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Advancing the knowledge of lichens in the Lisbon Metropolitan Area (Portugal)

Abstract

Munzi, S., Estorninho Ramos, M. & Ravera, S.: Advancing the knowledge of lichens in the Lisbon Metropolitan Area (Portugal). — Borziana 7: 5-16. 2026 — ISSN: 2724-5020 online.

This study presents new lichen records from two urban green areas in the Lisbon Metropolitan Area, contributing to Portugal's understudied mycobiota. A survey identified 64 species, including three new to Portugal and 21 new to the region. The findings underscore the lichenological richness of anthropized landscapes and highlight the value of citizen science initiatives, such as bioblitzes, in supporting biodiversity documentation.

Key words: Biodiversity, Citizen Science, Lichenized Ascomycetes.

Introduction

Lichenological research in Portugal during the last 25 years has progressively contributed to the knowledge of the country's mycobiota, particularly through studies focused on selected regions or habitats (e.g. Carvalho & al. 2002; Jones 2002; van den Boom & Jansen 2002; van den Boom 2017; Hespanhol & Marques 2023; Munzi & Ravera 2023). Parallel efforts have been directed towards the application of lichens in environmental monitoring (e.g. Munzi & al. 2014; Matos & al. 2015; Sérgio & al. 2016), as well as the development of citizen science programs aimed at raising public awareness and expanding data collection (e.g. Munzi & al. 2023). Although research activity has increased in recent decades, a comprehensive and systematic survey of the Portuguese lichen flora at the national scale is still lacking.

The continued discovery of taxa newly reported for Portugal (e.g. Rodrigues & al. 2011; Sergio & al. 2016; Munzi & Ravera 2023) and, in some instances, species new to science such as those reported by van den Boom & Etayo (2001), Giralt & al. (2011), van den Boom & al. (2017), Sanders & Llop (2020), Sipman & Aptroot (2020), and van den Boom & al. (2023), highlights the still largely unexplored lichenological richness of the country. In this context, the metropolitan area of Lisbon (LMA) offers an illustrative example: with 195 lichen species documented in the last 25 years, since 2000 to date (Munzi & al. 2014, 2023; Lepista & Aptroot 2016; Sérgio & al. 2016; Sanders & Llop 2020; GBIF 2025a) it

stands out for both the unexpectedly high species richness and the presence of diverse habitats supporting this biodiversity. These findings highlight the importance of continued field exploration, detailed taxonomic work, and updated floristic assessments to achieve a comprehensive understanding as a basis for an effective conservation of the lichen diversity of the region.

The Lisbon Metropolitan Area (LMA), located in western Portugal, covers approximately 3,000 km² around the Tagus (Tejo) estuary and comprises 18 municipalities, including Lisbon. It is a densely populated region with a strong urban, industrial, and infrastructural footprint (Instituto Nacional de Estatística 2021).

Biogeographically, the LMA lies within the Mediterranean region, under strong Atlantic influence. Native vegetation includes sclerophyllous evergreen forests and shrublands dominated by *Quercus suber* L., *Pistacia lentiscus* L., and *Arbutus unedo* L., although these communities are highly fragmented (Costa & al. 1998). Coastal dunes, rocky outcrops, and semi-natural grasslands still occur, especially in protected areas like Sintra-Cascais and Arrábida Natural Parks.

Geologically, the LMA comprises a complex mosaic of lithologies, including sedimentary formations (limestones, sandstones, marls, and clays) from the Mesozoic and Cenozoic, interspersed with volcanic outcrops, particularly in the Sintra Massif (Ribeiro & al. 1979).

The climate is Mediterranean with oceanic characteristics, featuring mild, rainy winters and warm, dry summers. Annual rainfall ranges from 600 to 1,000 mm, and mean temperatures from 15 to 18 °C, with strong seasonal and spatial variation (Santos & al. 2002).

To contribute to the understanding of lichen biodiversity in the LMA, this study presents the results of recent field observations carried out in support of citizen science activities within the framework of the projects developed by the association BioDiversity4All (https://www.biodiversity4all.org), which we subsequently verified.

