New and interesting lichen records for the Portuguese funga from the Upper Douro region (north-east Portugal)

JOANA MARQUES[1,2,3]
GRACIELA PAZ-BERMÚDEZ[3]
[1]CIBIO, Centro de Investigação em Biodiversidade e Recursos Genéticos
Campus Agrário de Vairão
P-4485-661 Vairão, Portugal
[2]Departamento de Biologia, Faculdade de Ciências da Universidade do Porto
Edifício FC4, Rua do Campo Alegre s/n
P-4169-007 Porto, Portugal
[3]Escola Universitaria de Enxeñeria Forestal, Universidade de Vigo
Campus Universitario A Xunqueira s/n
E-36005 Pontevedra, Spain
Emails: joanaMARQUES@cibio.up.pt; graciela@uvigo.es

Accepted 7. May 2014

Key words: Lichen diversity, saxicolous lichens, terricolous lichens, schist. – Mycobiota of the Iberian Peninsula.

Abstract: Thirty five saxicolous and terricolous lichens are here reported for the first time from the Upper Douro region (province of Trás-os-Montes e Alto Douro, north-east Portugal) with data on their currently known distribution and regional ecology. *Acarospora charidema*, *A. macrospora* subsp. *murorum*, *Aspicilia crespiana*, *A. cupreoglauca*, *A. viridescens*, *Caloplaca arnoldii* subsp. *obliterata*, *C. rubelliana*, *Endocarpon loscosii*, *Lichinella nigritella*, *Psorotichia schaereri*, *Pterygiopsis affinis*, *Rhizoplaca maheui*, *Rinodina vezdae*, *Toninia toepferii* and *Verrucaria geophila* are new for mainland Portugal.

Zusammenfassung: Fünfunddreißig gesteins- und erdbewohnende Flechten werden hier erstmals aus der Region Alto Douro mit Daten über ihre derzeit bekannte Verbreitung und regionale Ökologie berichtet (Provinz Trás-os-Montes e Alto Douro, nordöstliches Portugal). *Acarospora charidema, A. macrospora* subsp. *murorum, Aspicilia crespiana, A. cupreoglauca, A. viridescens, Caloplaca arnoldii* subsp. *obliterata, C. rubelliana, Endocarpon loscosii, Lichinella nigritella, Psorotichia schaereri, Pterygiopsis affinis, Rhizoplaca maheui, Rinodina vezdae, Toninia toepferii* und *Verrucaria geophila* sind neu für das portugiesische Festland.

Résumé: Trente-cinq lichens saxicoles et terricoles sont ici rapportés pour la première fois de la région du Haut Douro (province de Trás-os-Montes e Alto Douro, nord-est du Portugal) avec les données sur leur répartition actuellement connue et écologie régionale. *Acarospora charidema*, *A. macrospora* subsp. *murorum*, *Aspicilia crespiana*, *A. cupreoglauca*, *A. viridescens*, *Caloplaca arnoldii* subsp. *obliterata*, *C. rubelliana*, *Endocarpon loscosii*, *Lichinella nigritella*, *Psorotichia schaereri*, *Pterygiopsis affinis*, *Rhizoplaca maheui*, *Rinodina vezdae*, *Toninia toepferii* et *Verrucaria geophila* sont nouveaux pour le Portugal continental.

The Upper Douro region (province of Trás-os-Montes e Alto Douro, north-east Portugal) is well-known as the origin of Port wine production, whose beginnings are set in the late 18th century. The tradition of winemaking in the region is much longer, however, and can be traced back to Roman times. The vineyards have been planted on nar-

row platforms along the steep hillsides of the Douro and its tributary rivers, supported by walls made out of schist, after breaking of the original bedrock and part of the surrounding outcrops. The resulting landscape was finally classified as World Heritage by UNESCO in 2001. At the easternmost point of this region and extending nearly to the Spanish border, is an area that had previously been granted the same UNESCO classification, after the discovery of what is now considered to be one of the most important and extensive open-air prehistoric rock-art collections worldwide, carved in thousands of exposed vertical schist surfaces. The main area stretches within the boundaries of the Côa Valley Archaeological Park, named after that tributary of the Douro, along the last 22 km of the Côa river valley and extending into a portion of the Douro river valley. Some remnants of prehistoric rock-art can also be found outside the Park, towards the north-west, along the Tua and Sabor river valleys, two main tributaries on the right margin of the Douro.

The Upper Douro region is also quite appealing to ecologists for its unique combination of a harsh climate, diverse geology and complex topography. However, many parts of its territory are yet unexplored by lichenologists, with few exceptions (PAZ-BERMÚDEZ & al. 2009). In the Côa Valley and surroundings, vineyards are less extensive and natural vegetation has been left more or less untouched between olive and almond plantations.

The effect of lichen growth in the process of open-air rock-art deterioration is currently under study in the Côa Valley Archaeological Park and provided an exceptional opportunity to further access the lichen diversity of the region. As a result of this study, a remarkable lichen collection has been reported recently (MARQUES & al. 2013), comprising three novelties for mainland Europe and one species new to science.

The purpose of this paper is to present additional information on new and interesting lichen records for the Portuguese flora as well as new data on the ecology and distribution of poorly known lichen species in the Iberian Peninsula. Schist outcrops were the main target of this study but some collections were also made in granite and quartzite, which outcrop throughout the region in the vicinity of schist. Lime-silicates may also occur as rather narrow intercalations within the schist and certainly play a major influence on the composition of these lichen assemblages, especially those occurring on crevices, where calcareous soil accumulates thanks to limited precipitation.

Materials and methods

Fieldwork was carried out between September 2006 and May 2012 in the Upper Douro region (province of Trás-os-Montes e Alto Douro, north-east Portugal). Collected specimens were analysed morphologically and chemically, following the standard identification methods for lichenized fungi (Smith & al. 2009), and deposited in the herbaria of the University of Porto (PO). Specimens provided by the herbaria PO, SANT and BCN were used for comparison. Thallus morphology was examined under a Nikon SMZ800 stereomicroscope. Internal morphology of the lichen thallus and ascomata were studied from hand cut sections mounted in water observed under a Nikon Eclipse 50i microscope. Ascus structure and amyloid reaction of the ascus wall were observed by adding Lugol's solution directly to sections and squash preparations mounted in water before and after treatment with K (10%). Chemical analysis followed standardized TLC methods (ORANGE & al. 2001). Data on accompanying species was obtained in situ or after examination of collections from the same microhabitat. Lichen names are according to INDEX FUNGORUM (2013). Recent phylogenetic and taxonomic treatments within the genera *Aspicilia* (e.g. NORDIN & al. 2010, SOHRABI & al. 2013) and *Caloplaca* (ARUP & al. 2013) have resulted in several new combinations which are not yet contemplated by that checklist. As many

taxa of both genera are still pending further treatment, the original names are maintained in the following list to avoid confusion, and a reference is made to the new combination, whenever applicable.

The species list

Since all specimens were collected in Portugal, province of Trás-os-Montes e Alto Douro, this information is omitted in the following paragraphs. Species that are new records to mainland Portugal are marked with an asterisk (*). The remaining lichens are second records to the country, new records to the province and rare species in Portugal or the Iberian Peninsula.

* *Acarospora charidema* (COLMEIRO) LLIMONA

Acarospora charidema is a pioneer species described from south-east Spain that was later found in Morocco (EGEA & ROWE 1987), formed by robust, moderately convex squamules, up to 5(–6) mm wide; with numerous apothecia up to 0.5 mm wide (CLAUZADE & al. 1981). *Acarospora charidema* is usually distinguished from *A. epithallina* H. MAGN., a juvenile parasite of *A. hilaris* (DUFOUR) ARNOLD, on the basis of life habit, ecology and shape of spores, which are globose in *A. epithallina* and ovoid in *A. charidema* (CLAUZADE & al. 1981) but bears a possible resemblance to free-living squamules of *A. epithallina* (CRESPO & al. 1976). EGEA & LLIMONA (1982) also mention the striate margins of squamules for *A. charidema*, a character that is present in both examined specimens but not in the specimens assigned to *A. epithallina* (below). The occurrence of *Acarospora charidema* in the study area as well as in the nearby Spanish province of Zamora (TERRÓN-ALFONSO & al. 2000) is quite rare and somewhat inconsistent with the thermo-mediterranean, semi-arid and pioneer character of *A. charidema* (EGEA & ROWE 1987). *Acarospora epithallina*, on the contrary, is considered a meso-mediterranean species (EGEA & ROWE 1987). Further clarification on the distinction between both taxa is needed (VÍCTOR J. RICO, pers. comm.). In the study area, *A. charidema* was found on highly exposed vertical schist surfaces together with *Glyphopeltis ligustica* (B. DE LESD.) TIMDAL, *Lichinella cribellifera* (NYL.) P. P. MORENO & EGEA, *Peltula euploca* (ACH.) POELT ex OZENDA & CLAUZADE, *P. placodizans* (ZAHLBR.) WETMORE and *P. zahlbruckneri* (HASSE) WETMORE.

Specimens examined: Murça, Candedo, Alto das Eirinhas, 29TPF3978, 260 m s. m., on vertical schist surfaces, 16. October 2011, leg. & det. J. MARQUES (PO9042-L); Vila Nova de Foz Côa, Muxagata, Monte do Fariseu, 29TPF5844, 263 m s. m., on vertical schist surfaces, 1. April 2010, leg. & det. J. MARQUES (PO9041-L).

