

The genus *Leptogium* (Collemataceae, Ascomycotina) in mainland Portugal

M. E. López de Silanes^{1*}, G. Paz-Bermúdez¹, R. Carballal² & J. Marques^{1,3}

¹ Dpto. E.R.N.M.A., E. Forestal, Universidade de Vigo, A Xunqueira s/n, 36005 Pontevedra, Spain

² Dpto. Botánica, Facultade de Bioloxía, Universidade Santiago de Compostela, Campus Sur, 15701 Santiago de Compostela, Spain

³ Cibio, Centro de Investigação em Biodiversidade e Recursos Genéticos, Campus Agrario de Vairão, 4485-661 Vairão & Departamento de Biologia, Faculdade de Ciências, Universidade do Porto, Rua do Campo Alegre s/n, 4169-007 Porto, Portugal

López de Silanes M. E., Paz-Bermúdez G., Carballal R. & Marques J. (2012) The genus *Leptogium* (Collemataceae, Ascomycotina) in mainland Portugal. – *Sydowia* 64 (1): 67–102.

A revision of the genus *Leptogium* occurring in mainland Portugal is presented based on collections of 24 out of the 25 species previously reported for the Portuguese territory. Inclusion of *L. resupinans* is based exclusively on recent literature reporting this species from southern Portugal. Anatomical, ecological and geographical data on these species is provided, as well as an identification key. *Leptogium plicatile* is here recorded for the first time in Portugal. *Leptogium aragonii*, *L. cochleatum*, *L. coralloideum*, *L. cyanescens*, *L. furfuraceum*, *L. pulvinatum* and *L. schraderi* constitute new records for some Portuguese provinces. The presence of the following species previously reported from Portugal is considered doubtful: *L. azureum*, *L. caesium*, *L. chloromelum*, *L. hildenbrandii*, *L. intermedium* and *L. microphylloides*.

Keywords: lichenized fungi, taxonomy, key, Iberian Peninsula, Europe.

The genus *Leptogium* (Ach.) Gray belongs to the family Collemataceae, and is therefore characterized by a foliose to squamulose, rarely crustose, blue-grey, greenish or blackish thallus, that acquires a gelatinous consistency when wet. The photobiont is always *Nostoc*.

The presence of a distinct true cortex is broadly used to distinguish the genus *Leptogium* from the closely related genus *Collema*, although recent molecular data suggest that this character is a poor predictor of genetic relationships within family Collemataceae (Otálora *et al.* 2010).

Apothecia in *Leptogium* are lecanorine and asci are usually octosporate. Ascospores are hyaline, in general ovoid, ellipsoid or fusiform with septation that varies from single to muriform. Pycnidia are rare but, when present, immersed or slightly emergent, with bacilliform conidia.

The genus *Leptogium* is widely distributed in the temperate and warm regions of the globe, and has its ecological optimum in the tropics. It com-

* Authors e-mails: esilanes@uvigo.es, graciela@uvigo.es, mregina.carballal@usc.es, joanamarques@fc.up.pt

prises around 250 species worldwide, of which about 40 are currently known from Europe. Aside from few occasional and isolated references in floristic papers, there is not, to our knowledge, any published work focusing on this genus from mainland Portugal, prior to this study. The only exception appears to be that of Tavares (1950 a), describing *Leptogium juressianum* as a new species for science. Important to the Portuguese lichen flora are the European studies of Jørgensen (1977, 1994, 1997, 2007), Jørgensen & James (1983), Guttová (2000), Otálora *et al.* (2008), Gilbert & Jørgensen (2009).

This study should be considered an addition to the studies of the genus *Leptogium* from the Iberian Peninsula by Aragón & Otálora (2004) and Aragón *et al.* (2005) since these do not take into consideration the specimens here examined.

Materials and methods

More than 500 voucher specimens were revised, comprising mainly collections from different herbaria (BM, COI, G, GZU, LISU, PO, SANT), the private collection of P. v. d. Boom as well as the authors' own collections.

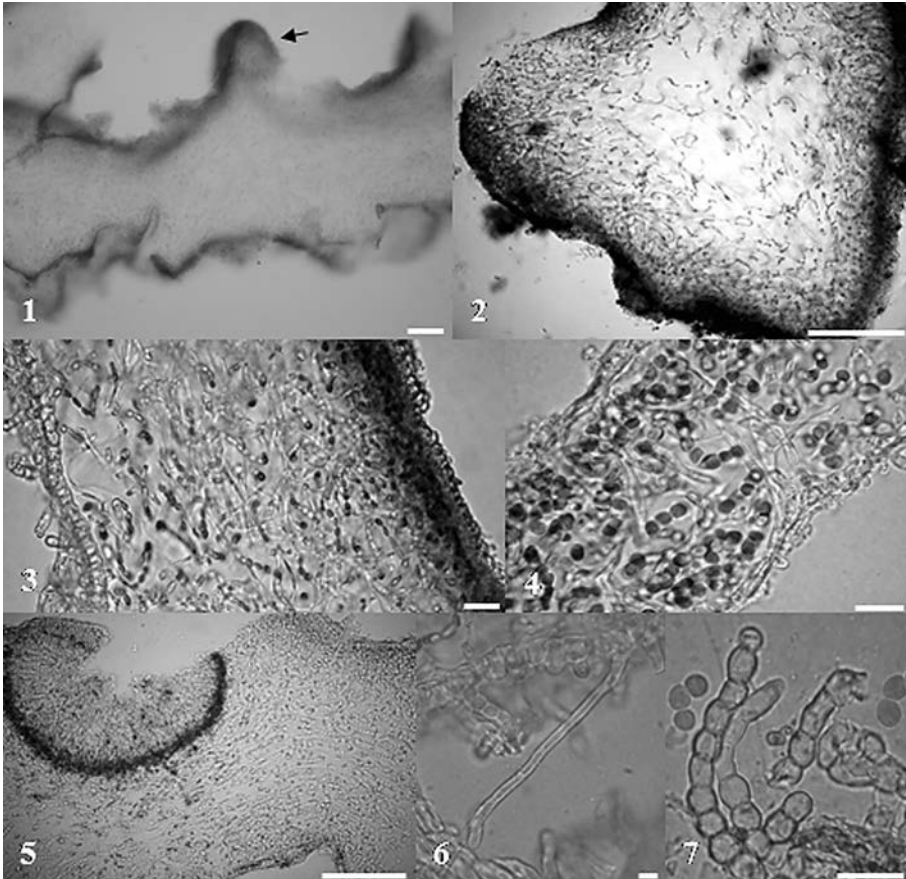
Similarly to other authors (Sierk 1964; Awasthi & Akhtar 1977, 1979; Jørgensen 1975, 1977, 1994, 1997, 2007; Jørgensen & James 1983; Swinscow & Krog 1988; Verdon 1992; Galloway 1999; Brodo *et al.* 2001; Aragón *et al.* 2005; Gilbert & Jørgensen 2009), taxa delimitation was based only on morphological and anatomical characters, since *Leptogium* species produce no chemical reactions.

The study of macroscopic morphology was performed under a Nikon SMZ stereomicroscope, and the microscopic characters observed under a Nikon Eclipse 80i microscope. Thallus, apothecia and pycnidia examination and measurements were carried out on squash preparations or hand-cut sections mounted in water.

Terminology concerning the rugosity of the thallus can be quite confusing in consulted literature. Three categories have been used for this matter: striae, wrinkles and ridges. Striae are thin linear depressions visible only with magnification in dehydrated thalli, disappearing with hydration or in a cross section under the microscope. Wrinkles are visible to the naked eye and produce small prominences in cross section, always less than half the thallus thickness. Finally, ridges are the heaviest forms of rugosity, usually exceeding half the thallus thickness in cross section (Fig. 1).

Taxonomy

The most important characters to distinguish *Leptogium* species are thallus and lobule colour, size, morphology and thickness; thallus and cortex anatomy (Figs. 2–4); the presence/absence of striae, wrinkles and/or ridges on thallus surface; isidia, tomentum, tomental hairs and hair cell morphology. Ascoma related characters were used to a lesser extent since in many cases specimens were sterile or presented immature apothecia.



Figs. 1–7. Thallus sections of *Leptogium* species. **1.** *L. brebissonii* with ridges on the upper surface and wrinkles on the lower surface. **2.** *L. schraderi* with lax medullary hyphae. **3.** *L. saturninum* with paraplectenchymatous cortex and non-paraplectenchymatous section. **4.** *L. ferax* with pseudocortex and paraplectenchymatous section. **5.** *L. plicatile* showing globose cortex cells and a cross section of a pycnidium. **6.** *L. saturninum* hairs with cylindrical cells. **7.** *L. hibernicum* hairs with globose cells. Bars: 1, 5. 100 μm . 2. 50 μm . 3, 4, 6, 7. 10 μm .

Each currently accepted name is followed by the synonyms referred in Portuguese records or collections from Portuguese herbaria. A section of observations includes some details on closely similar species or particular characters that may lead to confusion, and is followed by a brief description of the habitat and currently known distribution as well as the most important provincial records. The last section is a list of all, or a selection of, the examined voucher specimens, with information according to their respective vouchers.

A key to the mainland Portuguese species is here presented. Signalled by parenthesis are those taxa which, although never seen or considered of

doubtful presence in Portugal, are commonly confused with the currently accepted taxa.

Leptogium aragonii Otálora

Description. – Thallus foliose, thin, striate and slightly rugose, lead-grey to matt brown; lobules flat, oblong to orbicular, 3–4(5) mm wide, margins entire to weakly lacerate, slightly undulate but not isidiate; thallus section 100–150 µm thick; cortex brown, paraplectenchymatous; occasionally with hairs 4 µm in diameter arising from the lower cortex at the base of the lobules. – *Nostoc* cells, 4–5 µm in diameter, in chains or in groups. – Apothecia rare, 0.2–0.4 mm in diameter; thalline exciple smooth to slightly striated, with small flat lobules. – Ascospores not seen.

