

Short Communication

Gyalectidium minus Sérus., new to oceanic western Europe in the first reported foliicolous lichen community of continental Portugal

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(Accepted 17 December 2019)

During a pre-congress excursion (23 July 2019) to the Sintra mountain range, led by the organizers of the XXII Symposium of Cryptogamic Botany, we found foliicolous (epiphyllous) lichens growing abundantly in the ‘enchanted forest’ of Peninha (38°46′9.06″N, 9°27′32.27″W), c. 40 km north-west of Lisbon. Folii-colous lichen communities are principally tropical but do occur to a limited extent in subtropical and oceanic-temperate regions where high humidity, relatively mild conditions, and adequate non-deciduous leaf substrata are found (Santesson 1952; Lücking 2008). In Europe, foliicolous lichen communities are mainly restricted to highly localized microsites, particularly protected gorges and ravines. Such localities have been reported within, and north and south of, the Pyrenees (Vězda & Vivant 1972; Sérusiaux 1993; van den Boom & Sérusiaux 1996; Llop & Gómez-Bolea 2006, 2009), in southern Italy (Puntillo *et al.* 2000) and in the Black Forest (Lücking *et al.* 2009). While foliicolous lichen communities are known from the laurisilva forests of Madeira and the Azores, previous reports from continental Portugal appear limited to a collection of *Byssoloma subdiscordans* (Nyl.) P. James on cycad leaves in Monserrate Park, Sintra (as *B. rotuliforme*; Santesson 1952). Other foliicolous species from continental Portugal have been cited mainly on bark substrata (Santesson 1952; Sérusiaux 1996, 1998; Breuss 2016).

The presence of a foliicolous lichen community at the Peninha site is hardly surprising. The north-eastern-facing forested slope is bathed in mist-laden winds from the Atlantic, strongly reminiscent of the wet Macaronesian laurisilva forests. Amidst a profuse cover of *Hedera helix* ssp. *canariensis* (Willd.) Cout., the predominant tree supporting the foliicolous lichens is also strikingly similar in appearance to those of the laurisilva forest. However, while diverse indigenous tree species comprise laurisilva, the ‘enchanted forest’ of Peninha is principally just *Pittosporum undulatum* Vent., an Australian tree introduced to the area in the 19th century. The Serra de Sintra itself has a unique microclimate and a considerable degree of autochthonous biological diversity and endemism, owing to its substantial elevation (to 528 m) and exposure to year-round Atlantic fog that effectively doubles the moisture supplied by precipitation (Pinto da Silva *et al.* 1991).

The indigenous vegetation includes *Cupressus lusitanica* Mill., as well as *Quercus pyrenaica* Willd. and the more Mediterranean *Q. faginea* Lam. and *Q. suber* L. Bryophytes are notably diverse (Cacciatore *et al.* 2015). However, centuries of human exploitation, followed by the introduction of many exotic species into the vast gardens of local aristocrats, has taken a very heavy toll on the original plant communities (Pinto da Silva *et al.* 1991).

Elsewhere in the Iberian Peninsula, where foliicolous lichens occur on native vegetation, the main substratum is usually box-wood leaves (*Buxus sempervirens* L.), but that shrub/tree was not seen at the Peninha site. An interesting question is what, if any, native substrata might allow these lichens to persist in the area in the absence of the introduced *Pittosporum* upon which they are currently thriving. A number of authors have considered the role of non-native tree plantations in potentially reducing epiphytic lichen diversity (Quine & Humphrey 2010; Nascimbene *et al.* 2012, 2015; González-Montelongo & Pérez-Vargas 2019). At the Peninha site, by contrast, an introduced exotic is providing the substratum for a lichen community not reported previously for the region. It is interesting to compare this situation with that of other reported foliicolous communities in Iberia and Western Europe, which frequently occur in gorges or narrow ravines with hyperhumid conditions and mild temperatures (Puntillo *et al.* 2000; Llop & Gómez-Bolea 2006). These relatively inaccessible habitats typically preserve native vegetation that would be vulnerable to any alterations in the microclimate. Thus, while foliicolous lichen communities may serve as important indicators of unique microclimatic conditions that are significant for biodiversity, their presence does not necessarily correlate with the conservation of native plant community structure.