Acarospora epithallina H. MAGN.

This taxon was recently reported from Portugal by PAZ-BERMÚDEZ & al. (2009) and is relatively frequent in the study area where it can be easily recognized by the small, up to 3 mm wide, convex squamules always growing as a parasite on *Acarospora hilaris* (DUFOUR) ARNOLD. According to CRESPO & al. (1976), the occurrence of this species could be indicative of more hydric and eutrophic microhabitats than typically occupied by the host *A. hilaris*. Our data is insufficient to support such distinction but, contrarily to what was described by these authors, specimens collected in the study area were not exclusively on horizontal surfaces, colonizing both vertical and horizontal schist and quartzite surfaces.

Specimens examined: Carrazeda de Ansiães, Pombal, São Lourenço, 29TPF3572, 156 m s. m., on vertical granite surfaces, 14. October 2011, leg. & det. J. MARQUES (PO9049-L); Mogadouro, Bemposta, Faia da Água Alta, 29TQF0775, 514 m s. m., on vertical schist surfaces, 12. May 2009, leg. & det. J. MARQUES (PO9046-L); Murça, Candedo, Alto das Eirinhas, 29TPF3978, 260 m s. m., on vertical schist surfaces, 16. October 2011, leg. & det. J. MARQUES (PO9042-L); Foz do Tinhela, 29TPF3676, 181 m s. m., on vertical schist surfaces, 17. September 2011, leg. & det. J. MARQUES (PO9047-L); Vila Flor, Vilarinho das Azenhas, Vilarinho das Azenhas, 29TPF4982, 206 m s. m., on vertical schist surfaces, 15. October 2011, leg. & det. J. MARQUES (PO9048-L); Vila Nova de Foz Côa, Castelo Melhor, Alto da Penascosa, 29TPF5846, 270 m s. m., on vertical schist surfaces, 15. May 2007, leg. & det. J. MARQUES (PO9043-L); Canada do Amendoal, 29TPF5946, 344 m s. m., on vertical schist surfaces, 30. March 2010, leg. & det. J. MARQUES (PO9044-L); Muxagata, Ribeira de Piscos, 29TPF5843, 130 m s. m., on vertical schist surfaces, 9. May 2009, leg. & det. J. MARQUES (PO9045-L).

* ***Acarospora macrospora*** subsp. ***murorum*** (A. MASSAL.) CLAUZADE & CL. ROUX

Rare, on dry and exposed earth-filled crevices or compacted soil between schist outcrops. The large spores, thallus with the same colour as the substrate and prominent thalline margin in apothecia are distinctive characters (CLAUZADE & al. 1981). Before this study, it had only been reported in Portugal from the archipelago of the Azores by TAVARES (1944).

Specimens examined: Vila Nova de Foz Côa, Castelo Melhor, Canada do Amendoal, 29TPF5946, 330 m s. m., on wide crevices of schist outcrops, 29. October 2010, leg. & det. J. MARQUES (PO9050-L); Muxagata, Ribeira de Piscos, 29TPF5843, 136 m s. m., on narrow crevices of schist outcrops, 9. May 2009, leg. & det. J. MARQUES (PO9051-L); Vila Nova de Foz Côa, Vale do Forno, 29TPF5748, 297 m s. m., on wide crevices of schist outcrops, 30. March 2010, leg. & det. J. MARQUES (PO9052-L).

Agonimia opuntiella (BUSCHART & POELT) VĚZDA

Easily overlooked due to its small size but quite frequent in the study area among chasmolithic and epigeic lichen communities. It was erroneously cited as a first record for Portugal by PAZ-BERMÚDEZ & al. (2009) as it had already been reported from Nazaré (VAN DEN BOOM 2006). It is also known from several localities in the Algarve (VAN DEN BOOM & GIRALT 2012).

Selected specimens examined: Mirandela, Valverde, Serra de Valverde, 29TPF5183, 219 m s. m., on vertical quartzite surfaces, 15. October 2011, leg. & det. J. MARQUES (PO9005-L); Vila Nova de Foz Côa, Castelo Melhor, Penascosa, 29TPF5941, 162 m s. m., on vertical schist surfaces, 31. March 2010, leg. & det. J. MARQUES (PO8997-L); Chãs, Quinta da Barca, 29TPF5941, 150 m s. m., on vertical schist surfaces, 14. October 2010, leg. & det. J. MARQUES (PO9057-L); Muxagata, Fariseu, 29TPF5844, 127 m s. m., on wide crevices of schist outcrops, 1. April 2010, leg. & det. J. MARQUES (PO9384-L); Ribeira de Piscos, 29TPF5843, 150 m s. m., on vertical schist surfaces, 9. May 2009, leg. & det. J. MARQUES (PO9054-L); Vila Nova de Foz Côa, Canada do Inferno, 29TPF5846, 110 m s. m., on wide crevices of schist outcrops, 8. February 2006, leg. & det. J. MARQUES (PO9055-L); Vale do Forno, 29TPF5748, 297 m s. m., on wide crevices of schist outcrops, 30. March 2010, leg. & det. J. MARQUES (PO9056-L).

* ***Aspicilia crespiana*** V. J. RICO

A species described by RICO (1999) from material collected in several Spanish provinces and in Sardinia (Italy), recently combined into *Circinaria crespiana* (V. J. RICO) SOHRABI & V. J. RICO by SOHRABI & al. (2013). This species has some morphological affinities with *Aspicilia contorta* (HOFFM.) KREMP. subsp. *hoffmanniana* S. EKMAN &

FRÖBERG ex R. SANT. but develops into a clearly squamulose thallus with a dense network of rhizomorphs, on saxicolous mosses and rock crevices of exposed siliceous rocks. In the study area it was found on both granite and schist but fertile specimens were only found in more humid situations, overgrowing mosses.

Specimens examined: Alijó, Amieiro, 29TPF3471, 153 m s. m., on vertical granite surfaces, 13. October 2011, leg. & det. J. MARQUES (PO9078-L); Alfândega da Fé, Parada, Santo Antão da Barca, 29TPF7669, 175 m s. m., on narrow crevices of schist outcrops, 13. May 2009, leg. & det. J. MARQUES (PO9074-L); Carrazeda de Ansiães, Castanheiro, Praia fluvial, 29TPF3466, 136 m s. m., on vertical schist surfaces, 12. October 2012, leg. & det. J. MARQUES (PO9080-L); Mogadouro, Bemposta, Faia da Água Alta, 29TQF0775, 514 m s. m., on wide crevices of schist outcrops, 12. May 2009, leg. & det. J. MARQUES (PO9077-L); Murça, Candedo, Alto das Eirinhas, 29TPF3978, 260 m s. m., on vertical schist surfaces, 16. October 2011, leg. & det. J. MARQUES (PO9081-L); Vila Nova de Foz Côa, Castelo Melhor, Penascosa, 29TPF5846, 161 m s. m., on vertical schist surfaces, 15. May 2007, leg. & det. J. MARQUES (PO9075-L); Muxagata, Ribeira de Piscos, 29TPF5843, 136 m s. m., on wide crevices of schist outcrops, 9. May 2009, leg. & det. J. MARQUES (PO9076-L); Vila Nova de Foz Côa, Vale de José Esteves, 29TPF5849, 196 m s. m., on wide crevices of schist outcrops, 2. May 2011, leg. & det. J. MARQUES (PO9082-L).

* *Aspicilia cupreoglauca* B. DE LESD.

This species has been recorded scarcely in the Iberian Peninsula mainly from central and south-eastern Spain (HLADUN & LLIMONA 2002–2007), and is also rare in the study area but readily distinguished by the orange-brown colour of the thallus reacting K+ yellow to red.

Specimens examined: Alfândega da Fé, Parada, Santo Antão da Barca, 29TPF7669, 175 m s. m., on vertical schist surfaces, 13. May 2009, leg. J. MARQUES, det. V. J. RICO & J. MARQUES (PO9073-L).

* *Aspicilia viridescens* (A. MASSAL.) HUE

A member of the former *Aspicilia contorta* (= *Circinaria contorta*) group similar to *A. contorta* subsp. *hoffmanniana* in the development of a continuous thallus. Although not widely accepted as a separate species, according to OZENDA & CLAUZADE (1970) it differs from typical *A. contorta* subsp. *hoffmanniana* in the colour of thallus, which is greyish green or yellowish green and intensified by the action of acids. Relatively rare in the study area, on north- to north-west-facing schist surfaces.

Specimens examined: Alfândega da Fé, Parada, Santo Antão da Barca, 29TPF7669, 175 m s. m., on vertical schist surfaces, 13. May 2009, leg. J. MARQUES, det. V. J. RICO & J. MARQUES (PO9083-L).

* *Caloplaca arnoldii* subsp. *obliterata* (PERS.) GAYA

A new combination recently incorporated in the *Caloplaca saxicola* group (GAYA 2009). The examined specimen falls within the range of the "*Caloplaca saxicola* subsp. *obliterata*" morphotype, as defined by the same author, including a slightly pruinose thallus that is dusty orange to ochraceous, or deep orange where the pruina is absent; formed by well delimited rosettes, with well developed marginal lobes broadened at the apices; and crowded apothecia where the colour of the margin is lighter than the disk. According to GAYA (2009), the distribution of the "*Caloplaca saxicola* subsp. *obliterata*" morphotype in the Iberian Peninsula was limited to central Spain, previous to this study. It was found only once in the study area, on a vertical schist surface facing south-east, close to a small watercourse.