Materials and methods

The study was conducted in two urban green areas located in the Lisbon Metropolitan Area (Fig. 1). The first site is the historical park of Quinta de Cima do Marquês de Pombal, situated in Oeiras. This estate, dating back to the 18th century, is characterized by ornamental gardens, old olive groves, tree-lined avenues, and patches of urban woodland, with a tree cover that includes both Mediterranean and Atlantic species such as *Olea europaea* L., *Quercus suber*, *Cupressus sempervirens* L., *Pinus pinea* L., and various deciduous broadleaved trees. The fieldwork was carried out during the week from 20 to 24 July 2024.

The second site is a landscaped park located in Praça de Espanha, in the central area of Lisbon. This urban park has recently been renovated and includes a mix of open lawns, ornamental vegetation, and mature trees. The fieldwork was carried out from 1 to 9 July 2025.

A lichen survey took place in both study areas, where specimens were examined with a magnifier (10×) and, when necessary, samples were collected for further identification in the laboratory, based on morphological and chemical characteristics. Macroscopic features (e.g., thallus morphology, reproductive and vegetative structures) were examined under a

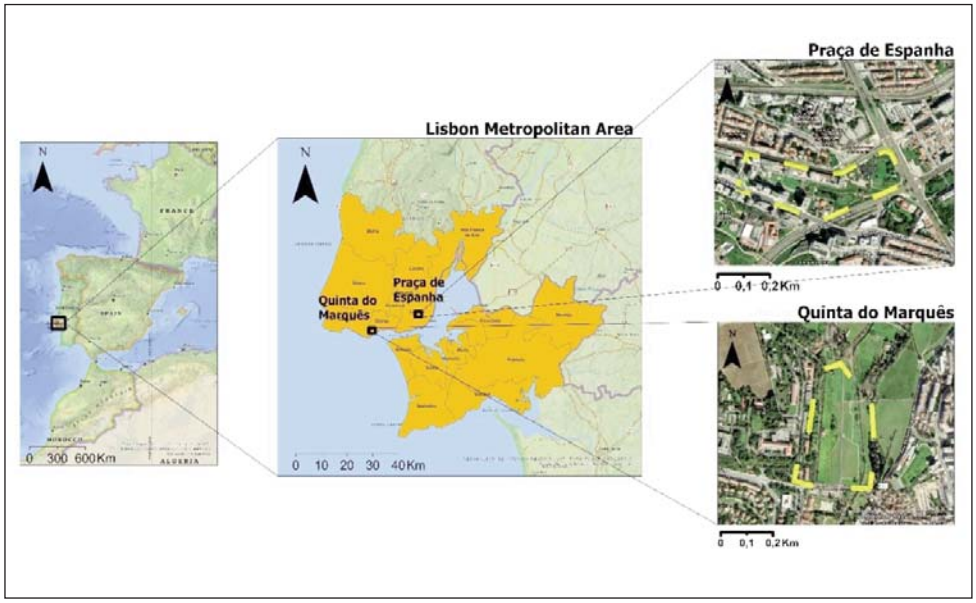

Fig. 1. Location and map of the study area and sampling sites.

stereomicroscope, and standard spot tests – K (a solution of 10% potassium hydroxide), C (sodium hypochlorite solution) – were applied. Microscopic traits, including paraphyses, asci, and spores, were studied with a light microscope. For the identification of the lichen species, several keys were used, mainly online identification keys on ITALIC 8.0 (see Nimis & Martellos 2020). The nomenclature follows Nimis (2025).