Observations. – Similar to *L. lichenoides*, from which it can be readily distinguished by the absence of isidia. It differs from *L. pulvinatum* in having flat and slightly larger lobules with entire to weakly lacerate margins. Most problematic among the examined material was the distinction between *L. aragonii* and scarcely fertile specimens of *L. gelatinosum*, since both are characterized by entire margins. In such cases, the less rugose matt blue-grey thallus and the presence of hairs on the lower surface was diagnostic for *L. aragonii*.

Habitat and distribution. – This species is widely distributed throughout Europe in preserved forests and was also seen from Japan and North America (Otálora *et al.* 2008). The examined specimens were found growing on pleurocarpous mosses, as indicated by Otálora *et al.* (2008) in the type description. These authors do not provide information on the precise location of Portuguese specimens. The examined specimens are therefore the first confirmed occurrences of *L. aragonii* in the provinces of Alto Alentejo, Beira Litoral, Estremadura and Trás-os-Montes e Alto Douro.

Material examined. – MAINLAND PORTUGAL, Alto Alentejo, PNSSM, Azinhal de Porto da Espanha, UTM PD5840, 555 m a.s.l., *Quercus ilex*, 26 May 1995, leg. P. Carvalho, (LISU 235188); Beira Litoral, Cortica, Rego de Murta, Alvaiazere, NE5304, 250 m a.s.l., *Olea*, Jul 1985, leg. M. P. Jones (LISU 200461); Estremadura, Sintra, muros, 27 Apr 1916, leg. G. Sampaio (PO 938); Trás-os-Montes e Alto Douro, Bragança, 10 Sep 1915, leg. G. Sampaio (PO 530).

Leptogium biatorinum (Nyl.) Leight.

Description. – Thallus squamulose, greenish-grey or dark grey-brown; squamules 0.3–0.5 mm wide, flat to convex, lobulate or crenulate; lobules very small, rounded, of granular appearance, covering most of the thallus; paraplectenchymatous in section, 160–180 µm thick; upper cortex inconspicuous, brown; lower cortex hyaline, consisting of 1–2 layers of elongated cells 6–8 × 4 µm. – *Nostoc* cells in chains or in groups, 4–5 µm in diameter. – Apothecia 0.3–1 mm in diameter, frequent, concave, sessile; disk orange to reddish-brown; thalline exciple persistent and prominent, thicker in young apothecia, smooth or with 85–115 µm wide granular lobes; proper exciple

10–20 μm wide; hymenium 170–180 μm high; hypothecium 10–15 μm high, usually formed by elongated thick-walled cells. – Asci clavate. – Ascospores ellipsoid, muriform, often rounded at one end, 20–25 \times 10–12 μm .

Observations. – In the study area it can be mistaken for *Epiphloea terrena* (Nyl.) Trevis. last recorded from Portugal (Bragança) by Sampaio (1921). *E. byssina* (Hoffm.) Henssen & PM Jorg. (= *Leptogium byssinum* (Hoffm.) Zwackh ex Nyl.), is also similar but has not been found in Portugal to date. *Epiphloea* is distinguished from *L. biatorinum* by the crustose-granular thallus, paraplectenchymatous throughout, and flat, more or less sunken apothecia, with a narrow thalline exciple and prototunicate asci (Jørgensen 2007, James & Jørgensen 2009)

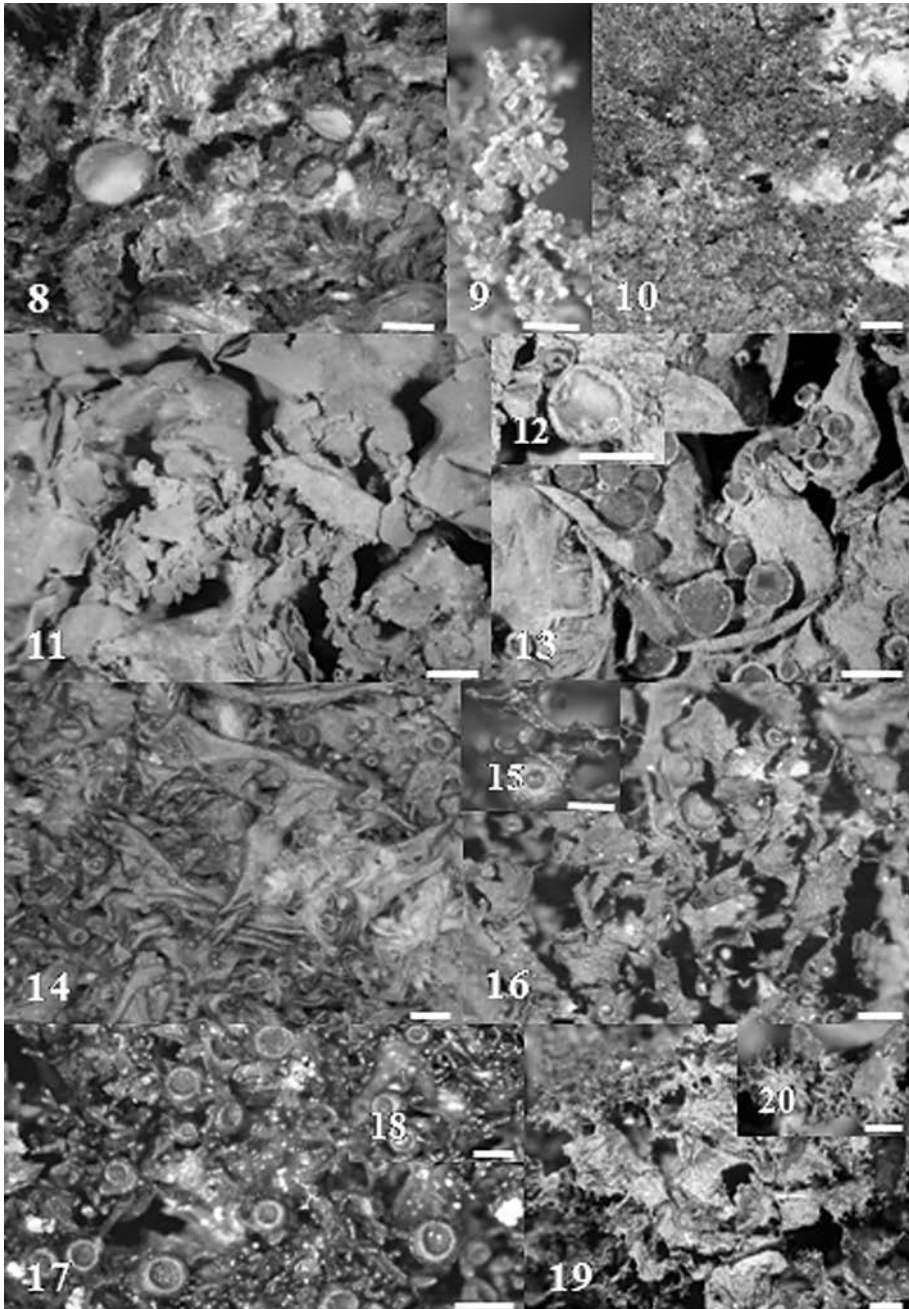
Habitat and distribution. – The specimen studied was found growing together with bryophytes and soil, on an old mortar-covered wall. The species is widespread in the temperate regions of the Northern Hemisphere avoiding colder regions (Jørgensen 2007). The first and only citation of *Leptogium biatorinum* for the Iberian Peninsula was by van den Boom (2005) from the Portuguese province of Ribatejo.

Material examined. – MAINLAND PORTUGAL, Ribatejo, 7 km E of Tomar, road to Olalhas, Pelinos, campsite, 8° 18.60' W 39° 38.70' N, 100 m a.s.l., *Olea europaea* and *Ficus carica* and N-side vertical old wall with much mortar along road, 4 Aug 1997, leg. P. v. d. Boom (hb. P. v. d. Boom 19280).

***Leptogium brebissonii* Mont.** – Figs. 1, 8.

Description. – Thallus foliose, thick, lead-grey, greenish-grey or blackish-brown, with a strongly rugose and distinctly wrinkled surface; wrinkles and ridges very apparent in dry state; markedly swollen when wet; lower surface without tomentum; lobules ample, 0.5–1 cm wide, poorly distinct, not or only slightly convoluted; isidia minute, granular or cylindrical, simple or branched, agglomerated, dark grey, grey-brown or blackish-brown, darker than the thallus, marginal and on the ridges, spreading through the entire thallus surface; thallus section 225–350 μm thick, or 650–600 μm thick at ridges; upper and lower cortex paraplectenchymatous, composed of a single layer of cells. – *Nostoc* chains concentrated in the ridges, closer to the upper and lower cortex, leaving a wide photobiont-free central area. – Apothecia rare; thalline exciple isidiate; epithecium brown to pale orange; hypothecium paraplectenchymatous, yellowish to brown. – Ascospores acicular, (5)6 to 10-septate, 55–70 \times 5–6 μm , finely rugose.

Observations. – Although most of the studied specimens are sterile there are some fertile ones (LISU 9b, LISU 200410, BM 762 928), this being a rare characteristic among European specimens. Some specimens had been previously identified as *L. furfuraceum* (LISU sn 1) and *L. hibernicum* (BM 762895, BM 762894), but do not present a tomentose lower surface. Collections from the early twentieth century, in the herbaria PO (53, 170, 419, 594, 1676) and COI sn, had been previously identified as *L. chloromelum*, a taxon which has not been confirmed in Portugal to date (see excluded taxa).



Figs. 8–20. *Leptogium* species with lobules larger than 5 mm. 8. *L. brebissonii*. 9, 10. *L. coralloideum*. 11. *L. cyanescens*. 12, 13. *L. cochleatum*. 14. *L. palmatum*. Species of the *L. lichenoides* group: 15, 16. *L. gelatinosum*. 17, 18. *L. intermedium*. 19, 20. *L. lichenoides*. Bars: 13, 20. 2 mm. 8, 9, 12, 16. 1 mm. 10, 11, 14, 15, 17, 18, 19. 0.5 mm.