Specimens examined: Vila Nova de Foz Côa, Castelo Melhor, Canada do Amendoal, 29TPF5946, 344 m s. m., on inclined schist surfaces, 30. March 2010, leg. J. MARQUES, det. E. GAYA & J. MARQUES (PO9084-L).

Caloplaca grimmiae (NYL.) H. OLIVIER

The only record of this species for Portugal, previous to this study, is the one by VAN DEN BOOM & JANSEN (2002), as *Caloplaca congrediens* STEINER, found at the higher altitudes of Serra da Estrela. Most collected specimens in the study area were growing as parasites on *Candelariella vitellina* (HOFFM.) MÜLL. ARG., but one (PO9086-L) was also growing upon *Candelariella coralliza* (NYL.) H. MAGN. The following records considerably extend the known distribution of the species in Portuguese territory.

Specimens examined: Alfândega da Fé, Parada, Santo Antão da Barca, 29TPF7669, 175 m s. m., on *Candelariella coralliza* on horizontal schist surfaces, 13. May 2009, leg. & det. J. MARQUES (PO9086-L); Vila Nova de Foz Côa, Castelo Melhor, Alto da Penascosa, 29TPF5846, 270 m s. m., on *C. vitellina* on vertical schist surfaces, 15. May 2007, leg. & det. J. MARQUES (PO9537-L); Muxagata, Ribeira de Piscos, 29TPF5843, 150 m s. m., on *C. vitellina* on vertical schist surfaces, 9. May 2009, leg. & det. J. MARQUES (PO9375-L).

* ***Caloplaca rubelliana*** (ACH.) LOJKA

Readily distinguished by the dark orange apothecia sunken in a thin salmon orange thallus. In the Iberian Peninsula it has been mainly recorded from south-east Spain (HLADUN & LLIMONA 2002–2007) and was found only once in the study area, on a south-east facing schist surface.

Specimens examined: Vila Nova de Foz Côa, Foz do Côa, 29TPF5941, 156 m s. m., on vertical schist surfaces, 5. July 2012, leg. & det. J. MARQUES (PO9085-L).

Caloplaca squamuloisidiata VAN DEN BOOM & V. J. RICO

This is a recently described species, known only from the Iberian Peninsula (VAN DEN BOOM & RICO 2006, PAZ-BERMÚDEZ & al. 2009) with an unsettled phylogenetic position although morphologically fitting *Caloplaca cerina* group (ŠOUN & al. 2011). It can be recognized by the greyish green subsquamulose to weakly placodioid thallus with abundant branched coralloid isidia appearing from small erect squamules. It is easily overlooked due to small size, discrete thallus colour and peculiar habitat, on sheltered and often slightly overhung schist, quartzite and granite surfaces. The assemblage of accompanying species in the Upper Douro region is more similar to the one mentioned for the type locality in Spain than to the previously described from northern Portugal (VAN DEN BOOM & RICO 2006), and includes *Acarospora epithallina*, *A. hilaris*, *Caloplaca carphinea* (FR.) JATTA, *C. demissa* (FLOT.) ARUP & GRUBE and *Solenopsora vulturiensis* A. MASSAL.

Specimens examined: Carrazeda de Ansiães, Pombal, São Lourenço, 29TPF3572, 156 m s. m., on vertical schist surfaces, 14. October 2011, leg. & det. J. MARQUES (PO9091-L); MURÇA, Candedo, Foz do Tinhela, 29TPF3676, 181 m s. m., on vertical schist surfaces, 17. September 2011, leg. & det. J. MARQUES (PO9092-L); Vila Nova de Foz Côa, Canada do Amendoal, 29TPF5846, 330 m s. m., on vertical schist surfaces, 29. September 2010, leg. & det. J. MARQUES (PO9090-L).

Endocarpon adscendens (ANZI) MÜLL. ARG.

Composed of broadly ascending to imbricate squamules loosely attached to substrate through a pale brown lower surface that lacks rhizomorphs. It was first reported in

Portugal by CORDEIRO (1915) as *Verrucaria pallida* (ACH.) NYL. from the more southern region of Setúbal but was never reported again in Portuguese territory and is elsewhere known in the Iberian Peninsula from north and south-east Spain. Very rare in the study area, overgrowing mosses on vertical schist surfaces along the riverbanks of the main watercourses.

Specimens examined: Mogadouro, Bemposta, Faia da Água Alta, 29TQF0775, 514 m s. m., on vertical schist surfaces, 12. May 2009, leg. & det. J. MARQUES (PO9093-L).

* ***Endocarpon loscosii*** MÜLL. ARG.

This species is similar to *Endocarpon adscendens* in thallus shape and colour of lower surface, but differs in the development of pale robust rhizomorphs. In the Iberian Peninsula it was previously reported only from north-east Spain (HLADUN & LLIMONA 2002–2007) and is rare in the study area, overgrowing mosses on periodically submerged granite boulders associated with temporary riverbeds together with *Solenopsora vulturiensis* and *Peltula lobata* J. MARQUES, M. SCHULTZ & PAZ-BERM.

Specimens examined: Alijó, Amieiro, 29TPF3471, 153 m s. m., on vertical schist surfaces, 24. March 2012, leg. & det. J. MARQUES (PO9095-L); Carlão, Vale do Moinho, 29TPF3477, 203 m s. m., on vertical schist surfaces, 7. March 2012, leg. & det. J. MARQUES (PO9096-L); Carrazeda de Ansiães, Castanheiro, Praia fluvial, 29TPF3466, 136 m s. m., on vertical schist surfaces, 12. October 2012, leg. & det. J. MARQUES (PO9097-L); MURÇA, Candedo, Foz do Tinhela, 29TPF3676, 181 m s. m., on vertical schist surfaces, 17. September 2012, leg. & det. J. MARQUES (PO9094-L).

Epiphloea terrena (NYL.) TREVIS.

This species belongs to a poorly-known genus of family *Heppiaceae* characterized by muriform spores and comprising only two species formerly included in *Collemataceae*. *Epiphloea terrena* differs from the similar *Epiphloea byssina* (HOFFM.) HENSSEN & P. M. JØRG. in the well-developed, squamulose thallus that is paraplectenchymatous in section. Easily overlooked due to its small size, it was twice reported from Portugal by SAMPAIO (1921) as *Amphidium terrenum* NYL. and more recently by VAN DEN BOOM & GIRALT (2012). It is elsewhere known only from a few localities in the Mediterranean region (NIMIS 1993), the closest to the study area being from south-east Spain (HLADUN & LLIMONA 2002–2007). It is highly dependent on soil stability and relatively rare in the study area, on horizontal schist surfaces where soil accumulates and on earth banks between schist outcrops.

Specimens examined: Alijó, Amieiro, 29TPF3471, 153 m s. m., on earth banks between schist outcrops, 24. March 2012, leg. & det. J. MARQUES (PO9127-L); Carlão, Alto do vale de Moinho, 29TPF3477, 324 m s. m., on earth banks between schist outcrops, 7. March 2012, leg. & det. J. MARQUES (PO9128-L); TORRE DE MONCORVO, Cardanha, Ribeira de Relvas, 29TPF6669, 259 m s. m., on earth banks between schist outcrops, 18. February 2011, leg. J. MARQUES, det. P. M. JØRGENSEN (PO9129-L); Vila Nova de Foz Côa, Vale Cabrões, 29TPF5750, 302 m s. m., on wide crevices of schist outcrops, 30. September 2011, leg. & det. J. MARQUES (PO9130-L); Vale do Forno, 29TPF5748, 297 m s. m., on horizontal schist surfaces with soil accumulation, 30. March 2010, leg. & det. J. MARQUES (PO9131-L).

Glyphopeltis ligustica (B. de LESD.) TIMDAL

Previously included in the genus *Psora*, it is characterized by the large, pale brown squamules, up to 10 mm wide, centrally attached by an umbilicus; and the black marginal apothecia. In the study area it is quite frequent, growing directly on exposed vertical schist surfaces as a characteristic species of rain-track communities dominated by

Peltula euploca. It has been reported from the Mediterranean region, Madeira, Morocco and South Africa (NIMIS 1993) but this is only the second record from mainland Portugal, after having been found in the valley of river Sabor (PAZ-BERMÚDEZ & al. 2009).

Specimens examined: Alfândega da Fé, Parada, Santo Antão da Barca, 29TPF7669, 175 m s. m., on vertical schist surfaces, 13. May 2009, leg. & det. J. MARQUES (PO9133-L); Macedo de Cavaleiros, Lagoa, Casas, 29TPF8587, 345 m s. m., on vertical schist surfaces, 5. September 2006, leg. & det. J. MARQUES (PO9134-L); Mirandela, Barcel, Longra, 29TPF4680, 219 m s. m., on vertical schist surfaces, 15. October 2011, leg. & det. J. MARQUES (PO9135-L); Mogadouro, Bemposta, Faia da Água Alta, 29TQF0775, 514 m s. m., on vertical schist surfaces, 12. May 2009, leg. & det. J. MARQUES, (PO9136-L); Vila Nova de Foz Côa, Castelo Melhor, Canada do Amendoal, 29TPF5946, 344 m s. m., on vertical schist surfaces, 30. March 2010, leg. & det. J. MARQUES, (PO9137-L); Muxagata, Monte do Fariseu, 29TPF5844, 263 m s. m., on vertical quartzite surfaces, 1. April 2010, leg. & det. J. MARQUES (PO9008-L); Ribeira de Piscos, 29TPF5843, 150 m s. m., on vertical schist surfaces, 9. May 2009, leg. & det. J. MARQUES (PO9589-L); Vila Nova de Foz Côa, Canada do Inferno, 29TPF5846, 131 m s. m., on vertical schist surfaces, 7. May 2009, leg. & det. J. MARQUES (PO9642-L); Foz do Côa, 29TPF5849, 187 m s. m., on vertical schist surfaces, 3. May 2011, leg. & det. J. MARQUES (PO9140-L); Vale do Forno, 29TPF5748, 301 m s. m., on vertical schist surfaces, 4. May 2011, leg. & det. J. MARQUES (PO9013-L); Vale de José Esteves, 29TPF5949, 146 m s. m., on vertical schist surfaces, 8. May 2009, leg. & det. J. MARQUES (PO9141-L).

