lücking (2004: 410–412). However, the perithecia of *P. effilata* can reach full maturity (i.e. producing mature ascospores) while still deeply immersed in the thallus, and thus with only their upper part visible; even when sessile and subglobose, their bases can still be covered by a thin thallus layer; these two features can be confusing. Moreover, the long and tapering ascospores of both *P. guaranitica* and *P. heterospora* are quite similar to those of *P. effilata* and we suspect that Swinscow (1962: 47–49) had been confused by such a strong convergence.

In the field, *Porina effilata* can be confused with *Belonia lumbrispora* Etayo (Etayo 1996) with which it often grows in the Canary Islands. The perithecia of the latter are however slightly smaller, more yellowish or orange and are not pilose. Examination under the microscope immediately confirms that *Belonia* has a hamathecium filled with yellow oily droplets and ascospores that are multiseptate (40–55 septa), filiform, flexuose, very narrow, and measuring 125–160 × 3–4 μm.

The specimens from Macaronesia differ somewhat from those from the British Isles, mainly Ireland. All major characters that are diagnostic for the species are shared by both populations, but there are slight but significant differences in the size of perithecia and ascospores. This matter has not been studied in detail but can be demonstrated by the following comparison: *A. M. Brand* 13302 (hb Brand) from La Palma (Canary Islands) has perithecia always distinctly pilose, 0·4–0·5 mm diam., and ascospores (60–)62–*70·8*–81(–85) μm long (*n*=22) (Fig. 6B), while the collection by *P. W. James*, coll. 11 viii 1966 (BM) from Glengarriff, West Cork, Ireland, has smooth or rarely pilose perithecia, 0·5–0·6 mm diam., and ascospores (76–)80–*87·6*–94 (–104) μm (*n*=16) (Fig. 6C). Ascospores have been measured in standard conditions (mounted in water; only those expelled from asci under gentle pressure measured). We would not be surprised that future studies, based on more detailed analysis of the variation (including molecular techniques), might indicate two different taxa are involved.

Ecology and distribution. Porina effilata has been found in Madeira and in the Canary Islands (Tenerife, Gomera and La Palma), always in rather preserved stands of the laurisilva where it can grow on bark as well as on twigs. It is rare but, as it is an inconspicuous species, it may have been overlooked. It is also known from SW Ireland, Wales, and N Devon in England, where it is also quite rare and grows on old, mossy bark of *Quercus*, usually at the base of the trees, in highly preserved and humid localities. Both collections from Wales and one from Ireland are from bryophytes growing over rocks in sheltered conditions, and thus represent the only localities where *P. effilata* is not corticolous; one of them is the type locality of the recently described *Biatora britannica* Printzen, Lumbsch & Orange (Printzen *et al.* 2001). An additional locality is known in Portugal in the famous locality at the monastery of Sintra where the species is found in much more artificial conditions (bole of *Cupressus* in parkland).

Specimens examined. **Great Britain:** *England*: **V.C. 4**, North Devon: Bideford, Clovelly, woodland below (NW of) Gallantry Bower, on mossy base of large *Quercus*, 45 m, 1994, *B. J. Coppins* 16465 & *A. M. O'Dare* (E). *Wales*: **V.C. 46**, Cardiganshire: near Cardigan, Coedmor National Nature Reserve, SE of Coedmore house, on bryophytes on vertical rock face sheltered by ivy, 1996, *A. Orange* 10998 (NMW). **V.C. 48**, Merioneth: Talsarnau, Bryn Bwbach, Ceunant Coch, on slightly calcareous rock face in woodland, 2002, *A. Orange* 13840 (NMW).—**Ireland: V.C. H2**, North Kerry: Killarney, Cromaglown, on trees, viii 1935, *D. A. Jones* s. n. (BM); Eagle's Nest, shady ledge on shale cliff, on bryophytes, 26 vi 1961, *T. D. V. Swinscow* s. n. (BM, 2 specimens); near Killarney, Eagle's Nest Mountain, on *Quercus* in wood, 14 viii 1966, *P. W. James* s. n. (BM); Torc Mountain, oak in shade on west-facing slope, 31 vii 1965, *T. D. V. Swinscow* s. n. (BM); Killarney, Muckross, on *Quercus*,