Results

The annotated floristic list includes 64 species. Among them, three are new to Portugal (marked with # in the list), 21 are new to LMA (marked with * in the list). Taxa are listed in alphabetical order. Site – Oeiras (O), Lisbon (L) – and the host tree species, if known – *Celtis australis* L. (*Ca*), *Cupressus sempervirens* L. (*Cs*), *Fraxinus angustifolia* Vahl (*Fa*), *Laurus nobilis* L. (*Ln*), *Magnolia* sp. (*M*), *Olea europaea* L. (*Oe*), *Pinus* sp. (*Pi*), *Platanus orientalis* L. (*Po*), *Populus* sp. (*P*), *Quercus* sp. (*Q*), *Quercus suber* (*Qs*), *Tilia* sp. (T) – are reported. For each species the value of poleotolerance (PT) is indicated according to Nimis (2025): 0 – species which exclusively occur on old trees in ancient, undisturbed forests; 1 – species mostly occurring in natural or semi-natural habitats; 2 – species occurring also in moderately disturbed areas (agricultural areas, small settlements etc.); 3 – species occurring also in heavily disturbed areas, incl. large towns. A short note is added for the species new to Portugal and a few interesting species mostly occurring in natural or semi-natural habitats.

**Anisomeridium biforme* (Schaer.) R.C. Harris: O, *Fa*. 1
Alyxoria varia (Pers.) Ertz & Tehler: O, *Cs*, *Oe*. 1-2
**Arthonia atra* (Pers.) A. Schneid.: O, *Cs*. 1-2

Arthonia ilicina Taylor: O, *P*. 0. 23 July 2024. *Leg*. M. Estorninho Ramos, S. Munzi & S. Ravera, *det*. S. Ravera

This is a crustose, endosubstratic lichen with a white to cream thallus and dark red-brown to black apothecia, typically 0.2–1 mm wide, rarely elongate, flat to slightly convex, and immersed to broadly erumpent. It is distinguished from similar taxa by its long, non-muriform ascospores (25–36 × 9–14 µm) with one enlarged terminal cell. *A. ilicina* occurs mostly on smooth bark of old deciduous trees in humid, oceanic montane or temperate rainforest woodlands. Its distribution is Mediterranean-Atlantic in Europe (Nimis 2025). It is also known from North and South America, South Africa, Taiwan, Australia, and several Atlantic islands and the Caribbean (Cannon & Minter 2018). In the study area, this species is known from Serra de Sintra (e.g. WIS-L-0111323 in GBIF 2025b).

**Arthonia melanophthalma* Nyl.: O, *Fa*. 1

#*Arthopyrenia salicis* A. Massal.: L, *Ca*. 1. 9 July 2025. *Leg.* S. Munzi, *det*. S. Munzi & S. Ravera (Fig. 2)

This is a crustose lichen with an often inconspicuous, pale brown thallus. Thalli may range from lacking a detectable photobiont to containing abundant *Trentepohlia*; the collected specimen showed the presence of the alga. It is characterized by very small perithecia and is distinguished from similar perithecioid species by the absence of pseudopara-