Habitat and distribution. – Corticolous among bryophytes, usually on broad-leaved trees, rarely on mossy rocks. This is a relatively cosmopolitan species, common in temperate and humid forests, known in the tropics and from the Southern Hemisphere with a southern subatlantic distribution in Europe, and reaching as far North as Scotland (Nimis 1993, Gilbert & Jørgensen 2009). It is the most frequent and abundant species of this genus in mainland Portugal (Carvalho 1997, 1998; Carvalho *et al.* 2002; Degelius 1941; Jones 1999, 2002; Tavares 1945, 1950 a, b; van den Boom & Giralt 1996, 1999; van den Boom *et al.* 1990).

Selected material examined. – MAINLAND PORTUGAL, Algarve, Monchique, nas Oliveiras, 9 Mar 1917, *leg.* G. Sampaio (PO 1676); Serra de Monchique, Nr Baranco Silvestre, S. of Madrinha, 600 m a.s.l., asp. S, *Olea*, Aug 1971, *leg.* M. P. Jones (BM 762895); Rocha dos Soidos, Alte, 400 m a.s.l., asp. S, *Ceratonia*, Dec 1975, *leg.* M. P. Jones (BM 762932); Rocha da Pena, Benafim, 450 m a.s.l., *Ceratonia*, 1973, *leg.* M. P. Jones (BM 762928); Alto Alentejo, PNSSM, S. Bento, numa quinta particular 29SPD3753, ± 660 m a.s.l., *Quercus robur*, 30 Sep 1997, *leg.* P. Carvalho (LISU sn 2); PNSSM, Quinta de Campos, PD3852, 658 m a.s.l., *Quercus pyrenaica*, 22 Dec 1994, *leg.* P. Carvalho (LISU 16); PNSSM, Ruguendo-Quinta do Leao, PD 5139, 670 m a.s.l., *Castanea sativa*, 9 Nov 1994, *leg.* P. Carvalho (LISU 9b); ponte de Sor, Rosmaninhal, Vale da Ferraria, ND8555, 220 m a.s.l., *Olea*, 15 Mar 1993, *leg.* M. P. Jones *et al.* (LISU 2); Ponte de Sor, entre Galveiras e Faia, a 14 km de Ponte de Sôr, ND8733, 60 m a.s.l., *Olea*, 17 Nov 1993, *leg.* M. P. Jones *et al.* (LISU 15); Baixo Alentejo, Mina da Somincor-Semblana cerca da Estaleja, x-591.80, and 4156.40, *Olea europaea*, 20 Oct 2000, *leg.* P. Carvalho *et al.* (LISU S3000); olival, 2 km W de Grândola, estrada para Melides, NC3625, 0 m a.s.l., *Olea*, 20 Mar 1998, *leg.* M. P. Jones, P. Carvalho & R. Figueira (LISU 71); Beira Alta, Gouveia, Quinta do Marques, próximo do Curral do Negro, 29TPE2083, sobre *Castanea sativa*, 1 Mar 2000, *leg.* C. Garcia, (LISU sn 1); Serra da Estrela-Casal do Rei, 29TPE06, *Castanea sativa*, 22 Mar 2000, *leg.* C. Garcia (LISU sn 3); oliveira do Hospital, aldeia das Dez, Nossa Senhora das Presses, 29TNE96, 400 m a.s.l., *Quercus robur*, 9 Aug 2002, *leg.* C. Sérgio (LISU sn 4); roadside terraces, 5 km N of S. Pedro do Sul, 300 m a.s.l., asp. N, NF 82, *Olea*, Feb 1990, *leg.* M. P. Jones (LISU 200410); 2 km of Rojao, near the junction to Tabua, 200 m a.s.l., NE 77, *Olea*, Abr 1990, *leg.* M. P. Jones (LISU 200414); Beira Litoral, Coimbra, Villa Franca, Mar 1881, *leg.* A. F. Moller, *det.* A. Nylander 13 (COI sn); Mizarela, 29TNE55, sobre carvalho, 2003, *leg.* C. Garcia (LISU sn 5); Serra do Sicó-Alvaizere-Venda do Negro, 29SNE5111, *Quercus ilex*, 10 Jul 2001, *leg.* P. Carvalho, C. Garcia, C. Sérgio & M. Sim-Sim (LISU sn); 1 km NE of Condeixa-a-Nova on the road to Montemôr-o-Velho, 100 m a.s.l., asp. O, *Olea*, 18. Jun 1984, *leg.* M. P. Jones (BM 762937); Douro Litoral, 8 km NW of Mesao Frio, on the road to Amarante, 600 m a.s.l., asp. N, NF 8664, *Quercus robur*, Nov 1992, *leg.* M. P. Jones (LISU 200418); Estremadura, Baleia, nas Oliveiras, Jun 1878, *leg.* A. F. Moller 110, (COI sn); Serra de S. Mamede, Mira d'Aire-Portela das Cruces, 29SND2483, 1 Apr 2000, *leg.* C. Garcia (LISU sn 6); Serra de Montejunto, em frente à casa do guarda, 29SMD93, ± 500, *Ceratonia*, 5 Feb 2000, *leg.* C. Garcia (LISU sn 6); Serra d'Arrabida, Portinho, Apr 1961, *leg.* J. Poelt 6846, (GZU Inv. Nr. 2-93); Convento-Arrabida, Buxo, Apr 1903, *leg.* V. A. Cordeiro, (COI 104); Minho, Viana do Castelo, jardim municipal, 29TNG11, epífito, 4 Feb 1998, *leg.* R. Figueira (LISU sn); Gerês Vilarinho das Furnas, near the Calcada Romana, 575 m a.s.l., asp. NW, *Quercus robur*, May 1982, *leg.* M. P. Jones (BM 762894); Póvoa de Lanhoso, S. Gens, árvores, Jun 1920, *leg.* G. Sampaio (PO 53); Braga, Bom Jesus, árvores, 6 Sept 1915, *leg.* G. Sampaio (PO 594); Ponte de Lima, Sá, nas Oliveiras, Oct 1914, *leg.* G. Sampaio (PO 170); Ponte de Lima, Moreira, 12 Aug 1915, *leg.* G. Sampaio (PO 419).

Additional material examined. – INSULAR PORTUGAL, Açores, S. Miguel, Abelheira, sobre pedras, Aug 1894, *leg.* B. S. Tavares Carreiro (COI 67); FRANCE, Normandie, sur quelques troncs d'arbres dans la forêt de Bricquebec, (Tipo BM 690954, 690959, 690961, 690962!); SPAIN, Cádiz, Jerez de la Frontera, Sierra del Aljibe, Puerto de Galiz,

30STF6748, 440 m a.s.l., *Quercus suber*, 19 Oct 1992, leg. S. Fos (VAB 8167, 8662); A Coruña, Pontedeume, Caaveiro, 29TNJ760, *Quercus robur*, 27 Oct 84, leg. J. Álvarez & M. E. López de Silanes (SANT 2284); Pontedeume, Caaveiro, 29TNJ760, *Castanea sativa*, 4 Jun 1986, R. Carballed & M. E. López de Silanes (SANT 2285); Pontevedra, Monteporreiro, *Malus* sp. 7 Jan 1987, leg. A. García-Molares (SANT 2080).

***Leptogium burgessii* (L.) Mont.** – Fig. 21.

Description. – Thallus foliose, weakly attached to the substrate, devoid of wrinkles, faintly striated; upper surface brown to dark grey without isidia; lower surface white due to the presence of tomentum; lobules flat, (1.5)2–3.5(4.5) mm wide, often wavy or sinuate due to the presence of phyllidia or folioles arising from margins; thallus section 50–65 µm; in thicker areas of the thallus, the photobiont is grouped closer to the upper and lower cortex, leaving an approximately 25 µm thick photobiont-free central area; upper and lower cortex of a single layer of cells, 5–6 × 5–6 µm, sometimes with a brownish epicortex that appears most frequently in the upper cortex; hyaline hairs in the upper cortex short and dispersed, only visible under the microscope, more abundant in the lower cortex, forming a dense tomentum, 25–55(90) µm long, simple to branched in the upper half with rounded or slightly elongated cells 4–5 × 5–7 µm in diameter. – Apothecia sessile or slightly pedicellate, (0.5)1.5–3 mm; disc dark brown to orange; thalline exciple with wavy and branched phyllidia, presenting hairs with the same characteristics as thalline hairs; hymenium hyaline, 120 µm high; epithecium brown to reddish-brown, 10–12.5 µm high; hypothecium paraplectenchymatous. – Ascospores muriform, ellipsoid, with smooth walls and acuminate ends, 25–45 × (10)15–20 µm.

Observations. – Most specimens are well-fruited. This species is characterized by the presence of lobuliform phyllidia both in the thallus and the thalline exciple, and the abundant tomentum on the lower surface. The only saxicolous specimen among the examined material (GZU PO–P1) reaches 80–110 µm in thallus section.

Habitat and distribution. – The studied specimens are corticolous among bryophytes, with the exception of one specimen growing on mossy rocks (GZU PO–P1). This is a cosmopolitan species, although not known in Australia (Gilbert & Jørgensen 2009) and presenting a western distribution in Europe (Jørgensen 2007). In mainland Portugal, besides the provinces associated with the selected examined specimens, it is known from Estremadura (Jones 1999, 2002).