The predominant foliicolous lichen of the Peninha forest is distinct from those seen in other Iberian or northern European localities. It consists of tiny, raised areolae thoroughly encrusted with white crystalline material. Apothecia are abundant and may have a volcano-like appearance where the surrounding areola is almost bullate-swollen and the apothecium appears as a sunken crater (Fig. 1A & B). The excipulum often has a distinctive orangy-brown pigment encircling the disc, which is frequently bright green with numerous photobiont cells embedded in the epithecium and hypothecium (Fig. 1C). Asci contain a single, large, hyaline, muriform ascospore measuring (22–)22.1–32.2–42.3(–45) × 5.6–11.9–18.2(–19) μm (Fig. 1D). Pycnidia are scarce, located at the thin marginal areas of the thallus and easily

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Cite this article: Sanders WB and Llop E (2020) *Gyalectidium minus* Sérus., new to oceanic western Europe in the first reported foliicolous lichen community of continental Portugal. *Lichenologist* 52, 247–249. <https://doi.org/10.1017/S0024282920000080>

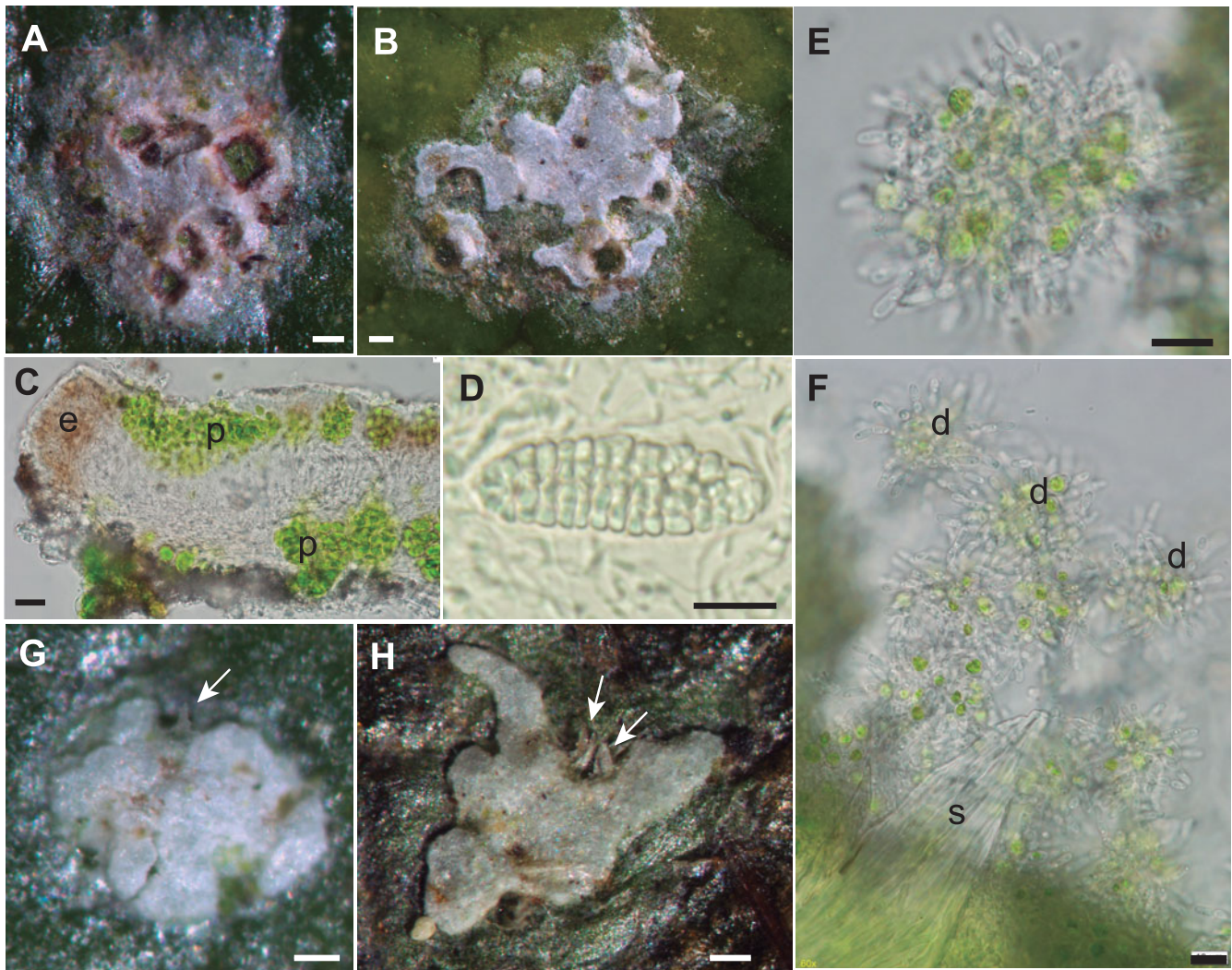


Fig. 1. *Gyalectidium minus* Sérus. from Peninha (Sintra), Portugal. A & B, thallus areolae with apothecia; C, hand-cut section through apothecium, showing orange pigment in excipulum (e) and photobiont layers (p) above and below immature hymenium; D, ascospore; E, diahyphal propagule with photobiont cells mixed within dense bundle of conidial chains; F, hyphophore with subtending scale (s) and several diahyphal propagules (d); G & H, thallus areolae with hyphophores subtended by pointed scales (arrows). Scales: A, B, G & H = 100 μ m; C–F = 10 μ m.

mistaken for young apothecia. Pycnoconidia are bacilliform, measuring $2\text{--}3 \times 0.8\text{--}1$ μ m. Asexual diahyphal propagules are characteristic of the genus *Gyalectidium*, each a roughly isodiametric bundle of sausage-like macroconidial chains with photobiont cells intermixed (Fig. 1E). They form at the base of one (or occasionally several) small, membranous hyphophore scales narrowing to a point at the tip; they are located at or near the periphery of thallus areolae (Fig. 1F–H). The hyphophores are infrequently observed, however, and their scales are inconspicuous without the use of higher magnification with a dissecting microscope. The material appears to represent *Gyalectidium minus* Sérus., an obligately foliicolous taxon described from the Canary Islands (Ferraro *et al.* 2001) and also known from a single site in southern Italy. The Italian material was previously recorded as *G. caucasicum* (Elenkin & Woron.) Vězda (Puntillo *et al.* 2000), a taxon once thought to occur rarely in France and Spain (Sérusiaux 1996), but excluded from Europe in a more recent treatment (Ferraro *et al.* 2001). Since *G. minus* has not been recorded for Madeira (Sérusiaux 1996) or the Azores, the Peninha