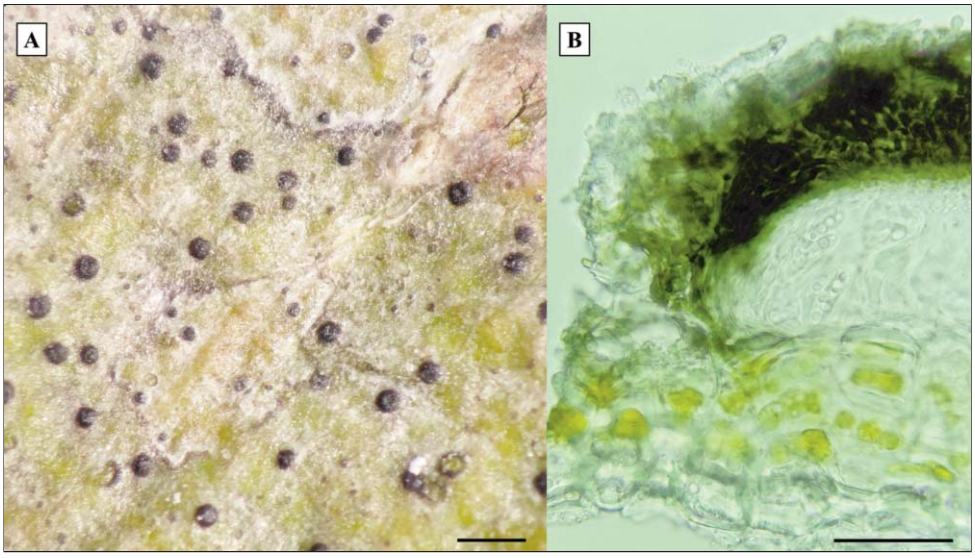

Fig. 2. *Arthopyrenia salicis* (Photo S. Munzi). Thallus (A), bar = 1 mm; perithecium (B), bar = 50 µm.

physes and the presence of periphysoids. This species grows mainly on the smooth bark of deciduous trees and is common in temperate upland areas. It is widely distributed in northern and western Europe, North America, and parts of Asia (GBIF 2025c). Previously confused with *Naetrocymbe punctiformis* (Pers.) R.C. Harris and related taxa, it is now known to be unrelated to *Arthopyrenia* sensu stricto (Thiyagaraja & al. 2021).

Athallia cerinelloides (Erichsen) Arup, Frödén & Søchting: L, *Ca*, *Po*, *Q*. 1-2

**Bacidia iberica* Aragón & I. Martínez: O, *Cs*, *Fa*, *Oe*. 0. 24 July 2024. *Leg*. M. Estorninho Ramos, S. Munzi & S. Ravera, *det*. S. Ravera

This epiphytic lichen can be distinguished from the closely related *B. rubella* (Hoffm.) A. Massal. by its squamulose thallus and by differences in the spore length-to-width ratio, which is significantly higher in the latter species. *Bacidia iberica* appears to be more common in humid Mediterranean woodlands of Central and Southern Spain (Aragón 2003) but it is also known from Italy (Nimis 2025), Greece (Sipman & Raus 2002), Iran (Valadbeigi & Sipman 2010), and Estonia (GBIF 2025d).

Bacidia rubella (Hoffm.) A. Massal.: O, *Oe*. 1-2
**Bacidina phacodes* (Körb.) Vězda: O, *Cs*, *Oe*. 1
**Biatoridium monasteriense* J. Lahm ex Körb.: O, *Fa*. 1-2
Candelaria concolor (Dicks.) Stein: L, *Ca*, *T*. 1-3
Collema flaccidum (Ach.) Ach.: O, *Oe*. 1-2
Collema furfuraceum (Arnold) Du Rietz: O, *Oe*. 1-2
Collema subflaccidum Degel.: O, *Oe*. 1-2
Coppinsiella ulcerosa (Coppins & P. James) S.Y. Kondr. & Lőkös: O, *Cs*, *P*. 1-2
Dendrographa decolorans (Sm.) Ertz & Tehler: O, *Oe*. 1-2
Diploicia canescens (Dicks.) A. Massal.: L; O, *Cs*, *P*. 1-2
**Dirina ceratoniae* (Ach.) Fr.: O, *Ln*, *Oe*, *P*. 1-2
Diromma dirinellum (Nyl.) Ertz & Tehler: O, *Oe*, *P*. 1
Flavoparmelia caperata (L.) Hale: L; O, *Oe*. 1-2
Hyperphyscia adglutinata (Flörke) H. Mayrhofer & Poelt: L, *Ca*, *Oe*, *Po*, *Q*, *T*. O, *Cs*, *M*, *Oe*, *P*. 1-3
Lecania cyrtella (Ach.) Th. Fr.: L, *Po*, *Q*. O, Fa. 1-3
Lecania naegelii (Hepp) Diederich & van den Boom: O, *Cs*, *Fa*. 1-2
Lecanora chlarotera Nyl.: O, *Oe*, *Pi*, *Fa*. 1-3
Lecanora horiza (Ach.) Linds.: O, *P*. 1-2
Lecanora rubicunda Bagl.: O, *M*. 1