Selected material examined. – MAINLAND PORTUGAL, Alto Alentejo, PNSSM, Encostas de Vale de Rodão, PD3763, 600 m a.s.l., *Castanea sativa*, 24 Jun 97, leg. P. Carvalho & M. M. Costa (LISU 17); Beira Litoral, Buçaco, Cruz Alta, árvores, Jul 1916, leg. G. Sampaio (PO 6236); Buçaco perto da Cruz Alta, 9 Jan 1916, leg. G. Sampaio (PO 884); Serra do Buçaco, prope Cruz Alta, 260 m a.s.l., ad rupes muscosas, 9 Apr 1960, Tavares: Lichenes Lusitaniae selecti exsiccati 206, (GZU PO–P1, G 52006); Minho, Gerêz, Agua da Pala, beside the Rio Homem, 2 km SE of Portela do Homem, 800 m a.s.l., *Quercus robur*, May 1982, leg. M. P. Jones (BM 762925); Vilarinho das Furnas, near the Calçada Romana, 575 m a.s.l., asp. NW, *Quercus robur*, May 1982, leg. M. P. Jones (BM 762924).

Additional specimens examined. – INSULAR PORTUGAL, Açores, Ilha do Pico, bei Madalena, an der Strada longitudinal, *Juniperus brevifolia*, Jun 1978, leg. A. Henssen (G 52033); Madeira, Chá do Loiro, *Laurus canariensis*, 31 Jul 1951, leg. C. N. Tavares (G 52031).

Leptogium cochleatum (Dicks.) P. M. Jørg. & P. James – Figs. 12, 13.

Synonym. – *Leptogium tremelloides* (L. f.) Gray.

Description. – Thallus foliose, greyish-blue to dark grey, striated, not ridged; lobules flat and rounded, (3)5–8(10) mm wide; thallus section 100–150 μm ; upper and lower cortex paraplectenchymatous, of a layer of cells 7.5–10 \times 7.5–10 μm . – *Nostoc* cells in chains, more abundant in the direction of the upper and lower cortex, leaving a central area approximately 75 μm wide, with few isolated chains or completely deprived of photobiont. Apothecia (0.5)1–3(4) mm in diameter, numerous, sessile or constricted at the base or slightly stipitate; disc reddish-brown, flat to slightly convex; thalline exciple of the same colour as thallus, finely striated, thin but persistent at maturity, 75–112 μm wide; proper exciple approximately 25 μm wide, paraplectenchymatous; epithecium orange or yellowish, 12.5–17 μm ; hymenium hyaline 125–140 μm high; hypothecium hyaline prosoplectenchymatous, 30–37 μm high. – Ascii cylindrical, 100–115 μm long. – Ascospores ellipsoid, with acuminate ends and hyaline walls, 27–35 \times 10–15 μm .

Observations. – Specimens from Serra de Sintra (BM 762923, GZU Inv. Nr. 3–93, 2–93, PO 1353) and Vila Nova de Foz Côa (PO9017–L) present a few small and dispersed lobules growing in the thalline exciple. Thallus in these specimens is striated and the thalline exciple is wider and more rugose than in the specimens without thalline lobules. No additional differences were observed among the examined material. All specimens previously identified from mainland Portugal as *L. azureum* (GZU PO–P1, BM 762923) were reidentified as *L. cochleatum* since their characteristics, namely lobule size, thallus thickness, arrangement of *Nostoc* cells and ascospore morphology, are consistent with the description by Jørgensen & James (1983) and Gilbert & Jørgensen (2009). *Leptogium corticola* (Taylor) Tuck. was included in the key for its similarity with *L. cochleatum*, but it has not been found in Portugal to date. Collections from Italian localities (BM 762913, 762914, 762915) were studied for comparison. In *L. corticola*, the thallus is thicker and abundantly ridged, 75–100 μm thick at the smooth to wrinkled areas and 150–250 μm thick at ridges. This latter taxon has a very restricted distribution in Europe (Jørgensen & James 1983). It is found associated with old woodlands and is apparently declining due to woodland disturbance. *Leptogium corticola* is also known from India and North America (Awasthi & Akhtar 1979).

Habitat and distribution. – Muscicolous over trees or rocks, preferring moist and shady areas. Cosmopolitan species, except North America. It is apparently rare and local in southwestern Europe (Gilbert & Jørgensen 2009). In Spain, the species is known only from the northwest (Carballal *et*

al. 1995). In addition to the provinces mentioned below, specimens were also found in the Portuguese province of Ribatejo (Jones 1999). First record for the province of Tras-os-Montes e Alto Douro.

Selected material examined. – MAINLAND PORTUGAL, Beira Litoral, Buçaco, nas árvores, 10 Jan 1916, *leg.* G. Sampaio (PO 1249); Buçaco, Vale dos fetos, 200 m a.s.l., *Cedrus lusitanica*, Apr 1983, *leg.* M. P. Jones (BM 22572); Estremadura, Castelo dos Mouros, ad rupes graniticas, 500 m a.s.l., 12 Apr 1955, Tavares, Lichenes Lusitaniae selecti exsiccati n° 87 (BM 762923, GZU PO–P1); Sintra, Tapada, nos penedos musgosos, 23 Aug 1916, *leg.* G. Sampaio (PO 1353); Serra d'Arrabida, Portinho, Apr 1961, *leg.* J. Poelt 6846, (GZU Inv. Nr. 2–93, 3–93); Serra de Sintra, Castelo dos Mouros, 500 m a.s.l., Apr 1983, *leg.* M. P. Jones (BM 22570); Serra de Arrábida, Mata do Solitário, 200 m a.s.l., *Quercus coccifera*, *Arbutus*, May 1982, *leg.* M. P. Jones (BM 762922); Minho, Braga, Bom Jesus, nas árvores, 6 Sep 1915, *leg.* G. Sampaio (PO 562); Braga, Bom Jesus do Monte, árvores, Jan 1921, *leg.* G. Sampaio (PO 52); Leonte, 5 km N of Gerêz, 875 m a.s.l., *Quercus robur*, May 1982, *leg.* M. P. Jones (BM 22573); Auga de Pala, beside the Rio Homem, 2 km SE of Portela do Homem, 800 m a.s.l., *Quercus robur*, May 1982, *leg.* M. P. Jones (BM 762921); Trás-os-Montes e Alto Douro, Vila Nova de Foz Côa, Quinta das Tulhas, Muscícola em superfície vertical de xisto, 3 May 2007, *leg.* J. Marques (PO 9017-L).

Additional specimens examined. – *Leptogium cochleatum*: insular portugal, Açores, S. Miguel, parque Terra Nostra, Jul 1989, epiphyte, *leg.* M. P. Jones (LISU 200428); S. Miguel, parque Terra Nostra, As Furnas, 25 Sep 1998, sobre *Liriodendron tulipifera*, *leg.* G. Paz-Bermúdez & M. E. López de Silanes (SANT 10133); SPAIN, A Coruña, Pontedeume, fraga de Caaveiro, 26THJ7607, *Castanea sativa*, 4 Jun 1986, *leg.* A. García-Molares & M. E. López de Silanes (SANT 2289). – *Leptogium corticola* (Taylor) Tuck.: ITALY, Brescia, Treviso, in nemore Montello, arborum truncos, (BM 762915); Verbano, valle Intrasca, Bagliello, Castanearum truncos, (BM 762914); Vicenza, circa Breganze supra muscos ad Castanearum truncos, (BM 762 913).

***Leptogium coralloideum* (Meyen & Flot.) Vain. – Figs. 9, 10.**

Observations. – Similar to *L. brebissonii*, with which it can easily be mistaken when sterile. However these two species differ in isidia morphology and thallus thickness. *L. coralloideum* presents cylindrical, simple to coralloid isidia, that may reach a height of 1 mm and are concolorous with thallus, or only slightly darker; thallus section 200–300 µm thick, not taking the ridges into account. According to Swinscow & Krog (1988) ascospores are ellipsoid, muriform, 25–35 × 12–18 µm, and are a good character to distinguish this species from *L. brebissonii*. No fertile specimens were found among the examined material and most had been previously identified as *L. brebissonii* but agree with *L. coralloideum* in isidia morphology and thallus anatomy. *L. coralloideum* is much less frequent than *L. brebissonii* in mainland Portugal.

Habitat and distribution. – Corticolous. Widespread in the tropics and warmer areas of the temperate region (Jørgensen 1994). In mainland Portugal it was previously known from the Algarve and Beira Litoral (Jørgensen 1994). It is here cited for the first time for the provinces of Alto Alentejo, Baixo Alentejo and Estremadura.

Selected material examined. – MAINLAND PORTUGAL, Algarve, 3 km N of road to Lagoa do Nave on the Salir road, 200 m a.s.l., *Olea*, Apr 1976, *leg.* M. P. Jones (BM

762919); 2 km SE of Parragil, Loulé road, 150 m a.s.l., *Ceratonia*, Apr 1973, *leg.* M. P. Jones (BM 762920); Rocha dos Soidos, Alte, 400 m a.s.l., *Ceratonia*, Dic 1975. *leg.* M. P. Jones (BM 762932); Alto Alentejo, Large olive grove, some 2 km west of Grândola 100 m a.s.l., *Olea*, Oct 1981, *leg.* M. P. Jones (BM 762929); Ponte de Sôr, Rosmaninhal, Vale da Ferreira, ND8555, 220 m a.s.l., *Olea*, 15 Mar 1993, *leg.* M. P. Jones, C. Sérgio & C. Garcia-Pereira (LISU sn); Baixo Alentejo, Mina da Somincor-Semblana, Cerca da Estaleja, *Olea*, 20 Oct 2000, *leg.* P. Carvalho, M. P. Jones & C. Branquinho (LISU S3000); Beira Litoral, Coimbra, Jardim Botânico, Apr 1881, *leg.* A. F. Moller, *det.* A. Nylander 42, (COI sn); Estremadura, arredores de Lisboa, Quinta de Sta Marta, 29SMC8298, 130 m a.s.l., *Quercus faginea*, 23 Jan 2002, *leg.* C. Garcia (LISU sn). INSULAR PORTUGAL, Açores, San Miguel, Parque Terra Nostra, *Liriodendron tulipifera*, 23 Sep 1998, *leg.* M. E. López de Silanes & G. Paz-Bermúdez (SANT 10134); San Miguel, Parque Terra Nostra, As Furnas, *Camellia japonica*, 25 Sep 1998, *leg.* M. E. López de Silanes & G. Paz-Bermúdez (SANT 10135).