Koerberia sonomensis (TUCK.) HENSSEN

Easily distinguished by the rosulate thallus with narrow lacinia and striate surface. Apothecia are dark brown to black with a persistent thalline margin. Once reported from Póvoa de Lanhoso in the province of Minho by SAMPAIO (1924) as *Koerberia lusitanica* SAMP. and later from Serra da Estrela by JANSEN (1993). However, VAN DEN BOOM & JANSEN (2002) realized that the specimen from Serra da Estrela had been misidentified and actually belonged to *Polychidium muscicola* (SW.) GRAY. The references provided by BURGAZ & MARTINEZ (2003) for the province of Trás-os-Montes e Alto Douro are also erroneous as they refer to the epiphyte *Koerberia biformis* A. MASSAL. *Koerberia sonomensis* is one of the rarest species in the study area, growing on vertical schist surfaces facing south. The examined specimen therefore represents a second record for Portugal and the first for the province of Trás-os-Montes e Alto Douro, extending the currently known distribution of the species in Portugal further north-east.

Specimens examined: MURÇA, Candedo, Ponte do Tinhela, 29TPF3676, 204 m s. m., on vertical schist surfaces, 17. September 2011, leg. & det. J. MARQUES (PO9132-L).

Lecanora pseudistera NYL.

This species, said by SAMPAIO (1917) to occur in the nearby locality of Barca d'Alva, was recently found in Nazaré (VAN DEN BOOM 2006), the Algarve (VAN DEN BOOM & GIRALT 2012), and is quite frequent in the study area colonizing both north-west and south-east facing vertical schist surfaces. It often extends towards the narrow crevices of south-east facing schist surfaces, together with *Caloplaca subsoluta* (NYL.) ZAHLBR. (*C. irrubescens* misapplied by auct. iber.) and *C. pellodella* (NYL.) HASSE, in addition to *Aspicilia crespiana*, *Peltula obscurans* (NYL.) GYELN. and *Toninia cinereovirens* (SCHAER.) A. MASSAL.

Specimens examined: Mirandela, Valverde, Serra de Valverde, 29TPF5183, 219 m s. m., on vertical schist surfaces, 15. October 2011, leg. & det. J. MARQUES (PO9149-L); Vila Nova de Foz Côa, Castelo melhor, Penascosa, 29TPF5941, 164 m s. m., on narrow crevices of schist outcrops, 15.

May 2007, leg. & det. J. MARQUES (PO9142-L); Muxagata, Ribeira de Piscos, 29TPF5843, 136 m s. m., on narrow crevices of schist outcrops, 9. May 2009, leg. & det. J. MARQUES (PO9143-L); Vila Nova de Foz Côa, Canada do Inferno, 29TPF5941, 110 m s. m., on wide crevices of schist outcrops, 8. February 2009, leg. & det. J. MARQUES (PO9144-L); Foz do Côa, 29TPF5849, 187 m s. m., on vertical schist surfaces, 3. May 2011, leg. & det. J. MARQUES (PO9145-L); Tudão, 29TPF5650, 378 m s. m., on vertical schist surfaces, 8. May 2009, leg. & det. J. MARQUES (PO9146-L); Vale de José Esteves, 29TPF5949, 146 m s. m., on horizontal surfaces above schist outcrops, 8. May 2009, leg. & det. J. MARQUES (PO9147-L); Vermelhosa, 29TPF5950, 147 m s. m., on vertical schist surfaces, 14. October 2010, leg. & det. J. MARQUES (PO9148-L).

Lichinella cribellifera (Nyl.) P. P. MORENO & EGEA

Characterized by the foliose, polyphyllous thallus with radial folds in the upper surface and attached to the substrate by an umbilicus. According to MORENO & EGEA (1992) it is one of the most typical species of rain-track communities in exposed siliceous rocks. It was previously reported for Portugal, from the province of Minho (MORENO & EGEA 1992). The examined specimens represent new records for the province of Trás-os-Montes e Alto Douro, extending the currently known distribution of the species in Portugal further east.

Specimens examined: Alijó, Amieiro, 29TPF3471, 153 m s. m., on vertical granite surfaces, 24. March 2012, leg. & det. J. MARQUES (PO9099-L); Carlão, Praia fluvial do Vale do Moinho, 29TPF3477, 203 m s. m., on vertical granite surfaces, 7. March 2012, leg. & det. J. MARQUES (PO9100-L); Mirandela, Abreiro, Quinta da Pendurada, 29TPF4479, 200 m s. m., on vertical granite surfaces, 9. March 2012, leg. & det. J. MARQUES (PO9101-L); Vila Nova de Foz Côa, Castelo Melhor, Canada do Amendoal, 29TPF5846, 309 m s. m., on vertical schist surfaces, 14. March 2012, leg. & det. J. MARQUES (PO9102-L); Muxagata, Monte do Fariseu, 29TPF5844, 263 m s. m., on vertical schist surfaces, 1. April 2010, leg. J. MARQUES, det. M. SCHULTZ & J. MARQUES (PO8983-L); Ribeira de Piscos, 29TPF5843, 136 m s. m., on inclined schist surfaces, 9. May 2009, leg. J. MARQUES, det. M. SCHULTZ & J. MARQUES (PO9589-L); Vila Nova de Foz Côa, Foz do Côa, 29TPF5849, 187 m s. m., on wide horizontal crevices of schist outcrops, 3. May 2011, leg. J. MARQUES, det. M. SCHULTZ & J. MARQUES (PO9150-L); Vale de José Esteves, 29TPF5949, 161 m s. m., on vertical schist surfaces, 8. May 2009, leg. J. MARQUES, det. M. SCHULTZ & J. MARQUES (PO9104-L); Vale do Forno, 29TPF5748, 297 m s. m., on vertical schist surfaces, 30. March 2010, leg. J. MARQUES, det. M. SCHULTZ & J. MARQUES (PO9103-L).

* ***Lichinella nigritella*** (LETTAU) P. P. MORENO & EGEA

Similar to *L. cribellifera*, however the deeply branched lobes, often dissected into small lobules and globose isidia are distinctive (MORENO & EGEA 1992). In the Iberian Peninsula it was only known from south and south-east Spain, previous to this study.

Specimens examined: Alijó, Carlão, Vale do Moinho, 29TPF3477, 203 m s. m., on vertical granite surfaces, 7. March 2012, leg. & det. J. MARQUES (PO9100-L); Vila Nova de Foz Côa, Castelo Melhor, Canada do Amendoal, 29TPF5846, 330 m s. m., on vertical schist surfaces, 14. March 2012, leg. & det. J. MARQUES (PO9105-L); Muxagata, Fariseu, 29TPF5844, 127 m s. m., on vertical schist surfaces, 1. April 2010, leg. J. MARQUES, det. M. SCHULTZ & J. MARQUES (PO9106-L); Vila Nova de Foz Côa, Foz do Côa, 29TPF5849, 187 m s. m., on vertical schist surfaces, 3. May 2011, leg. J. MARQUES, det. M. SCHULTZ & J. MARQUES (PO9107-L).

Lichinella stipatula NYL.

This is the most ubiquitous species of the genus (SCHULTZ 2007), and a recurrent element of rain-track communities on both siliceous and calcareous rocks (MORENO & EGEA 1992). In the study area it also occurs among the terricolous lichen communities that colonize the narrow crevices of vertical schist surfaces. It is separated from *Lichi-*

nella robusta HENSSEN, known to occur in the southerly province of Alentejo (HENSSEN & al. 1985), by the absence of a robust hyphal strand in the centre of the thallus and by forming compact, irregularly branched, dwarf-fruticose cushions (MORENO & EGEA 1992). *Lichinella stipatula* was recently reported from Algarve by VAN DEN BOOM & GIRALT (2012) and is here reported for the first time from the province of Trás-os-Montes e Alto Douro thus extending the known distribution of this species in Portugal considerably further north.