#*Lecanora strobilinoides* Giralt & Gómez-Bolea: L, *Qs*. 1. 9 July 2025. *Leg.* S. Munzi, *det*. S. Munzi (Fig. 3)

This species is a rare member of the *Lecanora symmicta* group, characterized by lecanorine apothecia with an ecorticate thalline exciple and asci containing (12–)16(–32) ascospores, which are simple or 1-septate (Giralt & Gómez-Bolea 1991). It occurs on acidic bark of evergreen trees and shrubs or on pine cones in the Mediterranean region and is currently known from north-eastern Spain at elevations between 25 and 700 m (GBIF

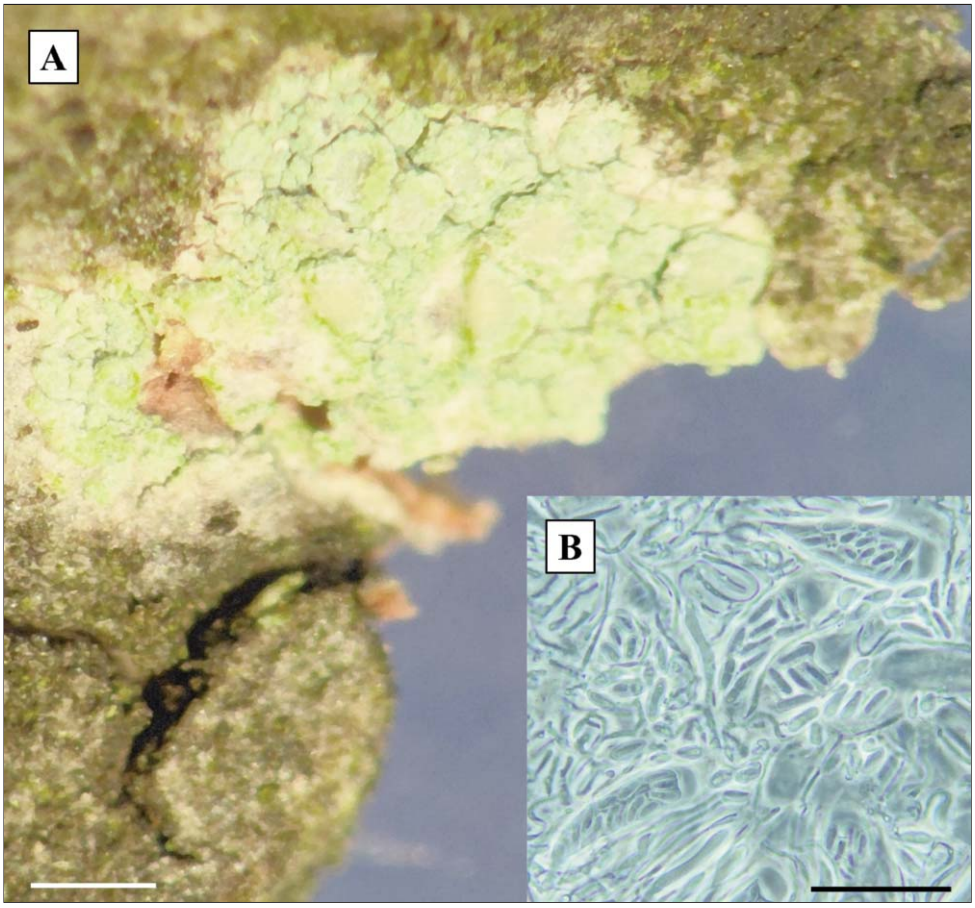

Fig. 3. *Lecanora strobilinoides* (Photo S. Munzi). Thallus (A), bar = 1 mm; asci with 16 spores (B), bar = 50 µm.

2025e). Phylogenetic analyses have confirmed *L. strobilinoides* as a distinct species (Pérez-Ortega & Kantvilas 2018), previously confused with *L. strobilina* (Spreng.) Kieff., from which it differs particularly in the number and size of its ascospores.