***Leptogium cyanescens* (Rabenh.) Körb. – Fig. 11.**

Description. – Thallus usually pale bluish-grey, smooth, papery, not or only slightly swelling in water, naked, with straight cylindrical, coralloid or squamulose isidia; lobules 4–8(15) mm wide, rounded, upturned or not; thallus section 45–60 µm thick; upper and lower cortex consisting of a layer of 5 × 5 µm hyaline isodiametric cells. – *Nostoc* cells in chains and regularly distributed, except one voucher specimen (PO 199) where these are displayed in groups and irregularly distributed. – Apothecia rare, seen only in voucher specimen PO 730; thalline exciple sometimes isidiate. – Ascospores hyaline, muriform, ellipsoid, 22–28 × 10–12.5 µm.

Observations. – Frequently sterile. Jørgensen & James (1983) stated that *Nostoc* cells in *L. cyanescens* are usually clustered, although in the studied specimens they were mostly found in chains. PO specimens (371, 592, 730, 1335) previously identified as *L. caesium*, were reidentified as *L. cyanescens*.

Habitat and distribution. – On mossy bark, rocks, walls and soil. Cosmopolitan in temperate and subtropical regions (Gilbert & Jørgensen, 2009). Widely cited in mainland Portugal (Sampaio 1917; Tavares 1945, 1950 b; van den Boom *et al.* 1990; van den Boom & Giralt 1996; Jones 1999, 2002; Carvalho *et al.* 2002). First record for the province of Trás-os-Montes e Alto Douro.

Selected material examined. – MAINLAND PORTUGAL, Algarve, 2 km SW of Monchique on road to Foia, 550 m a.s.l., *Castanea sativa*, Aug 1972, *leg.* M. P. Jones (BM 762898); Baixo Alentejo, Olival a 2 km W de Grândola, estrada para Melides, 90 m a.s.l., NC3625, *Olea europaea*, 20 Apr 1998, *leg.* M. P. Jones, P. Carvalho & R. Figueira (LISU 71); Beira Litoral, Buçaco, Vale dos Fetos, 200 m a.s.l., *Cedrus lusitanica*, Apr 1983, *leg.* M. P. Jones (BM 76205); Coimbra, Olivais 6 Jan 1916, *leg.* G. Sampaio (PO 730); Estremadura, arredores de Lisboa, Quinta de Sta Marta, 130 m a.s.l., 29SMC8298, *Quercus faginea*, 23 Jan 02, *leg.* C. Garcia (LISU sn); Mata Coberta, Serra d'Arrábida, 300 m a.s.l., SE, Oct 1981, *leg.* M. P. Jones (BM 762904); Serra de Montejunto, Quinta da Neve, sobre as árvores musgosas, 3 Jan 1950, *leg.* C. N. Tavares (G 52009); Lisboa, Alfeite, na terra musgosa, 16 Aug 1916, *leg.* G. Sampaio (PO 1337); Sintra, nos Penedos musgosos, 23 Aug 1916, *leg.* G. Sampaio (PO 1335); Serra de Sintra, Castelo dos Mouros, ad rupes graníticas muscosas, 450 m a.s.l., 5 Apr 1947, Tavares *Lichenes Lusitaniae selecti exsiccati* n° 59 (BM 762912); Arrabida vertente sul, Medronheiros, Apr 1904, *leg.* V. A. Cordeiro (COI sn); Minho, Braga, Bom Jesus, nas ar-

vores, 6 Sep 1915, *leg.* G. Sampaio (PO 592); Ponte de Lima, Sá, arvores, Sep 1922, *leg.* G. Sampaio (PO 6237); Ribatejo, Road to Cabaleiros, Carrequeiros, Tomar, 100 m a.s.l., ND6185, *Olea*, Mar 1983, *leg.* M. P. Jones (LISU 200440); Trás-os-Montes e Alto Douro, Vila Nova de Foz Côa, Vale de José Esteves, Superfície vertical de xisto, 2 May 2011, *leg.* J. Marques (PO 9018-L).

Additional material examined. – INSULAR PORTUGAL, Açores, Abelheira, sobre pedras, Aug 1894, *leg.* B. Tavares Carreiro (COI 67). Sao Miguel, Parque Terra Nostra, Furnas, 0 m a.s.l., epiphyte, 1984, *leg.* M. P. Jones (LISU 200408); Sao Miguel Parque Terra Nostra, Furnas, sobre *Liriodendron tulipifera*, 25 Sep 1998, *leg.* G. Paz-Bermúdez & M. E. López de Silanes (SANT 10136); Madeira, Entre os Balcões e a Chã da Nogueira, sobre taldes musgosos, 1 Aug 1951, *leg.* C. N. Tavares (G 52016); Encumeada de S. Vicente face Norte, sobre o solo musgoso 30 Jun 1951, *leg.* C. N. Tavares (G 52015); SÃO TOMÉ AND PRÍNCIPE, Sao Tomé, Saudade, 750 m a.s.l., Jan 87 (COI sn); SPAIN, A Coruña, Pontedeume, Caaveiro, 90 m a.s.l., sobre esquistos musgosos, 19 Apr 1985, *leg.* R. Carballal & M. E. López de Silanes (SANT 2286); Bizcaia, Cabo Ogoño, 50 m a.s.l., Sur, *Quercus ilex*, 30 Dec 1984, *leg.* M. B. Aguirre (BIO 179); Tarragona, El Retaule, La Cenia, 21 Sep 1986, *leg.* V. Atienza (VAB 1066); Santa Cruz de Tenerife, Pico del Ingles, 960–990 m a.s.l., 12 Sep 1986, *leg.* P. Clerc (G 52013, 52014).

Leptogium ferax (Durieu & Mont.) Rabenh. – Figs. 4, 31.

Synonyms. – *Collema ferax* Durieu & Mont.

Description. – Thallus foliose, small, 2–3 cm in diameter, dark grey, smooth; lobules rounded, 1–2.5 mm wide with lobed margins, non-isidiate; thallus section 75–90 µm thick, paraplectenchymatous; pseudocortex on both upper and lower surfaces, usually yellow; the areas of contact with bryophytes in lower surface, when observed under the microscope, presenting a few isolated hairs, less than 9 µm long. – *Nostoc* in chains of 5–12 cells, 5–6 µm in diameter, more abundant at the pseudocortex. – Apothecia numerous, 0.4–1.2 mm in diameter with a persistent thalline exciple that often grows small lobules; epithecium yellowish 10–15 µm; hymenium hyaline, 100 µm tall; hypothecium hyaline to slightly yellowish, 25–30 µm high. – Ascii cylindrical. – Ascospores 3-septate to submuriform, hyaline, 20–29 × 8–10 µm.

Observations. – Rare in Portugal, only located in the province of Estremadura.

Habitat and distribution. – Muscicolous on rocks. In Europe it is only known from Greece, France, Spain (Arvidsson 1984, Clauzade & Roux 1985, Aragón *et al.* 2005) and the Portuguese province of Estremadura (Carvalho & Jones 1997, Jones 2002).

Material examined. – MAINLAND PORTUGAL, Estremadura, Mata do Solitario, Serra de Arrabida, NC0057, on mossy limestone rocks, Apr 1994, *leg.* M. P. Jones (LISU 200451).

Leptogium furfuraceum (Harm.) Sierk – Figs. 22, 23

Synonyms. – *Leptogium hildenbrandii* (Garov.) Nyl. var. *furfuraceum* Harm.

Description. – Thallus striated and wrinkled, sometimes with isolated ridges, dark slate-grey to brown, grey-black when wet; flabellate lobules, flat

to undulate, 0.5–1.5 cm wide; isidia granular, cylindrical or clavate, simple to branched, marginal and/or laminar, brown, darker on top, where a small depression is sometimes visible; lower surface covered with a white, yellowish or light brown tomentum, composed of 120–300 μm long hairs, with elongated cells 8–20(25) \times 3–5(6) μm ; thallus section 175–250 μm ; upper and lower cortex paraplectenchymatous. – *Nostoc* cells in chains, more abundant near the upper cortex. – Apothecia not seen.

Observations. – Some voucher specimens previously identified as *Leptogium furfuraceum* were included under *L. brebissonii* (LISU sn 1), or under *L. hibernicum* (LISU sn 2, sn 4, 39a). *Leptogium furfuraceum* resembles *L. brebissonii* in the presence of wrinkles and ridges but is distinguished by the presence of tomentum. *Leptogium furfuraceum* differs from *L. hibernicum* in the morphology of tomental hair cells. The voucher specimen PO 2555, previously identified as *L. hildenbrandii*, was reidentified as *L. furfuraceum*.

Habitat and distribution. – Corticolous, common on trunks of old olive trees. It extends to North America, India, East and South Africa and southwestern Europe (Nimis 1993). Besides the provinces mentioned in the examined material, it is known from the Portuguese provinces of Alto Alentejo (Carvalho 1997, 1998). First record for the province of Algarve.

Material examined. – MAINLAND PORTUGAL, Algarve, Öste. Algarve, Tavira, Mar 1961, leg. J. Poelt (GZU Inv. Nr. 2–93); Benafim, Quinta de Freixo, Mar 1978, leg. M. P. Jones (BM 762896); Beira Alta, Abrunhosa-a-Velha, Casal de S. Sebastião, *Olea europaea*, 5 Sep 1963, leg. C. N. Tavares (LISU 6871); Trás-os-Montes e Alto Douro, Moncorvo, Vale do Pia, nas oliveiras velhas, leg. J. Santos Junior (PO 2555); S Bragança, valle del rio Sabor, 500 m a.s.l., 29TPF853872, *Juniperus oxicedrus*, 5 Sep 2006, leg. M. E. López de Silanes (SANT 10994).

Additional material examined. – SPAIN, Jaén, Sierra de Cazorla, Farraga mill valley, *Prunus dulcis*, Aug 1983, leg. M. P. Jones (BM 762882).