site would also represent its first report in Portuguese territory. It appears to show a typical tethyan distribution (Ferraro *et al.* 2001; Lücking 2003), with a presence in Macaronesia (Canary Islands) and the western Mediterranean region (Iberian and Italian peninsulas). In the single known locality in Italy, *G. minus* is considered a threatened species (Ravera *et al.* 2011).

Gyalectidium minus is distinct from the two other species of the genus known to occur in foliicolous localities of northern Spain, southern France and the Black Forest (Germany). *Gyalectidium setiferum* Vězda & Sérus. has very long, slender, seta-like hyphophore scales that are abundant and prominent; apothecia are unknown in this taxon. *Gyalectidium puntilloi* Sérus. has separate, white, polygonal encrustations of crystals surrounded by a thin green thallus; apothecia are ‘very rare’ (Ferraro *et al.* 2001). It should be noted that these are the current phenotype-based species concepts, which, as in other genera of foliicolous lichen fungi, await evaluation by molecular sequence comparisons.

Gyalectidium minus grows alone on many of the leaves examined. However, a number of leaves are also colonized by

additional foliicolous species. The most common companions of *G. minus* in the Peninha ‘enchanted forest’ are *Bacidina apiahica* (Müll. Arg.) Vězda, *Fellhanera seroexpectata* Sérus. and *Fellhaneropsis myrtillicola* (Erichsen) Sérus. & Coppins. Less frequent associates include *Byssoloma croceum* Sérus. & Puntillo, *Fellhanera bouteillei* (Desm.) Vězda, *Phylloblastia fortuita* Llop & Gómez-Bolea and *Porina hoehneliana* (Jaap) R. Sant. All the aforementioned species are new reports for continental Portugal, while *B. croceum* is a new report for the Iberian Peninsula (Breuss 2016). The distribution pattern of the latter species appears, at present, similar to that of *G. minus*.

Considering the markedly oceanic character of the western Iberian Peninsula, it seems plausible that other overlooked foliicolous communities could occur in Portugal and north-western Spain, and these might well include unexpected taxa as reported here.

Acknowledgements. Support for travel expenses was kindly provided to WBS by Florida Gulf Coast University through a Scholarship-Research Venture Capital Award and a Professional Development Fund Grant, and to ELL by the Facultat de Biologia, Universitat de Barcelona, through the programme ‘Ajuda per a participació en congressos internacionals i cursos de formació en recerca a l’estranger’. We thank Dr Cecília Sérgio (University of Lisbon) for providing helpful bibliography.

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