Lecanographa lyncea (Sm.) Egea & Torrente: O, *Oe*. 0. 24 July 2024. *Leg*. M. Estorninho Ramos, S. Munzi & S. Ravera, *det*. S. Ravera

Lecanographa lyncea is distinguished by its thick, ecorticate, chalky white crustose thallus, and by black, subimmersed apothecia that are elliptical to shortly lirelliform, with a frequently grey-white pruinose disc. It differs from similar taxa in its chemistry, containing confluentic and 2′-O-methylmicrophyllinic acids (the thallus reacts UV+ white, K/UV+ mauve), and by the lack of a C+ red apothecial pruina. The species occurs mostly on dry, rough, well-lit bark of very old oaks in semi-open habitats with long ecological

continuity. It has a mild-temperate, mainly western distribution in Europe where it is declining (e.g. Sérgio & al. 2016; SLU Artdatabanken 2025; Nimis 2025), reflecting its strong dependence on rare and threatened veteran-tree habitats. It has also been reported from other regions of the world (GBIF 2025f), where it occurs in different habitats, which, according to Knutsson (2015), would suggest that the species is not globally threatened.

Lecidella elaeochroma (Ach.) M. Choisy var. *elaeochroma* f. *elaeochroma*: O, *Pi*, *Fa*. 1-3
Lepra amara (Ach.) Hafellner: O, *Oe*. 1-2

#*Leptorhaphis laricis* (J. Lahm) M.B. Aguirre: O, *Pi*. 1. 23 July 2024. *Leg.* M. Estorninho Ramos, S. Munzi & S. Ravera, *det*. S. Ravera (Fig. 4)

The thallus of this species is crustose, inconspicuous, and immersed, sometimes associated with chlorococcoid or *Trentepohlia* algae. Perithecial ascomata measure 100–150(–200) µm in diameter, are semi-immersed, circular, and feature a central ostiole; the involucrellum is dark brown to black, while the exciple is colourless. Asci are (30–)35–50(–55) × 9–12 µm, cylindrical to broadly clavate, mostly 8-spored. Ascospores are arranged in one bundle in the asci, slightly twisted, sometimes in two bundles, fusiform, arcuate, 30–40(–7) × 2–2.5 µm, 1-septate, not constricted at the septum, attenuated at the apices. This species has been reported from Belgium, France, Germany, Netherlands, Slovakia, Spain and UK where it grows on acidic bark, particularly of *Larix* and *Betula* (Aguirre-Hudson & al. 2016).

**Mycocalicium subtile* (Pers.) Szatala: O, *Oe*. 1
**Mycomicrothelia confusa* D. Hawksw.: O, *P*. 1
Normandina pulchella (Borrer) Nyl.: L, *T*. 1-2

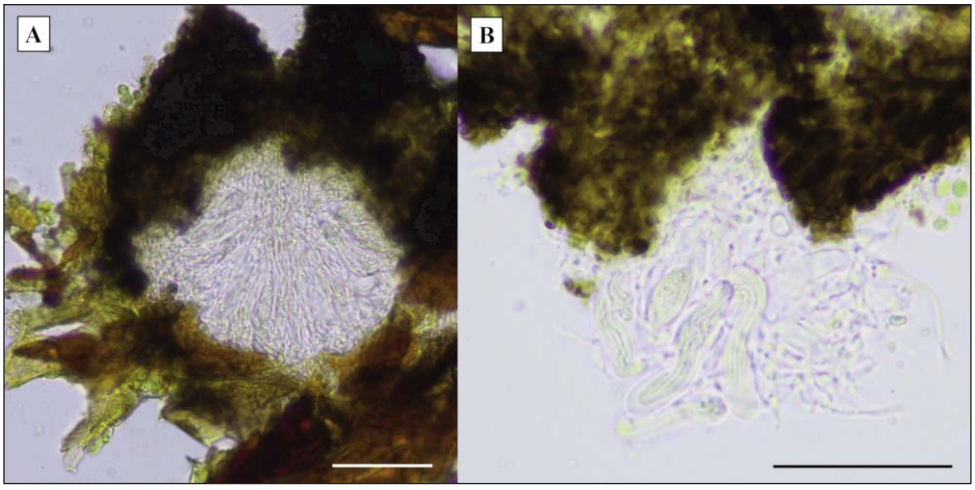

Fig. 4. *Leptorhaphis laricis* (Photo S. Ravera). Perithecium (A) and asci (B) with fusiform, arched, slightly spiralled spores. Bars = 50 µm.