Specimens examined: Mogadouro, Brunhoso, Ribeiro de Juncaínhos, 29TPF8380, 473 m s. m., on vertical surfaces of basic vulcanite rock outcrops, 17. February 2011, leg. J. MARQUES, det. M. SCHULTZ & J. MARQUES (PO9171-L); Soutelo, Alto da Fraga, 29TPF8886, 580 m s. m., on vertical schist surfaces, 11. May 2009, leg. J. MARQUES, det. M. SCHULTZ & J. MARQUES (PO9172-L); MURÇA, Candedo, Ponte do Tinhela, 29TPF3676, 204 m s. m., on vertical schist surfaces, 17. September 2011, leg. J. MARQUES, det. M. SCHULTZ & J. MARQUES (PO9173-L); Vila Nova de Foz Côa, Castelo Melhor, Canada do Amendoal, 29TPF5846, 310 m s. m., on vertical schist surfaces, 7. April 2011, leg. J. MARQUES, det. M. SCHULTZ & J. MARQUES (PO9174-L); Penascosa, 29TPF5846, 164 m s. m., on vertical schist surfaces, 15. May 2007, leg. J. MARQUES, det. M. SCHULTZ & J. MARQUES (PO9175-L); Chãs, Quinta da Barca, 29TPF5941, 150 m s. m., on vertical schist surfaces, 14. October 2010, leg. J. MARQUES, det. M. SCHULTZ & J. MARQUES (PO9176-L); Muxagata, Ribeira de Piscos, 29TPF5843, 136 m s. m., on wide horizontal crevices of schist outcrops, 9. May 2009, leg. J. MARQUES, det. M. SCHULTZ & J. MARQUES (PO9177-L); Vila Nova de Foz Côa, Canada do Inferno, 29TPF5846, 110 m s. m., on wide horizontal crevices of schist outcrops, 8. February 2006, leg. J. MARQUES, det. M. SCHULTZ & J. MARQUES (PO9055-L); Foz do Côa, 29TPF5849, 187 m s. m., on wide horizontal crevices of schist outcrops, 3. May 2011, leg. J. MARQUES, det. M. SCHULTZ & J. MARQUES (PO9150-L).

Placidium imbecillum (BREUSS) BREUSS

Although very common in the Iberian Peninsula it was not known to occur in Portugal until PRIETO & al. (2010) reported it for the first time based on material collected in the province of Beira Litoral (north-west Portugal). Specimens with intermediate features are very difficult to distinguish from *P. subrufescens* (BREUSS) BREUSS but we relied on the length of conidia (never exceeding 5 μm) to confirm the identity of examined specimens. These constitute second records for Portugal and first records for the province of Trás-os-Montes e Alto Douro, confirming the presence of *P. imbecillum* at the westernmost areas of the Iberian Peninsula. It was found growing on soil and horizontal crevices together with *Squamarina concrescens* (MÜLL. ARG.) POELT and *Massalongia carnosa* (DICKS.) KÖRB.

Specimens examined: Torre de Moncorvo, Felgar, Ribeira da Sardinha, 29TPF5946, 268 m s. m., on narrow crevices of schist outcrops, 25. April 2009, leg. & det. J. MARQUES (PO9151-L); Vila Nova de Foz Côa, Castelo Melhor, Canada do Amendoal, 29TPF5946, 315 m s. m., on earth banks between schist outcrops, 7. April 2011, leg. & det. J. MARQUES (PO9152-L); Vila Nova de Foz Côa, Quinta das Tulhas, 29TPF5949, 135 m s. m., on earth banks between schist outcrops, 17. March 2012, leg. & det. J. MARQUES (PO9153-L); Vale Cabrões, 29TPF5750, 302 m s. m., on earth banks between schist outcrops, 30. September 2011, leg. & det. J. MARQUES (PO9130-L); Vale do Forno, 29TPF5748, 297 m s. m., on vertical schist surfaces, 30. March 2010, leg. & det. J. MARQUES (PO9154-L).

Porocyphus coccodes (FLOT.) KÖRB.

According to MORENO & EGEA (1994), the genus *Porocyphus* is in need of a thorough revision, given its immense variability. *Porocyphus coccodes* is characterized by the combination of a dark green-olive thallus, composed of very uneven and coralloid areoles, apothecia that are initially immersed and globose and finally stalked with a thal-

line margin and 8-spored asci. Last reported from Portugal by SAMPAIO (1922) as *Porocyphus furfurellus* (NYL.) FORSSEL. New for the province of Trás-os-Montes e Alto Douro.

Specimens examined: Vila Nova de Foz Côa, Foz do Côa, 29TPF5849, 187 m s. m., on vertical schist surfaces, 3. May 2011, leg. & det. J. MARQUES (PO9108-L).

Psora gresinonis B. DE LESD.

A rare species known to occur in Mediterranean Europe and Macaronesia, as well as central Asia (TIMDAL 2010). The small, concave, dark olivaceous brown squamules, with smooth to crenulate edges, paler than thallus, and the presence of norstictic acid in the medulla are diagnostic (TIMDAL 1984, 2010). It was previously reported from Portugal by VAN DEN BOOM & GIRALT (1996, 2012). In the study area it is relatively frequent on the compacted mineral soil that accumulates on horizontal surfaces and stable earth banks, usually accompanied by *Peltula obscurans*, *Endocarpon pusillum* HEDW. and, less frequently, *Epiphloea terrena*.

Specimens examined: Carrazeda de Ansiães, Castanheiro, Quinta da Ribeira, 29TPF3265, 132 m s. m., on horizontal schist surfaces, 12. October 2011, leg. & det. J. MARQUES (PO9643-L); Vila Nova de Foz Côa, Castelo melhor, Canada do Amendoal, 29TPF5846, 344 m s. m., on horizontal schist surfaces, 30. March 2012, leg. & det. J. MARQUES (PO9541-L); Muxagata, Ribeira de Piscos, 29TPF5843, 130 m s. m., on horizontal schist surfaces, 11. October 2010, leg. & det. J. MARQUES (PO9543-L); Vila Nova de Foz Côa, Vale do Forno, 29TPF5748, 320 m s. m., on horizontal schist surfaces, 15. October 2010, leg. & det. J. MARQUES (PO9494-L); Vale de José Esteves, 29TPF5949, 146 m s. m., on horizontal schist surfaces, 8. May 2009, leg. & det. J. MARQUES (PO9109-L; PO9479-L); Vermelhosa, 29TPF5950, 147 m s. m., on horizontal schist surfaces, 14. October 2010, leg. & det. J. MARQUES (PO9542-L).

* ***Psorotichia schaereri*** (A. MASSAL.) ARNOLD

A widespread species known to occur in the European and American continents, but rare in the study area, found only in one locality on vertical schist surfaces facing south-east, and among other lichens of rain-track communities. The granulose-areolate thallus and apothecia with prominent margins are diagnostic. In the Iberian Peninsula this species is known to occur in several Spanish provinces (MORENO & EGEA 1994) but not in Portugal, before this study.

Specimens examined: Vila Nova de Foz Côa, Muxagata, Fariseu, 29TPF5844, 127 m s. m., on vertical schist surfaces, 1. April 2010, leg. J. MARQUES, det. J. MARQUES & M. SCHULTZ (PO9098-L).

* ***Pterygiopsis affinis*** (A. MASSAL**.)** HENSSEN

This species is easily distinguished from any other crustose *Lichinaceae* by the effigurate, lobulate thallus, multispored asci and small globose to ellipsoid spores (MORENO & EGEA 1994). A pink pigment is usually present in the epithecium and hymenium. In the study area it was found colonizing slightly inclined to fully vertical and exposed rain-track surfaces, of both schist and granite outcrops. In the Iberian Peninsula this species was previously reported only from the Spanish province of Murcia (HLADUN & LLIMONA 2002–2007).

Specimens examined: Alfândega da Fé, Parada, Santo Antão da Barca, 29TPF7669, 175 m s. m., on vertical schist surfaces, 13. May 2009, leg. & det. J. MARQUES (PO9014-L); Alijó, Amieiro, 29TPF3471, 310 m s. m., on inclined granite surfaces, 24. March 2012, leg. & det. J. MARQUES (PO9110-L); Carrazeda de Ansiães, Castanheiro, Fiolhal, 29TPF3264, 203 m s. m., on vertical schist

surfaces, 23. March 2012, leg. & det. J. MARQUES (PO9111-L); Mirandela, Abreiro, Quinta da Pendurada, 200 m s. m., 29TPF4479, on inclined granite surfaces, 9. March 2012, leg. & det. J. MARQUES (PO9112-L). Vila Nova de Foz Côa, Castelo Melhor, Canada do Amendoal, 29TPF5946, 310 m s. m., on vertical schist surfaces, 7. April 2012, leg. & det. J. MARQUES (PO9113-L); Vila Nova de Foz Côa, Foz do Côa, 29TPF5849, 187 m s. m., on vertical schist surfaces, 3. May 2011, leg. J. MARQUES, det. M. SCHULTZ (PO9108-L).

* ***Rhizoplaca maheui*** (HUE) GÓMEZ-BOLEA & M. BARBERO

A very detailed description of this species, originally described from Spain as *Polycauliona maheui* HUE and conspecific with *Omphalodina bullata* FOLLMANN & A. CRESPO, is provided by GÓMEZ-BOLEA & BARBERO (2009). Fully developed specimens are typically pulvinate and attached to substrate by an umbilicus. Examined specimens and field observations show that, at early stages of development, the thallus is somewhat placodioid with characteristic bullate lobes in the centre and marginal lobes slightly inflated. Both marginal and central lobes are weakly attached to the substrate and either deformed by contact with each other or completely obscured by clusters of apothecia. Usually accompanying *Acarospora hilaris* and *Caloplaca demissa* in vertical schist and granite surfaces, but also found on a remarkably large granite boulder among rain track communities dominated by *Pterygiopsis affinis* and *Peltula zahlbruckneri*.