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14 viii 1966, *P. W. James* s. n. (BM, E); Killarney Lake, Dinish Island, Camillan wood, on oak, 17 ix 1982, *P. W. James* s. n. (BM), *P. M. Jørgensen* 9121 (BG—L/48007) and s. n. (E); Killarney, Meeting of the Waters, N of old Weir Bridge, on old sheltered *Quercus* at shore, 2000, *A. M. Brand* 40242 (hb Brand). **V. C. H3**, West Cork: Glengarriff, road to Barley Lake, on shaded bole of *Quercus*, 11 viii 1966, *P. W. James* s. n. (BM).—**Portugal:** W of Lisboa, Sintra, near Capuchos monastery, on old *Cupressus*, 250 m, 2003, *A. M. Brand* 49782 (hb Brand).—**Canary Islands:** *La Palma*: 4·5 km WSW of Los Sauces, Los Tilos, laurisilva, narrow cleft with path along N facing rock sheer, on *Laurus azorica* and *Ocotea foetens*, 750–800 m, 1999, *P. van den Boom* 22240 & 22273 (hb van den Boom); *ibid*., narrow cleft with path over Bco del Aqua, mixed trees near bridge, on tree, 800 m, 1999, *P. van den Boom* 22285 (hb van den Boom); *ibid*., gorges profondes avec laurisilve, 600–700 m, sur arbre, iv 2004, *E. Sérusiaux* s. n. (LG, 5 collections); 8.5 km N of Santa Cruz, Bco la Galga, Cubo de la Galga, laurisilva forest in cleft, 550 m, 1999, *P. van den Boom* 22457 (hb van den Boom); *ibid*., on bark of young trees of Lauraceae in wood, 580 m, 1986, *A. M. Brand* 13302 (hb Brand); *ibid*., 500–600 m, on twigs, iv 2004, *E. Sérusiaux* s. n. (LG). *Tenerife*: Laurisilve de Monte del Agua, chemin au départ de Erjos, vers Las Portelas, laurisilve en mosaïque avec des fourrés de *Erica*, sur troncs, 900 m, 27 ii et 2 iii 1997, *E. Sérusiaux* s. n. (LG, 3 collections).—**Madeira:** Casa das Queimadas, chemin vers Caldeirâo Verde, laurisylve ± dégradée, 850–900 m, v 1992, *E. Sérusiaux* s. n. (LG); S de Seixal, Chão da Ribeira, le long du Riba da Seixal, plus haut que l'élevage de truites, laurisilve en bord de torrent, sur tronc, 500 m, vii 2003, *E. Sérusiaux* s. n. (LG, 2 collections).

Porina fortunata P. M. McCarthy & Etayo

Lichenologist **34:** 199 (2002); type: Canary Islands, Gomera, La Meseta de Vallehermoso, cliff of the "Cueva Encantada", on shaded basalt in laurisilva, 720 m, 22 vii 2000, *J. Etayo* 17823 & *A. Fernández* (TFC—holotypus, not seen; CANB, hb Etayo—isotypi, not seen).

This saxicolous species has been recently described from shaded basalt rocks in the laurisilva of Gomera in the Canary Islands (McCarthy & Etayo 2002), and is here reported from similar habitats in La Palma (collection checked by P. M. McCarthy). *Porina fortunata* has hemispherical to subglobose, small [(0·22–)0·28(–0·36) mm diam.], dark reddish brown to ± black perithecia and ascospores 3(–7)-septate, narrowly oblong to almost cylindrical with rather rounded ends, 18–*25*–33 × 2·5–*3*–4 μm.