***Leptogium gelatinosum* (With.) J. R. Laundon** – Figs. 15, 16.

Synonyms. – *Leptogium sinuatum* (Huds.) A. Massal., *L. scotinum* (Ach.) Fr., *L. scotinum* (Ach.) Fr. var. *sinuatum* (Huds.) Torss.

Description. – Thallus foliose, forming small compact tufts, grey in sheltered situations, dark brown in exposed areas, though the lower surface often maintains the grey colour; surface glossy, especially at the lobule ends, slightly to clearly wrinkled, wrinkles more apparent on the lower surface; lobules 2–4(5) mm wide, rounded, more or less raised and wavy, with crenulated margins due to the presence of small, flat, simple or branched, extensions; thallus section 50–90 μm ; upper and lower cortex composed of a single layer of cells, paraplectenchymatous. – *Nostoc* cells 5–6 μm in diameter, in chains of 7–11 cells. – Apothecia frequent and numerous, 0.5–1(2) mm in diameter; disk concave to flat; thalline exciple entire, smooth or finely wrinkled, slightly darker than the disk and non-isidiate but sometimes with 70 μm wide extensions similar to the ones formed in the thallus; hymenium

120–144 μm high; epitecium reddish-brown; hypothecium paraplectenchymatous 15–20 μm high. – Ascii 120 \times 25 μm , cylindrical to clavate. – Ascospores 27–40 \times (10)15–20 μm , ellipsoid, colourless, with acute ends, muriform to submuriform.

Observations. – External morphology is similar to *L. intermedium* but *L. gelatinosum* has a larger thallus, wider lobules, and larger ascospores with larger number of locules. Specimens with matt and blue-grey thallus are similar to *L. aragonii* but are here regarded as *L. gelatinosum* because they are either well-fruitified or present lobules and/or flat extensions in thalline exciple.

Habitat and distribution. – Usually associated with bryophytes on calcareous substrata, dunes, mortar, rarely at the base of old trunks. Cosmopolitan except in South America and widely distributed in Europe (Gilbert & Jørgensen 2009). Widely cited in mainland Portugal (Carvalho 1997, 1998; Carvalho *et al.* 2002; Coutinho 1916; Jones 1999, 2002; Paz-Bermúdez *et al.* 2009).

Selected material examined. – MAINLAND PORTUGAL, Alto Alentejo, Castelo de Vide, *Olea*, 23 Sep 1958, *leg.* C. N. Tavares (LISU 6412); PNSSM, Castelo de Marão, PD6239, 800 m a.s.l., sobre o muro do castelo, 28 Sep 94, *leg.* P. Carvalho (LISU 235187); Estremadura, Livramento, 1 km S do Porto de Mós, 300 m a.s.l., *Olea*, Oct 1981, *leg.* M. P. Jones (BM 762888); Sintra, na Vila, sôbre a terra musgosa de um muro, 1 Sep 1941, *leg.* C. N. Tavares (LISU 235214), Sintra, Palacio da Pena, 22 Oct 1989, *leg.* M. E. López de Silanes (SANT 10922); Minho, Melgaço, Peso, penêdos da margem do Minho, 21 Aug 1915, *leg.* G. Sampaio (PO 468); Ribatejo, Mata de Minde, Minde, ND2774, 193 m a.s.l., *Olea*, Oct 1981, *leg.* M. P. Jones (LISU 200457); Trás-os-Montes e Alto Douro, Vila Nova de Foz Côa, Canada do Inferno, Superfície vertical de xisto, 7 May 2009, *leg.* J. Marques (PO 9019-L).

Additional material examined. – SPAIN, Asturias, Cañada de Bandujo, Schlucht des Rio Trubia N von La Plaza, 300 m a.s.l., Silikat, 1 Sep 1980, *leg.* J. Hafellner 1044 (GZU 09–2003); A Coruña, Pontedeume, Caaveiro, 90 m a.s.l., en rocas esquistosas próximas al suelo, 14 Jun 1986, *leg.* A. García-Molares & M. E. López de Silanes (SANT 2294); Ourense, Rubiá, Vilar de Silva, sobre muro de esquistos, 9 Mar 2006, *leg.* R. Carballed (SANT 10874); Tarragona, Sierra de Prades, NW-geneigte Hänge SW ober dem Monasterio de Poblet, an der Straße nach Prades, 500 m a.s.l., *Quercetum ilicis* mit Schieferblöcken, 23 May 1983, *leg.* J. Hafellner 17501, (GZU 09–2003).

Leptogium hibernicum M. E. Mitch. ex P. M. Jørg. – Figs. 7, 24.

Description. – Thallus foliose, usually brown, with some bluish-grey to lead-grey areas, striated, often with small wrinkles; isidia granular, cylindrical, flat or coralloid, concolorous with thallus or somewhat darker, usually developing along lobule margins into a jagged appearance, but can subsequently expand to thallus center; lobules 5–7 mm wide; yellowish-brown tomentum on lower surface; tomental hairs short, (10)20–35(50) μm long, composed of 6–7 globose cells, 5–7.5 \times 5–8 μm in diameter, sometimes elliptical and 6 \times 8 μm ; older parts of thallus with hairs growing from the upper cortex, only visible under the microscope, a character that has not been mentioned before; thallus section 150–400(650) μm ; cortex consisting of a single layer of cells, paraplectenchymatous. – *Nostoc* in chains of 13–21 cells, 5 \times

6 μm in diameter, concentrated near the upper and lower cortex, leaving a lax central area deprived of cyanobacteria. – *Apothecia* not seen.

Observations. – *Leptogium hibernicum* shares some characters with *L. lacerooides*, differing mainly in the roughness of the thallus and lobule width. Specimens previously identified as *L. furfuraceum* (LISU sn, sn2, 39a) were reidentified as *L. hibernicum* and can be easily distinguished from the former species by the length and morphology of tomental hair cells. Specimens (PO 198, 650, 8181, 1351) previously identified as *L. chloromelum* were also also regarded as *L. hibernicum*.

Habitat and distribution. – Corticolous among bryophytes in undisturbed woodlands. It extends to Asia, South America, West Africa and Europe, from southwestern Norway to Portugal (Gilbert & Jørgensen 2009). In mainland Portugal, besides the provinces mentioned below, it is known from the Algarve (Jones 1999), Douro Litoral (Jørgensen 1973, van den Boom *et al.* 1990) and Estremadura (Jones 1999, 2002).

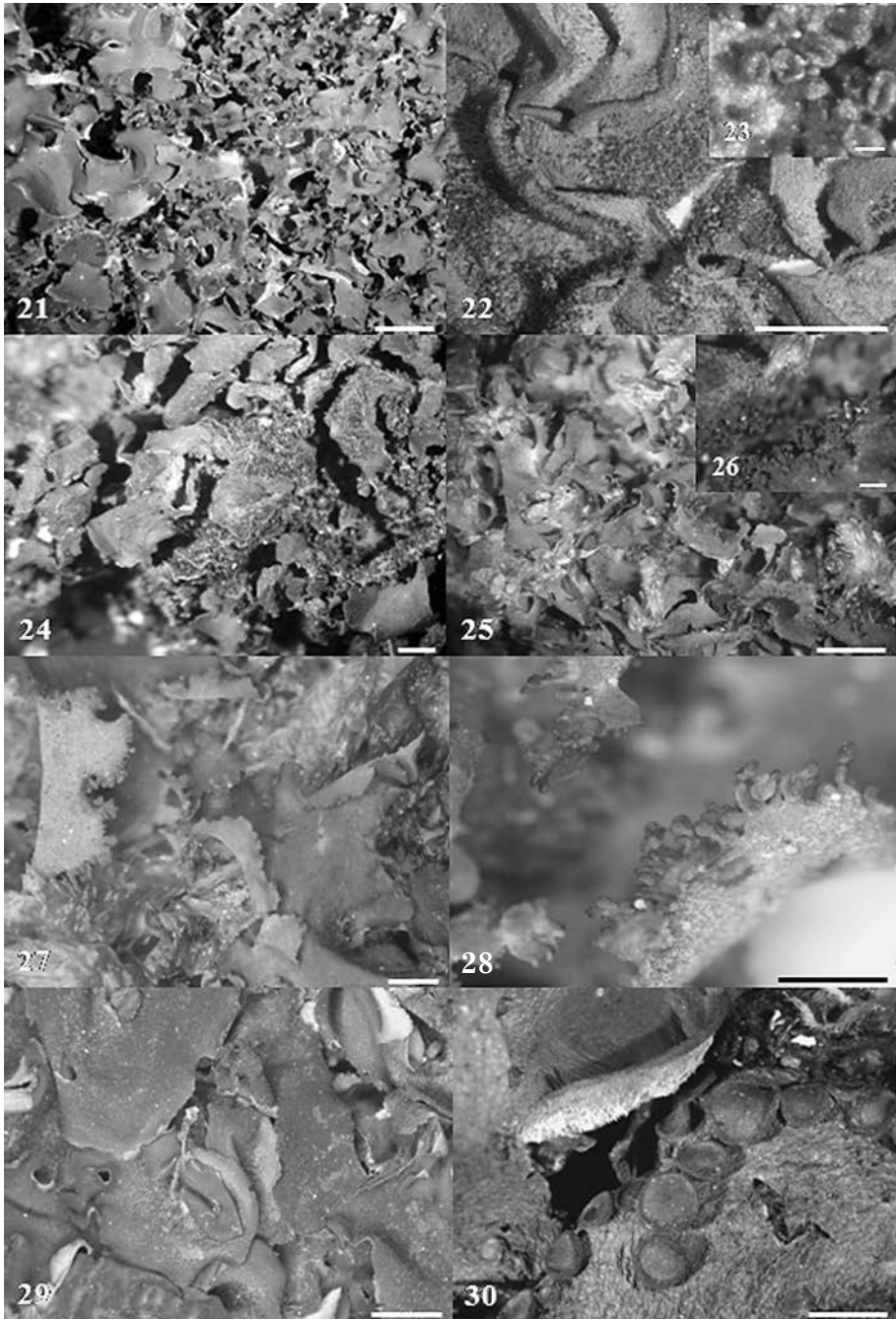
Selected material examined. – MAINLAND PORTUGAL, Alto Alentejo, PNSSM, Porto da Espada, PD4157, 590 m a.s.l., *Castanea sativa*, 24 Feb 1995, *leg.* P. Carvalho (LISU 39a); Beira Alta, Viseu, Mata de S. Miguel, nos carvalhos, 16 Apr 1916, *leg.* G. Sampaio (PO 1351); Beira Alta, Oliveira do Hospital, Penalva de Alva, 29TNE96, 400 m a.s.l., *Quercus robur*, 9 Aug 2002, *leg.* C. Sérgio (LISU sn 4); Gouveia, Quinta do Marquês, próximo do Curral do Negro, 29TPE2083, *Castanea sativa*, 1 Mar 2000, *leg.* C. Garcia, (LISU sn 2) Beira Litoral, near the park office, Serra de Malcata, near Benfeita Arganil, NE9254, 500 m a.s.l., *Quercus pyrenaica*, Jul 1995, *leg.* M. P. Jones (LISU 200470); Minho, Póvoa de Lanhoso, S. Gens, Dec 1902, *leg.* G. Sampaio (PO 198). Braga, Bom Jesus, nas árvores, 6 Sep 1915, *leg.* G. Sampaio (PO 650); Ponte de Lima, Moreira, nos carvalhos, 12 Aug 1915, *leg.* G. Sampaio (PO 8181).