Specimens examined: Alijó, Amieiro, 29TPF3471, 153 m s. m., on inclined granite surfaces, 13. October 2011, leg. & det. J. MARQUES (PO9155-L); Carrazeda de Ansiães, Pombal, São Lourenço, 29TPF3572, 156 m s. m., on vertical granite surfaces, 14. October 2011, leg. & det. J. MARQUES (PO9158-L); Mirandela, Abreiro, Quinta da Pendurada, 29TPF4479, 200 m s. m., on inclined granite surfaces, 9. March 2012, leg. & det. J. MARQUES (PO9157-L); MURÇA, Candedo, Foz do Tinhela, 29TPF3676, 181 m s. m., on vertical schist surfaces, 17. September 2011, leg. & det. J. MARQUES (PO9156-L).

* ***Rinodina vezdae*** H. MAYRHOFER

Morphological and chemically identical to *Rinodina oxydata* (A. MASSAL.) A. MASSAL., with which it often occurs on vertical south-east facing schist surfaces and respective crevices. It differs in the slightly larger spores, reaching 30 × 16 µm in size but doubts remain regarding the separation of both species (GIRALT 2001). In the Iberian Peninsula it was previously known only from a few localities in south-east Spain, with a similar ecology to that of the examined specimens.

Specimens examined: Alfândega da Fé, Parada, Santo Antão da Barca, 29TPF7669, 175 m s. m., on vertical schist surfaces, 13. May 2009, leg. & det. J. MARQUES (PO9011-L); Vila Nova de Foz Côa, Castelo Melhor, Penascosa, 29TPF5941, 160 m s. m., on wide crevices of schist outcrops, 15. May 2007, leg. & det. J. MARQUES (PO9305-L); Muxagata, Ribeira de Piscos, 29TPF5843, 150 m s. m., on wide crevices of schist outcrops, 9. May 2009, leg. & det. J. MARQUES (PO9644-L); Vila Nova de Foz Côa, Canada do Inferno, 29TPF5846, 126 m s. m., on wide crevices of schist outcrops, 8. June 2006, leg. & det. J. MARQUES (PO9306-L); Foz do Côa, 29TPF5849, 187 m s. m., on vertical schist surfaces, 5. July 2012, leg. & det. J. MARQUES (PO9307-L); Vale de José Esteves, 29TPF5949, 190 m s. m., on narrow crevices of schist outcrops, 8. May 2009, leg. & det. J. MARQUES (PO9308-L).

Squamarina concrescens (MÜLL. ARG.) POELT

This isidiate species is one of the most conspicuous terricolous lichen in the study area but was last reported from Portugal by TAVARES (1956 *apud* HLADUN & LLIMONA 2002-2007) as *Lecanora concrescens* (MÜLL. ARG.) ZAHLBR. At present it is also

known from other arid regions in the Algarve (VAN DEN BOOM & GIRALT 2012), Spain (HLADUN & LLIMONA 2002-2007) and Italy (NIMIS 1993). It grows on the compacted soil that accumulates in wide crevices and earth banks between schist outcrops.

Specimens examined: Alfândega da Fé, Parada, Santo Antão da Barca, 29TPF7669, 175 m s. m., on wide horizontal crevices of schist outcrops, 13. May 2009, leg. & det. J. MARQUES (PO9159-L); Mogadouro, Bemposta, Faia da Água Alta, 29TQF0775, 514 m s. m., on wide crevices of schist outcrops, 12. May 2009, leg. & det. J. MARQUES (PO9160-L); Brunhoso, Ribeiro de Juncaínhos, 29TPF8380, 473 m s. m., on wide crevices of schist outcrops, 17. February 2011, leg. & det. J. MARQUES (PO9161-L); Soutelo, Alto da Fraga, 29TPF8886, 580 m s. m., on vertical schist surfaces, 11. May 2009, leg. & det. J. MARQUES (PO9162-L); Ponte de Remondes, 29TPF8385, 200 m s. m., on wide crevices of schist outcrops, 11. May 2009, leg. & det. J. MARQUES (PO9163-L); Vila Nova de Foz Côa, Castelo melhor, Canada do Amendoal, 29TPF5846, 344 m s. m., on horizontal surfaces above schist outcrops, 30. March 2010, leg. & det. J. MARQUES (PO9164-L); Penascosa, 29TPF5941, 160 m s. m., on wide crevices of schist outcrops, 15. May 2007, leg. & det. J. MARQUES (PO9165-L); Muxagata, Fariseu, 29TPF5844, 127 m s. m., on wide crevices of schist outcrops, 1. April 2010, leg. & det. J. MARQUES (PO9166-L); Vila Nova de Foz Côa, Canada do Inferno, 29TPF5846, 110 m s. m., on wide crevices of schist outcrops, 8. February 2006, leg. & det. J. MARQUES (PO9167-L); Vale de José Esteves, 29TPF5949, 161 m s. m., on wide crevices of schist outcrops, 8. May 2009, leg. & det. J. MARQUES (PO9168-L).

Toninia cinereovirens (SCHAER.) A. MASSAL.

Erroneously cited as a first record for mainland Portugal (PAZ-BERMÚDEZ & al. 2009) since COUTINHO (1916) had already reported several Portuguese herbarium specimens, but very common in the study area on narrow crevices of both vertical and inclined schist surfaces facing south, together with *Aspicilia crespiana*, *Caloplaca subsoluta* (*C. irrubescens* misapplied by auct. iber.) and *Peltula obscurans*.

Specimens examined: Alfândega da Fé, Parada, Santo Antão da Barca, 29TPF7669, 175 m s. m., on narrow crevices of schist surfaces, 13. May 2009, leg. & det. J. MARQUES (PO9120-L); Mogadouro, Soutelo, Alto da Fraga, 29TPF8886, 580 m s. m., on wide crevices of ultrabasic rock outcrops, 11. May 2009, leg. & det. J. MARQUES (PO9121-L); Vila Nova de Foz Côa, Muxagata, Monte do Fariseu, 29TPF5844, 263 m s. m., on vertical schist surfaces, 1. April 2010, leg. & det. J. MARQUES (PO9122-L); Ribeira de Piscos, 29TPF5843, 130 m s. m., on narrow crevices of quartzite outcrops, 9. May 2009, leg. & det. J. MARQUES (PO9123-L); Vila Nova de Foz Côa, Canada do Inferno, 29TPF5846, 131 m s. m., on vertical schist surfaces, 7. May 2009, leg. & det. J. MARQUES (PO9125-L); Penascosa, 29TPF5941, 160 m s. m., on vertical schist surfaces, 15. May 2007, leg. & det. J. MARQUES (PO9124-L).

Toninia opuntioides (VILL.) TIMDAL

Erroneously cited as a first record for Portugal by PAZ-BERMÚDEZ & al. (2009) since TIMDAL (1991) had already reported several specimens from Lisbon area. It is separated from the closely related *Toninia sedifolia* (SCOP.) TIMDAL by the flat, rounded squamules, resembling the cladodes of *Opuntia* plants. Relatively rare in the study area on wide crevices of schist outcrops and schist walls.

Specimens examined: Vila Nova de Foz Côa, Muxagata, Monte do Fariseu, 29TPF5844, 263 m s. m., on vertical schist surfaces, 1. April 2010, leg. & det. J. MARQUES (PO9115-L); Vila Nova de Foz Côa, Vale do Forno, 29TPF5748, 301 m s. m., on vertical schist surfaces, 4. May 2011, leg. & det. J. MARQUES (PO9114-L).

Toninia squalida (ACH.) A. MASSAL.

Very similar to *Toninia cinereovirens* but the uniform thallus colour and large acicular spores are distinctive (TIMDAL 1991). In fact, in the study area it acts as an eco-

vicariant species of *Toninia cinereovirens*, colonizing more sheltered schist outcrops, usually facing north, directly on rock or overgrowing saxicolous mosses. Last reported from Portugal by VAN DEN BOOM & JANSEN (2002) and VAN DEN BOOM & GIRALT (2012) and from the province of Trás-os-Montes e Alto Douro by TIMDAL (1991).

Specimens examined: Mogadouro, Soutelo, Alto da Fraga, 29TPF8886, on wide crevices of ultrabasic rock outcrops, 11. May 2009, leg. & det. J. MARQUES (PO9116-L); Murça, Candedo, Foz do Tinhela, 29TPF3676, 181 m s. m., on vertical schist surfaces, 17. September 2011, leg. & det. J. MARQUES (PO9094-L); Vila Nova de Foz Côa, Castelo Melhor, Canada do Amendoal, 29TPF5846, 344 m s. m., on narrow crevices of schist outcrops, 30. March 2010, leg. & det. J. MARQUES (PO9117-L); Vila Nova de Foz Côa, Vale de José Esteves, 29TPF5849, 178 m s. m., on vertical schist surfaces, 2. May 2011, leg. & det. J. MARQUES (PO9118-L); Vale do Forno, 29TPF5748, 258 m s. m., on vertical schist surfaces, 4. May 2011, leg. & det. J. MARQUES (PO9119-L).