Specimen examined. **Canary Islands:** *La Palma:* 8·5 km N of Santa Cruz, Barranco La Galga, laurisilva forest in cleft with volcanic rockface, on shaded basalt boulder, 500 m, 1999, *P. van den Boom* 22447 (LG, hb van den Boom).

Porina leptospora (Nyl.) A. L. Sm.

Monogr. Brit. Lich. **2:** 338 (1911).—*Verrucaria leptospora* Nyl., *Flora* **47:** 487 (1864).

Porina olivacea (Pers.) A. L. Sm. var. *leptospora* (Nyl.) Keissler, *Rabenhorst Kryptogamen Flora*, Band 9, Abt. 1, Teil 2: 318 (1938).

Porina borreri (Trevis.) D. Hawksw. & P. James var. *leptospora* (Nyl.) D. Hawksw., *Lichenologist* **24:** 367 (1992). Type: Ireland: Kerry, Killarney, Dinish, on *Ilex*, *I. Caroll* (?BM—holotypus; not seen).

(Fig. 5D)

This taxon is either considered to be synonymous with *Porina borreri* (Trevis.) D. Hawksw. & P. James (Santesson *et al*. 2004: 271, sub *Pseudosagedia borreri*), or a variety [var. *leptospora* (Nyl.) D. Hawksw.; Purvis *et al.* 1992: 490]. In corticolous material of *Porina* with black perithecia and 7-septate ascospores in Macaronesia, we encountered only populations with narrow, almost cylindrical ascospores, rarely tapering towards one end that measure 37–50 × 2·5–3·5 (–4·0) μm. In material identified as *P. borreri* in continental Europe, ascospores are fusiform or clavate-fusiform and measure 22–33(–35) × 3–5 μm (Fig. 5E & F). We did not find any specimens with intermediate ascospores and thus believe the species rank is more appropriate for these taxa.

Porina leptospora occurs in the laurisilva in Macaronesia (La Palma and Tenerife, Canary Islands and São Miguel in the Azores) and, to our knowledge, is known with certainty only from SW Ireland and Devon in Western Europe. Although we have not seen the material, we assume that the reports of *P. borreri* from Madeira by Kalb & Hafellner (1992: 81–82) and Los Tilos in La Palma by Etayo (1996: 156, sub *Pseudosagedia borreri*) belong to *P. leptospora*.

Selected specimens examined. **Canary Islands:** *La Palma*: Los Tilos, W de Las Lomados, laurisilve

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dominée par *Ocotea foetens*, riche en *Hedera canariensis*, sur tronc, 600–700 m, vii 1997, *E. Sérusiaux* s. n. (LG); *ibid.*, sur un vieux *Ocotea*, iv 2004, *E. Sérusiaux* s. n. (LG). *Tenerife*: laurisilve de Monte del Agua, chemin au départ de Erjos vers Las Portelas, sur tronc d'*Erica*, 27 ii 1997, *E. Sérusiaux* s. n. (LG).—**Azores:** *São Miguel*: Praia, Caminho do Praia to Lagoa do Fogo, shady hollow, on *Myrica faya*, 120 m, 2003, *F. Berger* 17801 (hb Berger); Lagoa Furnas, Uferweg an NW Ecke, auf *Alnus cordifolia* & *Quercus* sp., 280 m, 2001 & 2003, *F. Berger* 15974, 17813, 17814 (hb Berger).

Selected specimens examined for Porina borreri: **Belgium:** *prov. Namur*: 1·2 km S of Furfooz, Parc national de Haute Recène, S-exposed slope, on big *Acer*, 160 m, 1993, *P. van den Boom* 13835 (LG).—**France:** *dépt. Pyrénées-Atlantiques*: Ste Engrâce, gorges de Kakouetta, fourrés de *Buxus* très humides à l'entrée des gorges, sur *Buxus*, 10 vii 1989, *E. Sérusiaux* s. n. [with P. W. James, F. Rose & J. Vivant] (LG).