Opegrapha celtidicola (Jatta) Jatta: O, *Oe*. 1
Opegrapha vulgata (Ach.) Ach.: O, *Fa*, *Ln*. 1-2
Parmotrema pseudoreticulatum (Tav.) Hale: O, *Oe*, *M*. 1
Parmotrema reticulatum (Taylor) M. Choisy: L. 1-2
Pertusaria heterochroa (Müll. Arg.) Erichsen: O, *Oe*, *Pi*, *P*. 1-2
Pertusaria hymenea (Ach.) Schaer.: O, *M*. 1-2

**Pertusaria werneriana* Boqueras: L, *Qs*. 0. 9 July 2025 (Fig. 5)
Leg. S. Munzi, *det*. S. Munzi

This is a rare Mediterranean corticolous crustose lichen. It is distinguished from similar species mostly by its chemistry – containing 2′-O-methylperlatolic and confluentic acids and lacking stictic acid – and by the eight spores arranged in a single row in the asci (Boqueras & Llimona 2003). It grows on the bark of broadleaved trees, mainly on small branches in warm, sunny, xeric habitats. The species occurs also in southern Spain, Corsica, Greece, and southern France (Sipman & Raus 2002; Boqueras & Llimona 2003; Bertrand & Balance 2023), typically in thermo- and mesomediterranean belts. This is the first record for Portugal since 1890 (Boqueras & Llimona 2003).

Phaeophyscia hirsuta (Mereschk.) Essl.: L, *Ca*, *Oe*; O, *Cs*, *Fa*, *M*. 1-2
Phaeophyscia orbicularis (Neck.) Moberg: L, *Ca*, *Oe*, *Po*, *Q*, *T*. 1-3
Physcia adscendens H. Olivier: L, *Po*, *Q*. O, *Fa*. 1-3

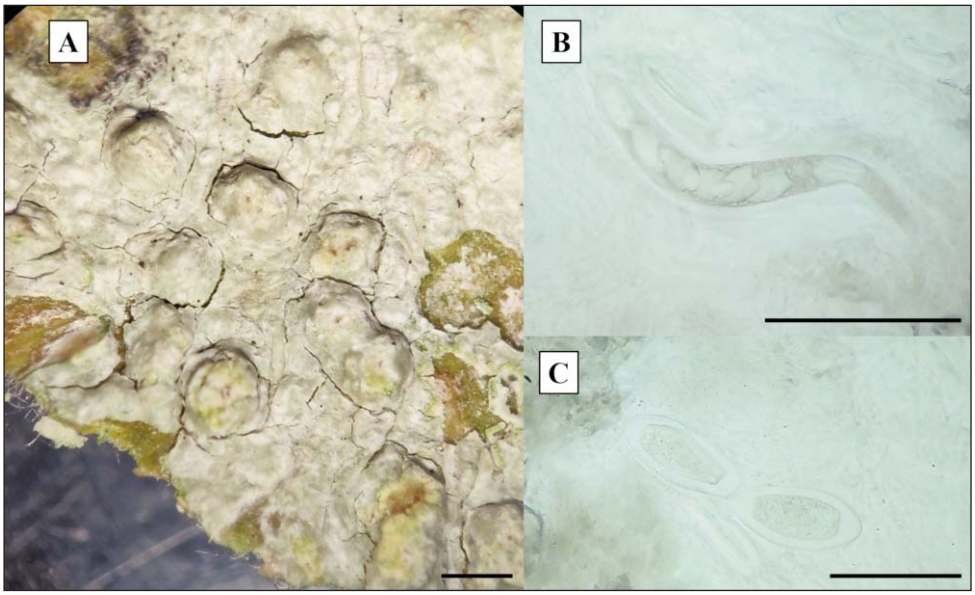

Fig. 5. *Pertusaria werneriana* (Photo S. Munzi). Thallus (A), bar = 1 mm; ascus (B), bar = 100 µm; ascospores (C), bar = 50 µm.