* ***Toninia toepfferi*** (STEIN) NAVÁS

Reported here for the first time from mainland Portugal, it was previously known from Macaronesia, including Madeira and the Azores (BARRENO & al. 1984), and from a few places along the Mediterranean basin, namely in southern Spain (BARRENO & al. 1984), Italy (NIMIS 1993), Greece (BREUSS 1989) and eastern Turkey (BREUSS & JOHN 2004). In the study area, it grows on stable compacted soil accumulated in the wide crevices of schist outcrops and schist walls built in the vicinity of these outcrops. A few specimens are moderately pruinose in some parts of thallus and apothecia, a character for *Toninia physaroides* (OPIZ) ZAHLBR., the other pseudocyphellate species of the genus. In such cases, the distinct, white punctiform pseudocyphellae in contrast with the brown-olive bullate squamules, as well as the dark reddish brown colour of the upper part of hypothecium and inner part of exciple (TIMDAL 1991) were considered distinctive.

Specimens examined: Alijó, Carlão, Alto do Vale do Moinho, 29TPF3477, 324 m s. m., on vertical schist surfaces, 7. March 2012, leg. & det. J. MARQUES (PO9072-L); Carrazeda de Ansiães, Castanheiro, Quinta da Ribeira, 29TPF3265, 132 m s. m., on schist walls, 12. October 2011, leg. & det. J. MARQUES (PO9067-L); Mogadouro, Bemposta, Faia da Água Alta, 29TQF0775, 514 m s. m., on wide crevices of schist outcrops, 12. May 2009, leg. & det. J. MARQUES (PO9069-L); Soutelo, Alto da Fraga, 29TPF8886, 580 m s. m., on earth banks between ultrabasic rock outcrops, 11. May 2009, leg. & det. J. MARQUES (PO9063-L); Soutelo, 29TPF8886, on schist walls, 11. May 2009, leg. & det. J. MARQUES (PO9064-L); Vila Nova de Foz Côa, Castelo Melhor, Canada do Amendoal, 29TPF5846, 344 m s. m., on horizontal surfaces of schist outcrops, 30. March 2010, leg. & det. J. MARQUES (PO9068-L); Muxagata, Fariseu, 29TPF5844, 127 m s. m., on wide crevices of schist outcrops, 1. April 2010, leg. & det. J. MARQUES (PO9058-L); Ribeira de Piscos, 29TPF5843, 136 m s. m., on wide crevices of schist outcrops, 9. May 2009, leg. & det. J. MARQUES (PO9062-L); Vila Nova de Foz Côa, Canada do Inferno, 29TPF5846, 130 m s. m., on wide crevices of schist outcrops, 8. February 2006, leg. & det. J. MARQUES (PO9065-L); Foz do Côa, 29TPF5849, 187 m s. m., on wide crevices of schist outcrops, 3. May 2011, leg. & det. J. MARQUES (PO9070-L); Vale Cabrões, 29TPF5750, on earth banks between schist outcrops, 30. September 2011, leg. & det. J. MARQUES (PO9126-L); Vale de José Esteves, 29TPF5949, 208 m s. m., on vertical schist surfaces, 2. May 2011, leg. & det. J. MARQUES (PO9071-L); Vale do Forno, 29TPF5748, 297 m s. m., on vertical schist surfaces, 30. March 2010, leg. & det. J. MARQUES (PO9066-L).

Toninia tristis subsp. ***pseudotabacina*** TIMDAL

The species is easily distinguished by the dark brown, bullate squamules with pores on the surface. The subspecies is characterized by simple ellipsoid spores, green epithecium and terricolous habit. In mainland Portugal it was previously known only from Coimbra (TIMDAL 1991) and the Algarve (VAN DEN BOOM & GIRALT 2012) and is

quite rare in the study area, on earth-filled crevices or compacted mineral soil between schist outcrops.

Specimens examined: Vila Nova de Foz Côa, Castelo Melhor, Canada do Amendoal, 29TPF5846, 330 m s. m., on wide crevices of schist outcrops, 29. September 2010, leg. & det. J. MARQUES (PO9060-L); Vila Nova de Foz Côa, Vale de José Esteves, 29TPF5949, 196 m s. m., on vertical schist surfaces, 2. May 2011, leg. & det. J. MARQUES (PO9061-L).

Vahliella leucophaea (VAHL) P. M. JØRG.

Last reported from Portugal by TAVARES (1965) as *Pannaria microphylla* (SW.) NYL. and known to occur in the Atlantic provinces of Minho and Douro Litoral (CARBALLAL & al. 2010) but very rare in the study area, found at very low altitudes, on moist and shaded vertical schist surfaces in the riverbanks of river Tua possibly compensating for the low relative humidity and high temperatures that characterize the main valleys. New for the province of Trás-os-Montes e Alto Douro.

Specimens examined: Alijó, Carlão, Vale do Moinho, 29TPF3477, 200 m s. m., on vertical schist surfaces, 18. September 2011, leg. & det. J. MARQUES (PO9169-L); Carrazeda de Ansiães, Castanheiro, Praia fluvial, 29TPF3466, 136 m s. m., on vertical schist surfaces, 12. October 2012, leg. & det. J. MARQUES (PO9170-L).

* ***Verrucaria geophila*** ZAHLBR.

A terricolous species with most currently known localities in southern Europe (BREUSS 1989, BREUSS & JOHN 2004, NIMIS 1993, SPRIBILLE & al. 2006) but also found in central Europe and Fennoscandia (PYKÄLÄ 2007) as a rare colonizer of calcareous soils. Among the terricolous species of the genus it differs in the combination of large ovoid spores and development of an involucrellum that completely encloses the excipulum (BREUSS 1989, CLAUZADE & ROUX 1985). The collected specimens are characterized by relatively large perithecia (ca 0.35–0.5 mm) and ascospores of 25–35 ×10–15 µm, and by a well developed light brown, cracked-areolate thallus. Rare in the study area but probably overlooked since it is well disguised among the brown soil with *Endocarpon pusillum*.

Specimens examined: Vila Nova de Foz Côa, Muxagata, Fariseu, 29TPF5844, 127 m s. m., on wide crevices of schist outcrops, 1. April 2010, leg. & det. J. MARQUES (PO9058-L); Vila Nova de Foz Côa, Canada do Inferno, 29TPF5846, 130 m s. m., on wide crevices of schist outcrops, 7. May 2009, leg. & det. J. MARQUES (PO9059-L).

The authors are grateful to the Côa Valley Archaeological Park for permission to collect lichen specimens. The archaeologists ANTÓNIO BATARDA FERNANDES, LUIS LUIS and THIERRY AUBRY are especially thanked for valuable information on the location of important outcrop areas and guided visits in the Côa Valley Archaeological Park. The identity of *Caloplaca arnoldii* subsp. *obliterata* was gently confirmed by Dr. ESTER GAYA (University of Barcelona) and that of *Epiphloea terrena* by Dr. PER JØRGENSEN (Bergen University). Dr. VÍCTOR J. RICO (University Complutense of Madrid) confirmed the identity of many *Aspicilia* and *Circinaria* specimens and Dr. MATTHIAS SCHULZ (Hamburg University) provided the identity of most *Lichinaceae*. Dr. VÍCTOR J. RICO and Dr. PIETER VAN DEN BOOM are gratefully acknowledged for their valuable comments on the manuscript. HELENA HESPANHOL and CRISTIANA VIEIRA (CIBIO) are thanked for all the help in field trips. The first author was supported by Fundação para a Ciência e Tecnologia (FCT) through PhD grant SFRH/BD/42248/2007. The study was partially financed by the European Regional Development Fund (ERDF) through the Spanish Ministry of Science and Innovation under the project CGL2011-22789.

References

ARUP, U., SØCHTING, U., FRÖDEN, P., 2013: A new taxonomy of the family *Teloschistaceae*. – Nordic J. Bot. **31**: 16–83. doi: 1-20. 10.1111/j.1756-1051.2013.00062.x.

BARRENO, E., NARANJO, J., SANTOS, A., 1984: *Toninia toepfferi* (B. Steiner) Navas (Lichenes): morfologia, anatomia y ecologia. – Anal. Biol. (Secc. Especial 1) **1**: 197–202.

BREUSS, O., 1989: Interessante Flechtenfunde aus Mittel- und Südeuropa. – Linzer Biol. Beiträge **21**: 591–600.

BREUSS, O., JOHN, V., 2004: New and interesting records of lichens from Turkey. – Österr. Z. Pilzk. **13**: 281–294.

BURGAZ, A. R., MARTÍNEZ, I., 2003: Flora Liquenológica Ibérica 8. *Peltigerales*: *Lobariaceae*, *Nephromataceae*, *Peltigeraceae*. – Murcia: Sociedad Española de Liquenología (SEL).

CARBALLAL, R., PAZ-BERMÚDEZ, G., LÓPEZ DE SILANES, M. E., PÉREZ, C., 2010: Flora Liquenológica Ibérica 6. *Pannariaceae*. – Murcia: Sociedad Española de Liquenología (SEL).

CLAUZADE, G, ROUX, C., 1985: Likenoj de okcidenta Europo: ilustrita determinlibro. – Bull. Soc. Bot. Centre-Ouest, n. s., núm. spec. **7**: 1–893.

CLAUZADE G., ROUX, C., RIEUX, R., 1981: Les *Acarospora* de l'Europe occidentale et de la region mediterraneenne. – Bull. Musee d'Histoire Naturelle de Marseille **41**: 41–93.

COUTINHO, A. X. P., 1916: Lichenum Lusitanorum Herbarii Universitatis Olisiponensis Catalogus. – Lisboa: Imprensa Manuel Lucas Torres.