Porina ocoteae Brand & Sérus. sp. nov.

A speciebus generis in Europa et Macaronesia differt a sporis elongatis-fusiformibus, 7–11(–13)-septate, (42–)44–50(–53) × (3·5–)4–5 µm.

Typus: Canary Islands, La Palma, W de Los Sauces, "Los Tilos", gorges profondes avec laurisilve et présence de vieux fûts d'*Ocotea*, base de tronc d'*Ocotea*, alt. 600–700 m, April 2004, *E. Sérusiaux* s. n. (LG—holotypus).

(Figs 1E & F, 6D & E, 7C)

Thallus epiphloeodal, able to overgrow liverworts and mosses growing on the bark, very rarely (one specimen seen) on basaltic rock at the base of a tree on which the species was abundant, crustose, shiny green to grey-brown, or sometimes pale brownish or olive-grey, usually maculate with black irregular patches, adherent to the bark but frequently forming bullate portions, bulges or ridges, and thus appearing to peel off from the bark, locally with oxalate crystals deposited in globose or irregular masses (crystallocumuli *sensu* Hafellner & Kalb 1995: 163–164); prothallus almost always present, to 0·5 mm wide, black or bluish black, sometimes covered by a thin, white and conspicuous hyphal layer that can give the prothallus a fibrous or cottony appearance. *Isidia* locally present, sometimes common, especially on thalli without perithecia and on apparently stressed specimens,

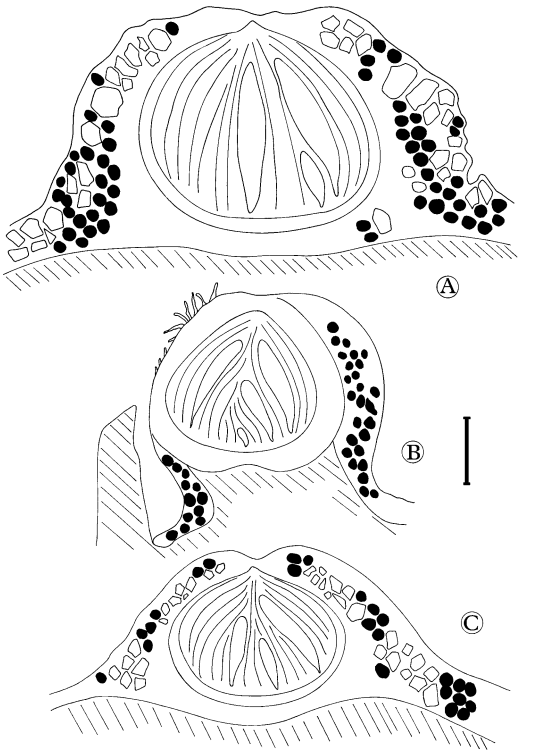

FIG. 7. Cross-sections through perithecia of *Porina* species. A, *P. atlantica* [Madeira, Chão da Ribeira, vii 2003, *E. Sérusiaux* s. n. (LG)]; B, *Porina effilata*, perithecium still covered with a thallus layer on its right side and with its left side emerged from the thallus and slightly pilose on its upper part [Gomera, El Cedro, 26 vii 1994, *E. Sérusiaux* s. n. (LG—holotypus)]; C, *P. ocoteae* [La Palma, Los Tilos, iv 2004, *E. Sérusiaux* s. n. (LG—holotypus)]. Scale = 100 µm.

simple or coralloid, shiny or with an eroded surface, sometimes globose and constricted several times along their length, brittle and easily removed, concolorous with the thallus or paler, 0·1–1·0 mm high.