Physcia clementei (Turner) Lynge: O. 1-2
Physcia tribacioides Nyl.: L, *Ca*, *Q*, *T*. 1
Physciella chloantha (Ach.) Essl. L, *Q*. 1-2
Polyozosia hagenii (Ach.) S.Y. Kondr., Lőkös & Farkas: L, *Ca*. 1-3
**Porina aenea* (Wallr.) Zahlbr.: O, *Fa*, *Pi*. 1
Punctelia borreri (Sm.) Krog: L, *T*, *Q*. 1-2
**Pyrenula nitidella* (Schaer.) Müll. Arg.: O, *Fa*. 1
Ramalina canariensis J. Steiner: O, *P*. 1-2
Ramalina fraxinea (L.) Ach.: O, *Fa*. 1
Ramalina lacera (With.) J.R. Laundon: O, *P*. 1
Ramalina lusitanica H. Magn.: O, *P*. 1
**Rinodina oleae* Bagl.: L, *Po*. 1
**Rinodina pruinella* Bagl.: O, *Fa*. 1
**Sanguineodiscus haematites* (Chaub. ex St.-Amans) I.V. Frolov & Vondrák: O, *Oe*. 1-2
**Scutula igniarii* (Nyl.) S. Ekman: O, *Cs*, *P*. 1-2
Scytinium teretiusculum (Wallr.) Otálora, P.M. Jørg. & Wedin: O, *Oe*. 1-2
Waynea stoechadiana (Abbassi Maaf & Cl. Roux) Cl. Roux & P. Clerc: L, *Oe*, *Po*, *Q*, *T*; O, *Cs*, *Oe*. 1
Xanthoria parietina (L.) Th. Fr.: L, *Ca*, *Oe*, *Po*, *Q*, *T*; O, *Cs*, *Fa*, *M*, *P*, *Pi*, *Oe*, *P*. 1-3
**Zwackhia viridis* (Ach.) Poetsch & Schied.: O, *P*. 1-2

Discussion and conclusion

In the absence of an official checklist for Portugal, these studies contribute to improve the current knowledge of lichen biodiversity at both regional and national levels. In addition to their taxonomic and biogeographical significance, the data presented here may serve as a reference point for future ecological and conservation-oriented studies. Furthermore, they suggested the potential relevance of citizen science activities, such as bioblitzes, in supporting collaborations and investigations in areas that are still relatively underexplored from a lichenological perspective.

From the floristic and bibliographic analysis, some species, known from the area through exsiccata dating back to the last century (e.g. *Lecanora rubicunda*, TSB no. 25354), were recently reconfirmed through records on collaborative online platforms (e.g. iNaturalist and Wikipedia). Although lichen identification by iNaturalist is not uniformly accurate for all species (Munzi & al. 2023), the reliability of the citizen science data is significantly strengthened by confirming species presence and incorporating expert assessment in the areas where bioblitzes are conducted. The results of this study may also support long-term environmental monitoring programs, particularly those addressing the effects of air pollution and climate change on lichen communities, where even the presence or absence of individual species can provide meaningful information due to their characteristic value of poleotolerance.

By integrating observations into citizen science platforms such as iNaturalist, this work fosters participatory approaches in ecological research and strengthens the connection between professional scientists and the wider public. Such collaborative frameworks not

only expand the spatial and temporal coverage of biodiversity data but also promote environmental awareness and stewardship. Altogether, these efforts contribute to building a more comprehensive understanding of the Portuguese lichen biota and emphasize the value of inclusive, data-sharing initiatives for documenting and preserving biodiversity.

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