Additional material examined. – SPAIN, A Coruña, Pontedeume, Caaveiro, 29TNJ7507, 50–100 m a.s.l., *Laurus nobilis*, 4 Jun 1986, *leg.* J. Álvarez & M. E. López de Silanes (SANT 2292); Lugo, Caurel, pista de Seoane a Visuña, 29TPH5222, 700–800 m a.s.l., *Quercus robur*, 19 Sep 1988, *leg.* J. Álvarez (SANT 7348, 7349).

***Leptogium juressianum* Tav.** – Figs. 25, 26.

Description. – Thallus loosely attached to the substrate, brown, with pale to slate-grey areas, slightly swollen when wet; lobules brown, rounded, 3–6 mm wide, with wavy and frequently revolute margins; isidia marginal or laminal, concolorous with thallus, granular, cylindrical or lobuliform, simple to branched, tapering at base; upper surface with light grey or yellowish arachnoid hairs, approximately 100 μm long, more abundant at the base of the lobules although they may cover the entire surface; lower surface partially pubescent; hair cells cylindrical, elongated, 8–12 \times 4 μm ; thallus section 50–63(75) μm ; upper and lower cortex paraplectenchymatous. – *Nostoc* cells 10 \times 9–10 μm in diameter, arranged in clusters that are distributed homogenously across the thallus. – *Apothecia* not seen.

Observations. – *Leptogium juressianum* is similar in appearance to *L. lacerooides*, differing from the former by the presence of an arachnoid tomentum on both sides of the thallus.



Figs. 21–30. *Leptogium* species with tomentum. 21. *L. burgessii*. 22, 23. *L. furfuraceum*. 24. *L. hibernicum*. 25, 26. *L. juressianum*. 27, 28. *L. laceroides*. 29. *L. saturninum*. 30. *L. hildenbrandii*. Bars: 21, 22, 25, 29. 5 mm. 24, 30. 2 mm. 26. 1 mm. 23, 27. 0.5 mm. 28. 0.2 mm.

Habitat and distribution. – Corticolous. Hyperoceanic species from South America, Africa, western Ireland, Portugal and the Azores (Gilbert & Jørgensen 2009), also in North America (Lendemer *et al.* 2008).

Material examined. – MAINLAND PORTUGAL, Alto Alentejo, 1 km S of Castelo de Vide, 600 m a.s.l., PD36, *Castanea*, Aug 1983, *leg.* M. P. Jones (LISU 200473); Beira Litoral, Mata de Margaraça, Serra de Açor, Arganil, NE9254, *Quercus pyrenaica*, Jul 1995, *leg.* M. P. Jones (LISU 200471); Minho, Laga, 4 km N for Gerês, 900 m a.s.l., NG72, *Quercus robur*, Jun 1984, *leg.* M. P. Jones (LISU 200472); Sobreiral de Ermida, a 3 km SE of Gerês, 800 m a.s.l., *Arbutus*, May 1982, *leg.* M. P. Jones (BM 762890).

Leptogium laceroides B. de Lesd. – Figs. 27, 28.

Synonyms. – *Leptogium americanum* Degel.

Description. – Thallus foliose, bluish-grey to dark brown, smooth, matt; lobules irregular, 3–5 mm wide, with wavy margins; isidia multiform (granular, cylindrical, coralloid and lobuliform), concolorous with thallus or darker, especially at tips, frequently developing along lobule margins into a jagged appearance; lower surface with a brown to dirty white tomentum; tomental hairs short 7–10(25) µm long, of globose cells 3.5–5 µm; thallus section 70–80 µm thick; cortex paraplectenchymatous, composed of a single layer of cells. – Apothecia not seen.

Observations. – The lobuliform isidiate specimens resemble *L. cyanescens*, but isidia are smaller and darker than *L. cyanescens*. Besides, *L. cyanescens* is not tomentose. The cylindrical isidiate specimens of *L. laceroides* resemble *L. furfuraceum*, but can be differentiated by the morphology of tomental hair cells and thallus surface, which is smooth in *L. laceroides* and rugose in *L. furfuraceum*.

Specimens (PO 1935, 8180) previously collected and identified by Sampaio (1916) as *L. myochroum* (synonym of *L. saturninum*) are here regarded as *L. laceroides*.

Habitat and distribution. – Corticolous. Examined specimens were found growing over the trunks of old olive trees. Reported from North America, Bolivia, Tristan da Cunha, East Africa, New Zealand (Jørgensen 1997). In Europe, it is only known from Portugal, including the studied provinces and the archipelago of Madeira (Jørgensen 1973).

Material examined. – MAINLAND PORTUGAL, Beira Litoral, Cruz Alta, Buçaco, 543 m a.s.l., *Quercus robur*, Apr 1983, *leg.* M. P. Jones (BM 762889); Minho, Póvoa de Lanhoso, S. Gens, numa oliveira, 13 Sep 1919, *leg.* G. Sampaio (PO 1935); S. Gens, oliveiras velhas, 1922, *leg.* G. Sampaio (PO 8180).

Leptogium lichenoides (Wulfen) Zahlbr. – Figs. 19, 20.

Synonyms. – *Leptogium lacerum* (Retz.) S. F. Gray

Description. – Thallus thin, smooth to slightly striated, lead-grey to bluish-brown in sheltered situations or dark brown in exposed situations,

green when wet; lobules numerous, erect and tall, 1.5–2 (3) mm wide, margins strongly fibrillose due to the presence of numerous simple to coralloid, cylindrical isidia that may cover up the entire thallus surface; surface striated and slightly wrinkled, especially in the lower side; thallus section (65)70–100(120) μm thick; cortex brown, paraplectenchymatous. – *Nostoc* cells, 4–5 μm in diameter, in chains of 5–9 cells. – Apothecia rare (LISU 235222), 0.3–1 mm in diameter; thalline exciple grey, isidiate. – Ascospores 37–47 \times 17–22 μm , muriform.

Observations. – Readily distinguished from closely related taxa by isidia morphology. Some specimens present abundant arachnoid tomental hairs in the lower surface, a character that has already been signalled by Jørgensen (1973) for this taxon, which may thus be confused with *L. juresianum*. These species differ in the shape and size of lobules.

Habitat and distribution. – At the base of old trees associated with moss, rocks and stone or concrete walls, also in coastal dunes among mosses, with preference for exposed habitats. It is a widely distributed species worldwide (Jørgensen 2007) and one of the most common and cited species of *Leptogium* in mainland Portugal (Carvalho 1998; Carvalho *et al.* 2002; Colmeiro 1889; Coutinho 1916; Jones 1983, 1999, 2002; Paz-Bermúdez *et al.* 2009; Tavares 1945, 1950 a, b; van den Boom & Giralt 1999; van den Boom & Jansen 2002).

Selected material examined. – MAINLAND PORTUGAL, Alto Alentejo, PNSSM, Fonte de Concelho, PD6240, 680 m a.s.l., rocha granítica, 13 Dec 1994, *leg.* P. Carvalho (LISU 235219); Baixo Alentejo: 3 km W of Moura, PC 3425, *Olea*, Mar 1995, *leg.* M. P. Jones (LISU 200475); Beira Litoral, Buçaco, Mata, no musgo da terra, 9 Jan 1916, *leg.* G. Sampaio (PO 859); Estremadura, Serra d’Aire e Candeeiros-Alvados, 29SND27, 233 m a.s.l., *Quercus faginea*, Aug 2001, *leg.* P. Pinho (LISU 235223); 16 Oct 2000, *leg.* P. Carvalho (LISU 235220); Minho, Ponte de Lima, Estorãos, 18 Aug 1915, *leg.* G. Sampaio (PO 370); Paredes de Coura (no meio da vila), 29TNG3640, *Tilia*, 7 Apr 2001, *leg.* P. Carvalho, C. Garcia, C. Sérgio & M. Sim-Sim (LISU 235222); Trás-os-Montes e Alto Douro, Bragança, Candaíra, 10 Sep 1915, *leg.* G. Sampaio (PO 2948); Carvalhal de Sezelhe, NG9329, 925 m a.s.l., *Quercus pyrenaica*, Jun 1984, *leg.* M. P. Jones (LISU 200474); E de Bragança, fondo de valle, 29TPG738299, 668 m a.s.l., en rocas ácidas musgosas, 8 Sep 2006, *leg.* M. E. López de Silanes (SANT 10995).