Perithecia abundant or absent, especially absent on thalli with well-developed isidia, hemispherical to subglobose, very rarely constricted at the base, 0·5–0·6(–0·7) mm diam., typically covered by a thallus layer containing masses of oxalate crystals and thus appearing as included in a large thallus wart; ostiolar region slightly depressed or not, concolorous with the thallus or pale orange to reddish, sometimes brownish. Involucrellum typically pale orange and K+

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bright orange to reddish, best developed in the upper half of the perithecium, *c.* 25 µm thick. *Excipulum* pale yellow, *c.* 10 µm thick. *Paraphyses* abundant, simple or rarely branched, especially near the base, not inflated at apices, *c.* 1·5 µm thick. *Asci* cylindrical-clavate, 150–170 × 10–15 µm. *Ascospores* 8/ascus, elongate-fusiform, sometimes slightly tapering towards one end, straight or slightly curved, 7–11(–13)-septate, (42–)44–50(–53) × (3·5–)4–5 µm, without a perispore.

Pycnidia rare, immersed in the thallus, *c.* 0·2 mm in diam., with a hyaline or pale orange, K+ bright orange wall. *Pycnidiospores* ellipsoid, hyaline, simple, 2·5–3·5 × 1·0–1·5 µm.

Notes. In Macaronesia, this species is easily distinguished from all other corticolous *Porina* with large perithecia by its shiny green to grey-brown thallus, usually maculate with black irregular patches, peeling off from the bark and frequently forming bullate portions, bulges or ridges, a typical black or bluish black prothallus, and narrow ascospores (not exceeding 5 µm wide).

Porina ocoteae belongs to the *P. mastoidea* group (referred to the genus *Clathroporina* by Harris 1995: 171). Closely related species include the pantropical *P. africana* Müll. Arg. and *P. tetracerae* (Ach.) Müll. Arg. (Fig. 6F & G). The former has perithecia with a typically black periostiolar region and less septate ascospores [(5–)7(–9): McCarthy 2001: 113] and the latter also has perithecia with a dark periostiolar region and regularly 7-septate ascospores 24–44 µm long (McCarthy 2001: 150). The material from Florida (USA) identified by Harris (1995: 171) as *P. tetracerae* has longer ascospores (35–50 µm). In any case, *P. ocoteae* consistently has narrower ascospores and most have more than 7 septa, making its distinction from *P. africana* and *P. tetraceae* easy. Dr P. M. McCarthy has studied several of our collections and confirmed (*in litt.*, 4. 2003) that they represent an undescribed species.

Ecology and distribution. The new species is named after its principal phorophyte, the laurel tree *Ocotea foetens* (Ait.) Benth. & Hook. f. (''el til'' in Spanish). On the island of La Palma (Canary Islands) in the two famous sites of Los Tilos and Cubo de La Galga, *Ocotea foetens* forms a few spectacular groves of old trees, becoming multi-stemmed by self-coppicing and with large and complex bases, which develop wood rolls expanding downwards and on which this new species of *Porina* develops conspicuous populations. *Porina ocoteae* has never been observed on other tree species, even at Los Tilos; it is however able to grow on basaltic stones embedded in the bases of *Ocotea* trees on which it is present. Fully developed and fertile collections are known only from Los Tilos; mostly sterile specimens are known from the other localities in La Palma and on São Jorge in the Azores. Accompanying species in Los Tilos include *Porina aenea, P. leptospora* and the very rare *Strigula brevis* (Roux & Sérusiaux 2004: 53–55). Easily detected because of its shiny green thallus with a conspicuous black prothallus, *Porina ocoteae* must be considered as a very rare species as it has not been observed elsewhere in the Canary Islands, nor in Madeira. Its status in the Azores must be further studied.