CORDEIRO, V. A., 1915: Lichenes de Setúbal – Brotéria, Sér. Bot. **13**: 5–16.

CRESPO, A., BARRENO, E., FOLLMAN, G., 1976: Sobre las comunidades liquénicas rupiculas de *Acarospora hilaris* (DUF.) HUE en la Peninsula Iberica. – Anal. Inst. Bot. Cavanilles **33**: 189–203.

EGEA, J. M., LLIMONA, X., 1982: Los liquenes silicicolas de la Sierra del Cabo de Palos, estudio floristico fitosociologico y ecologico. – Acta Bot. Malacitana **7**: 11–38.

EGEA J. M., ROWE J. G., 1987: Lichenological excursion in North Africa. I. Silicicolous lichens in Morocco. – Coll. Bot. (Barcelona) **17**: 27–45. http://dx.doi.org/10.3989/collectbot.1988.v17.153.

GAYA, E., 2009: Taxonomical revision of the *Caloplaca saxicola* group (*Teloschistaceae*, lichen-forming Ascomycota). – Biblioth. Lichenol. **101**: 1–191.

GIRALT, M., 2001: The lichen genera *Rinodina and Rinodinella (lichenized Ascomycetes, Physciaceae*) in the Iberian peninsula. – Biblioth. Lichenol. **79**. – Berlin: Cramer.

GÓMEZ-BOLEA, A., BARBERO, M., 2009: *Polycauliona maheui*, the basionym of *Rhizoplaca maheui* comb. nov.. – Mycotaxon **108**: 341–346. http://dx.doi.org/10.5248/108.341.

HENSSEN, A., BÜDEL, B., NASH, T. H. III., 1985: Three new species of *Lichinella* described from Mexico. – Bryologist **88**: 285–292. http://dx.doi.org/10.2307/3242664.

HLADUN, N., LLIMONA, X., 2002–2007: Checklist of the lichens and lichenicolous fungi of the Iberian Peninsula and Balearic Islands. [http://botanica.bio.ub.es/checklist/checklist.htm (accessed 31. July 2013)].

INDEX FUNGORUM. Landcare Research, Lincoln, New Zealand and RBG Kew: Mycology, Surrey, United Kingdom. [http://www.indexfungorum.org (accessed 30. April 2013)].

JANSEN, J., 1993: Korstmossen in de Serra de Estrela. – Buxbaumiella **31**: 7–15.

MARQUES, J., SCHULTZ, M., PAZ-BERMÚDEZ, G., 2013: A *Peltula* Nyl. diversity hotspot in north-east Portugal, with one species new to science and three species new to mainland Europe. – Lichenologist **45**: 483–496. http://dx.doi.org/10.1017/S0024282913000261.

MORENO, P. P., EGEA, J. M., 1992: El genero *Lichinella* Nyl. en el sureste de España y Norte de África. – Cryptogamie, Bryologie, Lichénologie, **13**: 237–259.

MORENO, P. P., EGEA, J. M., 1994: El género *Psorotichia* y especies próximas en el sureste de España y norte de Africa. – Bulletin de la Société Linéenne de Provence, **45**: 291–308.

NIMIS, P. L., 1993: The lichens of Italy: an annotated catalogue. – Torino: Museo Regionale di Scienze Naturali.

NORDIN, A., SAVIĆ, S., TIBELL, L., 2010: Phylogeny and taxonomy of *Aspicilia* and *Megasporaceae*. – Mycologia **102**: 1339–1349. doi: 10.3852/09-266.

ORANGE, A., JAMES, P. W., WHITE, F. J., 2001: Microchemical methods for the identification of lichens. – London: British Lichen Society.

OZENDA, P., CLAUZADE, G., 1970: Les lichens: étude biologique et flore illustrée. – Paris: Masson.

PAZ-BERMÚDEZ, G., ARROYO, R., ATIENZA, V., FERNÁNDEZ-BRIME, S., BURGAZ, A. R., CARVALHO, P., FIGUEIRAS, G., LLOP, E., LÓPEZ DE SILANES, M. E., MARCOS, B., PINO, R., PRIETO, M., RICO, V., FERNÁNDEZ-SALEGUI, A. B., SERIÑÁ, E., TERRÓN, A., 2009: Flora liquénica del Parque Natural de Montesinho, Serra da Nogueira y Valle del Río Sabor (Portugal). – Cryptog. Mycol. **30**: 279–303.

PRIETO, M., ARAGÓN, G., MARTÍNEZ, I., 2010: The genus *Catapyrenium* s. lat. (*Verrucariaceae*) in the Iberian Peninsula and the Balearic Islands. – Lichenologist **42**: 637–684. http://dx.doi.org/10.1017/ S0024282910000319.

PYKÄLÄ, J., 2007: Additions to the lichen flora of Finland. II. Calcareous rocks and associated soils in Lohja. – Graphis Scripta **19**: 17–32.

RICO, V. J., 1999: *Aspicilia crespiana*, a new lichen species from southern Europe. –Lichenologist **31**: 129–139. doi: http://dx.doi.org/10.1006/lich.1998.0181.

SAMPAIO, G., 1917: Líquenes novos para a flora portuguesa. 2ª série. – Brotéria, sér. bot. **15**: 12–29.

SAMPAIO, G., 1921: Novas contribuições para o estudo dos líquenes portugueses. – Brotéria, sér. bot. **19**: 12–35.

SAMPAIO, G., 1922: Materiais para a liquenologia portuguesa. – Brotéria, sér. bot. **20**: 147–163.

SAMPAIO, G., 1924: Novos materiais para a liquenologia Portuguesa. – Bol. Soc. Broteriana, sér. 2, **2**: 1–21.

SCHULTZ, M., 2007: *Lichinella* Nyl. – In NASH, T. H. III, GRIES, C., BUNGARTZ, F., (Eds.): Lichen flora of the Greater Sonoran Desert region 3. – Tempe (Arizona): Arizona State University.

SMITH, C. W., APTROOT, A., COPPINS, B. J., FLETCHER, A., GILBERT, O. L., JAMES, P. W., WOLSELEY P. A., (Eds.) 2009: The lichens of Great Britain and Ireland. –London: British Lichen Society.

SOHRABI, M., LEAVITT, S. D., RICO, V. J., HALICI, M. G., SHRESTHA, G., STENROOS, S., 2013: *Teuvoa*, a new lichen genus in *Megasporaceae* (*Ascomycota: Pertusariales*), including *Teuvoa junipericola* sp. nov. – Lichenologist **45**: 347–360. doi: http://dx.doi.org/10.1017/S0024282913000108.

ŠOUN, J., VONDRÁK, J., SØCHTING, U., HROUZEK, P., KHODOSOVTSEV, A., ARUP, U., 2011: Taxonomy and phylogeny of the *Caloplaca cerina* group in Europe. –Lichenologist **43**: 113–135. doi: http://dx.doi.org/10.1017/S0024282910000721.

SPRIBILLE, T., SCHULTZ, M., BREUSS, O., BERGMEIER, E., 2006: Notes on the lichens and lichenicolous fungi of western Crete (Greece). – Herzogia **19**: 125–148.

TAVARES, C. N., 1944: Notes lichénologiques. IV. Açores (Lichens nouveaux ou intéressants pour le Portugal). – Bol. Soc. Broteriana, sér. 2, **19**: 163–179.

TAVARES, C. N., 1956: Lichenes Lusitaniae Selecti Exsiccati. Fasciculus IV. – Lisbon: Instituto Botanico da Universidade de Lisboa.

TAVARES, C. N., 1965: The genus *Pannaria* in Portugal. – Portugaliae Acta Biol. **8B**: 1–16.

TERRÓN-ALFONSO, A., BURGAZ, A. R., ALVAREZ-ANDRÉS, J., 2000: Líquenes de la provincia de Zamora (España). – Botanica Complutensis **24**: 9–43.

TIMDAL, E., 1984: The delimitation of *Psora* (*Lecideaceae*) and related genera, with notes on some species. – Nordic J. Bot. **4**: 525–540. doi: http://dx.doi.org/10.1111/j.1756-1051.1984.tb02059.x.

TIMDAL, E., 1991: A monograph of the genus *Toninia* (*Lecideaceae, Ascomycetes*). – Opera Bot. **110**: 1–137.

TIMDAL, E., 2010: *Psora gresinonis* B. de Lesd.. [http://psora.lifedesks.org/pages/311 (accessed 10. October 2012)].

VAN DEN BOOM, P. P. G., 2006: Contribution to the flora of Portugal: lichens and lichenicolous fungi. – Österr. Z. Pilzk. **15**: 11–19.

VAN DEN BOOM, P. P. G., GIRALT, M., 1996: Contribution to the flora of Portugal, lichens and lichenicolous fungi I. – Nova Hedwigia **63**:145–172.

VAN DEN BOOM, P. P. G., GIRALT, M., 2012: Checklist and three new species of lichens and lichenicolous fungi of the Algarve (Portugal). – Sydowia **64**: 149–207.

VAN DEN BOOM, P. P. G., JANSEN, J., 2002: Lichens in the upper belt of the Serra da Estrela (Portugal). – Österr. Z. Pilzk. **11**: 1–28.

VAN DEN BOOM, P. P. G., RICO, V. J., 2006: *Caloplaca squamuloisidiata*, a new lichen from Portugal and Spain. – Lichenologist **38**: 529–535. doi: http://dx.doi.org/10.1017/S0024282906006153.