Specimens examined. **Canary Islands:** *La Palma*: Los Tilos (W de Las Lomados), laurisilve dominée par *Ocotea foetens*, riche en *Hedera canariensis*, on bark, 600–700 m, vii 1997, *E. Sérusiaux* s. n. (LG, 2 collections); *ibid.*, 800–850 m, vii 1997, *E. Sérusiaux* s. n. (LG); *ibid.* narrow cleft with path along N facing rock sheer, on *Ocotea*, 700 m, 1999, *P. van den Boom* 22174 (hb van den Boom); 3·5 km WSW of Los Sauces, N slope of Barranco del Agua, at the base of *Ocotea* in laurel wood, 530 m, 1986, *A. M. Brand* 13599 (hb Brand); 8·5 km N of Santa Cruz, Bco La Galga, laurisilva forest in cleft, on *Ocotea*, 500 m, 1999, *P. van den Boom* 22424 (hb van den Boom); La Galga, gorges au lieu-dit ''Cubo de La Galga'', 500–600 m, laurisilve sur flancs pentus, iv 2004, *E. Sérusiaux* s. n. (LG).— **Azores:** *São Jorge*: Weg Ribiera da Cedro – Faja do Alem, Hortensienhecke, auf abgestorbener *Hydrangia*, 450 m, 2001, *F. Berger* 15771 (hb Berger).

Selected specimens examined for other species mentioned. Porina africana Müll. Arg.: **Guatemala:** Dept. Baja Verapaz, SSE of Coban, SSE of Purulhá, Biotope Mario Dary Rivera, 15°13.2′N 90°13.9′W, NE exposed slope with tropical rain forest, on trunk of small

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tree, 1850 m, 2004, *P. van den Boom* 33423 (hb van den Boom, LG).

Porina tetracerae (Ach.) Müll. Arg.: **Rwanda:** *prov. Cyangugu*: Cyamudongo forest, 02°33′50·6″S, 28°58′94·9″E, lower montane forest with very tall trees of *Newtonia buchananii*, *Entandrophragma excelsum*, etc., on small trunks and lianas, 2000 m, 30 iii 2005, *E. Sérusiaux* s. n. [Field trip to Rwanda with Damien Ertz, Eberhard Fischer & Dorothee Killmann, 2005] (LG).

Key to the species of *Porina* in Macaronesia

1 On living leaves; ascospores 3-septate 2
On bark; ascospores with 3 or more septa 4
On rocks; ascospores with 3 or more septa 9

2(1) Perithecia black, usually lens-shaped, rarely hemispherical . ***P. oxneri*** R. Sant.
[very rare: reported only once from Gomera, Canary Islands by Etayo (1998: 102), *sub Pseudosagedia obsoleta* (Oksner) Hafellner & Kalb; not checked by us]
Perithecia never ''pure'' black, always with a reddish tinge, always constricted at the base 3

3(2) Perithecia 0·2–0·3 mm diam., subglobose or almost so, brownish red, at least when young partly covered by hyphal tissue; algal cells typically present in a layer between the inner and outer walls of the perithecium . . . . . ***P. hoehneliana*** (Jaap) R. Sant.
[very rare: known only from two localities in Madeira, i.e. the laurisilva of Riba da Seixal at 300–400 m, where it is abundant, and Chão de Louros where it was found in 1951 by C. Tavares but not seen there since]
Perithecia 0·1–0·2 mm diam., globose or vertically elongated, dark red to dark reddish brown; no hyphal tissue covering the perithecia and no algal cells present between the perithecial walls . . . . . ***P. leptosperma*** Müll. Arg.
[known only from Madeira where it is abundant in the laurisilva, even when heavily disturbed]

4(1) Thallus bluish grey or grey, rather pinkish when fresh, with abundant, simple to coralloid isidia which usually have hyaline, apical 'hairs'; perithecia rare or absent; ascospores ellipsoid, 9–11-septate, *c*. 40–65 × 9–15 μm . . . . . ***P. coralloidea*** P. James [=***Zamenhofia coralloidea*** (P. James) Clauzade & Cl. Roux]
[reported from Tenerife and Gomera in the Canary Islands, and the Azores archipelago; mostly found on old trunks of arborescent *Erica* at the edge of laurisilva; never abundant]
Thallus never bluish grey (in *P. ocoteae*, a bluish grey prothallus is present, and in *P. effilata*, the thallus can sometimes have a bluish tinge) and never with isidia terminated with hyaline 'hairs' 5

5(4) Perithecia black or almost so 6
Perithecia never black or almost so, ostiolar region sometimes dark brown or rarely blackish 7

6(5) Ascospores 3-septate, ellipsoid and rarely exceeding 20 μm in length . . . . . ***P. aenea*** (Wallr.) Zahlbr.
[on trees; probably rare in Macaronesia: only reported from Tenerife by Gil González *et al.* (1990: 106) and La Palma by Etayo (1996: 156); a single collection from La Palma, Los Tilos seen by us. The reports of *P. chlorotica* on trees in Tenerife by Champion (1976: 30) and Gomera by Etayo (1998: 102) may refer to this species]
Ascospores 7-septate, almost cylindrical and always exceeding 20 μm in length . . . . . ***P. leptospora*** (Nyl.) A. L. Sm.
[on trees; specimens seen by us from La Palma and Tenerife in the Canary Islands and São Miguel in the Azores; reports of *P. borreri* from Madeira (Kalb & Hafellner 1992: 81–82) and La Palma (Etayo 1996: 156) not checked but assumed to represent this species]

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7(5) Perithecia subglobose, 0·3–0·45(–0·5) mm diam., pale orange to orange, sometimes pinkish, sometimes distinctly and finely greyish whitish tomentose in the upper half, rarely slightly verruculose, but never containing agglomerations of oxalate crystals; ascospores narrowly fusiform, slightly but distinctly inflated in the upper half and tapering towards the proximal end, straight or most usually slightly curved, (7–)9–11(–13)-septate, (65–)68–83(–85) × 7–11 µm, with a thin but distinct perispore . . . . . ***P. effilata*** Brand & Sérus.
[on bark and twigs in the laurisilva of Madeira and Gomera, La Palma and Tenerife in the Canary Islands; rare but possibly overlooked]

Perithecia hemispherical to subglobose, containing agglomerations of oxalate crystals in their outer walls, always larger when mature 8

8(7) Thallus rugose to verrucose, sometimes wrinkled, sometimes with isidioid outgrowths, without a prothallus; perithecia 0·5–0·9(–1·1) mm diam.; ascospores fusiform, 7–9(–13)-septate, 44–80 × 7–13 µm, plus a distinct, 2–3 µm thick perispore . . . . . ***P. atlantica*** (Erichsen) P. M. Jørg.
[on bark in the laurisilva of Madeira (locally very abundant) and Gomera, La Palma and Tenerife in the Canary Islands]

Thallus usually maculate with black irregular patches, adherent to the bark but peeling off and forming bullate portions, bulges or ridges, locally isidioid outgrowths present, sometimes common, especially on thalli without perithecia, with a black or bluish black prothallus; perithecia 0·5–0·6(–0·7) mm diam.; ascospores elongate-fusiform, 7–11(–13)-septate, (42–)44–50(–53) × (3·5–)4–5 µm, without a perispore . . . . . ***P. ocoteae*** Brand & Sérus.
[known only at the bases of old boles of *Ocotea foetens*, in localities with well-preserved laurisilva in La Palma, Canary Islands—the most important being the most famous laurisilva of "Los Tilos", and from São Jorge in the Azores—Endemic]

9(1) Perithecia either yellow-orange or covered by a thallus layer but with the ostiole usually pale orange, pinkish to brownish; ascospores at least 7-septate . . . 10

Perithecia black or dark reddish brown; ascospores 3 or 7-septate 11

10(9) Perithecia 0·3–0·4 mm diam., yellow-orange to brownish red, not covered by a thallus layer containing oxalate crystals; thallus thin and smooth; ascospores 7-septate, 42–52 × 12–15 µm, plus a *c.* 2 µm thick perispore . . . . . ***P. ahlesiana*** (Körb.) Zahlbr.
[known from shaded basaltic boulders in laurisilva; reported from Gomera, Canary Islands by McCarthy & Etayo (2002) and Graciosa in the Azores by Aptroot & Rodrigues (2005), from La Palma and São Jorge in the Azores (LG, hb Berger); specimens from Gomera and Graciosa not seen by us]

Perithecia 0·5–0·9(–1·1) mm diam., usually distinctly constricted at their base, typically covered by a thallus layer containing agglomerations of oxalate crystals and thus concolorous with the thallus; ostiole usually pale orange, pinkish to brownish; thallus rather thick and rugulose-verruculose; ascospores fusiform, 7–9(–13)-septate, 44–80 × 7–13 µm, plus a distinct, 2–3 µm thick perispore . . . . . ***P. atlantica*** (Erichsen) P. M. Jørg.
[normally a corticolous species but found once on basaltic boulders inside laurisilva at La Palma, Canary Islands]

11(9) Perithecia hemispherical to subglobose, small [(0·22–0·28(–0·36) mm diam.], dark reddish brown to ± black; ascospores 3(–7)-septate, narrowly oblong to almost cylindrical with rather rounded ends, 18–33 × 2·5–4 µm . . . . . ***P. fortunata*** P. M. McCarthy & Etayo
[known from shaded basaltic boulders in laurisilva; only two localities, in Gomera and La Palma, Canary Islands—Endemic]

Perithecia usually hemispherical and rather immersed in the thallus, rarely subglobose, never dark reddish brown, always black 12

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12(11) Perithecia 0·2–0·3 mm diam., very rarely aggregated; ascospores 3-septate, 16–25(–32) × 4–6 μm . . . . . ***P. chlorotica*** (Ach.) Müll. Arg.
[reported from the Azores (Degelius 1941: 8), Madeira (Tavares 1952: 319), Gomera (McCarthy & Etayo 2002), and from La Palma and Tenerife, at: www.gobcan.es/medioambiente/biodiversidad/ceplam/bancodatos/libro.html]

Perithecia 0·4–0·6 mm diam., sometimes aggregated into clusters of 2–4; ascospores 7-septate 13

13(12) Ascospores fusiform to oblong-cylindrical with rounded ends, (26–)30–45 × 5–6 μm; thick (up to 5 μm) perispore present but not easily seen, usually associated with immature ascospores only . . . . . ***P. guentheri*** (Flot.) Zahlbr.
[known from shaded basaltic boulders, usually in laurisilva, in Gomera and La Palma, Canary Islands; only specimens from La Palma seen by us—report from La Gomera at: www.gobcan.es/medioambiente/biodiversidad/ceplam/bancodatos/libro.html; recently reported from Graciosa in the Azores by Aptroot & Rodrigues (2005)]

Ascospores narrow-fusiform to cylindrical, with rounded ends but usually slightly tapering towards one, 42–55 × 3–4 μm; perispore not seen . . . . . ***P. curnowii*** A. L. Sm.
[reported here from coastal localities, at low elevations in São Jorge and Flores, Azores; coll. in hb Berger]

Excluded species

Porina glabra (A. Massal.) Zahlbr.: this species is included in the checklist of lichens and lichenicolous fungi in the Canary Islands, available at the address below. The name refers to *Strigula glabra* (A. Massal.) V. Wirth, a species for which no material has been seen from Macaronesia (Roux & Sérusiaux 2004).
www.gobcan.es/medioambiente/biodiversidad/ceplam/bancodatos/libro.html

Porina rosei Sérus.: the doubtful report of a sterile collection of that species (Sérusiaux 1991) has been assumed to be actually one of *Porina isidiata* Kalb & Hafellner (Kalb & Hafellner 1992). We here confirm that the specimen (LG!) is close to but not unequivocally conspecific with *P. rosei* and is not an isidiate form of *Porina atlantica*.

P. semecarpi Vain.: the only collection of that species mentioned from Madeira belongs to *P. hoehneliana* (Sérusiaux 1996: 225); the world distribution map of the species published by McCarthy (2003: 89) should thus be corrected.

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