Additional material examined. – AUSTRIA, Steiermark, Hochschwab-Gruppe, Aflenzer Staritzen, N ober dem Seeberg, Sattel am Steig auf die Seeleiten, 1350 m a.s.l., MTB8357/4, Buchen-Tannen-Fichtenwald, auf niederen Kalkblöcken einer Blöße, 13 Oct 1990, *leg.* J. Hafellner, W. Obermayer & M. E. López de Silanes (SANT 7237); SPAIN, Lugo, Caurel, Moreda, 29TPH5521, 800 m a.s.l., sobre tronco muerto, Sep 1989, *leg.* J. Álvarez (SANT 7353); Ourense, Manzaneda, Raigada, en taludes húmedos, 24 Mar 2002, *leg.* R. Carballal (SANT 10373); Manzaneda, Vilarmeao, en musgos cerca de la iglesia, 26 Mar 2002, *leg.* R. Carballal (SANT 10372); Oviedo, Parque Nacional de Muniellos N von Cangas de Narcea, 650 m a.s.l., Wald in Talschluß mit Silikatblöcken, 1 Sep 1980, *leg.* J. Hafellner 10230 (GZU 09–2003).

***Leptogium magnussonii* Degel. & P. M. Jørg. – Fig. 32.**

Description. – Thallus foliose, dark brown, smooth or finely striate, naked; lobules rounded and lifted upwards, 1–3.5 mm wide, sometimes only

visible under the microscope; isidia both laminar and marginal, concolorous with thallus, darkening towards tips, shiny, cylindrical, simple to branched, the largest with an apical depression; thallus section 65–84 μm ; upper cortex dark brown; lower cortex hyaline, paraplectenchymatous, 9–10 μm wide. – *Nostoc* cells 6–7 μm in diameter, usually in groups surrounded by hyphae. – Apothecia not seen.

Observations. – It has often been confused with *L. lichenoides* from which it differs mainly in the isidia morphology, the dark brown thallus and the arrangement of *Nostoc* cells. Additional information on the differences between these two species is provided by Jørgensen (1994).

Habitat and distribution. – This species was initially found in Scandinavia, growing on wet siliceous rocks, often along the coast (Jørgensen 1994). In mainland Portugal, similarly to what was observed in Spain (Aragón & Otálora 2004), it was found growing on the trunk of olive trees in river valleys of the Algarve (van den Boom & Giralt 1996) and Trás-os-Montes e Alto Douro (Paz-Bermúdez *et al.* 2009). Here it was also recently found growing on north facing, moist and somewhat eutrophic, schist surfaces, probably compensating for the hot and dry conditions of the region. Its preference for humid and nutrient-enriched substrates might explain this unusual ecological behaviour.

Material examined. – MAINLAND PORTUGAL, Algarve: N of Portimão, 6.5 km WNW of Silves, 1–1.5 km N of road 124, along river Odelouca, 20 m a.s.l., base of *Olea*, 28 Jul 1993, leg. P. v. d. Boom, (hb. P. v. d. Boom 14803, GZU 95); Trás-os-Montes e Alto Douro, Valle del río Sabor, orilla izquierda, 29TPF853872 sobre *Olea europea*, 500 m a.s.l., 5 Sep 2006, leg. M. E. López de Silanes (SANT 10996); Trás-os-Montes e Alto Douro, Vila Nova de Foz Côa, Vale do Forno, Superfície vertical de xisto, 4 May 2011, leg. J. Marques (PO 9020-L).

***Leptogium palmatum* (Huds.) Mont. – Fig. 14.**

Synonyms. – *Leptogium corniculatum* auct.

Description. – Thallus foliose, striated and slightly wrinkled, grey to brown or dark brown, shiny, especially towards lobule ends, whose margins are downturned forming tube-like, or corniculate tips, (2)3–4 mm wide; thallus section 87.5–112.5 μm thick; upper and lower cortex composed of a single layer of cells, paraplectenchymatous. – *Nostoc* chains arranged homogeneously. – Apothecia 0.4–0.7 mm in diameter, disk brown, darker than the thalline exciple; thalline exciple paraplectenchymatous, 75–85.5 μm thick near the epithecium, with few cyanobacteria, and thickened, yellowish or light brown cell walls in the cortex; hymenium hyaline, 150–160 μm high; hypothecium paraplectenchymatous 50 μm high in central part. – Ascii subcylindrical 125 \times 20–25 μm . – Ascospores muriform, hyaline, ellipsoid with acute ends, 35–45 \times 16–18 μm .

Observations. – It is usually sterile in Europe (Clauzade & Roux 1985, Aragón *et al.* 2005, Gilbert & Jørgensen 2009), but some Portuguese

specimens are well-fruited (PO 549, 978, LISU 11028, 6394, 6509). It differs from similar species in lobule morphology. The record by Colmeiro (1889) is possibly the same as the voucher specimen PO 2950, since both the locality and collector agree with his description.

Habitat and distribution. – Muscicolous on soil and rock, rarely on bark. Besides Europe, where it is known mainly from coastal areas, it is known from Macaronesia, North and South America, Asia and Africa (Gilbert & Jørgensen 2009). Common in mainland Portugal (Carvalho 1997, 1998; Colmeiro 1889; Coutinho 1916; Jones 2002; Paz-Bermúdez *et al.* 2009; Tavares 1941 b, 1944, 1945, 1950 a, b; van den Boom & Jansen 2002).

Selected material examined. – MAINLAND PORTUGAL, Alto Alentejo, PNSSM, Fonte do Carvalho, perto do cemitério, PD3963, ± 650 m a.s.l., sobre os muros, 26 May 95, *leg.* P. Carvalho (LISU 51); À entrada de Marvão, 1 Apr 1959, *leg.* C. N. Tavares (LISU 6509); Serra de Portalegre, Quinta da Saude, 10 May 1948, *leg.* C. N. Tavares (LISU 2611); Beira Alta, Viseu, 16 Apr 1916, *leg.* G. Sampaio (PO 978); Serra da Estrela, Snra. do Desterro, 790 m a.s.l., sobre un muro granítico musgoso, Aug 1946, *leg.* C. N. Tavares (G 52023); Beira Litoral, Fraga de Pena, Serra da Malcata, 2 km E of Benfeita, Arganil, 500 m a.s.l., NE9254, *Prunus*, Jul 1995, *leg.* M. P. Jones (LISU 200435); Minho, Serra do Gerês, Prope Leonte, ad rupes graniticas muscosas, 1025 m a.s.l., 17 May 1947, Tavares Lichenes Lusitaniae selecti exsiccati, (BM 762916, G. 52022); Trás-os-Montes e Alto Douro, Bragança, na terra, 10 Sep 1915, *leg.* G. Sampaio (PO 531, 549); Bragança, terra musgosa, Oct 1921, G. Sampaio (PO 49); prox. de Moncorvo, na margem do Rio Sabor, 15 Jun 1958, *leg.* C. N. Tavares (LISU 6364); entre Chaves e Vinhais, próximo de Monforte de Rio Frio, PG32, 700 m a.s.l., no talude sombrio sobre rocha granítica, 28 Feb 1998, *leg.* C. Sérgio (LISU 11028); Cristóvão, Pinhão, Jun 1880, *leg.* I. Newton (PO 2950); Carrazeda de Ansiães, S. Lourenço, Muscícola em talude de terra, 14 Oct 2011, *leg.* J. Marques (PO 9021-L); Vila Nova de Foz Côa, Canada do Inferno, Muscícola em fenda larga de xisto, 7 May 2009, *leg.* J. Marques (PO 9022-L).

Additional material examined. – SPAIN, Ourense, Manzaneda, Raigada, taludes, 9 Nov 2001, *leg.* R. Carballal (SANT 10375); Santa Cruz de Tenerife, Tenerife, Montaña Cagancho, 17–18 km from La Laguna, 1400 m a.s.l., pine forest, 6 Jan 1964, *leg.* H. Imshaug (G 52024); Tenerife, Cordillera Dorsal, oberhalb Aguamansa, 1380 m a.s.l., 12 Jul 1983, *leg.* O. Breuß (G 52020).

***Leptogium plicatile* (Ach.) Leight.** – Figs. 5, 33, 34.

Description. – Thallus forming rosettes of 1–2 cm in diameter; surface dark brown to blackish, striated, becoming gummy and rubbery when wet; lobules flat to slightly thickened, 1–3 mm wide, often turning cylindrical and ascending; isidia scarce, visible only with a magnifying lens, rounded and striated; thallus section 175–250 µm thick; cortex yellowish, composed of globose cells or forming a pseudocortex; lower cortex of one or two layers of cells, 10–12.5 µm thick; upper cortex of more than two layers of cells, 25–50 µm thick. – *Nostoc* cells globose or elliptical, 4–5 × 2.5–4 µm, arranged in long chains of 10–23 cells and distributed homogenously throughout the thallus. – *Apothecia* rare, 0.5–1.2 mm in diameter; disc orange; proper exciple composed of globose cells with thick and necrotic walls, 10–15 µm wide at the sides, and 20–25 µm at the base; hymenium 120–180 µm high; paraphyses difficult to separate, immersed in a thick jelly, simple or slightly branched,

2 μm wide, with rounded granulated apices. – Ascii cylindrical to subclaviform, $60\text{--}65 \times 9\text{--}12 \mu\text{m}$. – Ascospores submuriform, $22\text{--}30 \times 9\text{--}10 \mu\text{m}$. – Pycnidia orange, immersed to semi-immersed in thallus, $250\text{--}370 \mu\text{m}$ in diameter; hamathecium hyaline, bordered by a thin necrotic pyrenium, $9\text{--}20 \mu\text{m}$ thick. – Conidia hyaline, bacilliform, simple, $3\text{--}5 \times 1\text{--}1.5 \mu\text{m}$.

Observations. – Pycnidia may be confused with young emerging apothecia, as they are both orange, which might explain the absence of references to this character in the consulted literature. Only two of the studied specimens are fertile (LISU 472, 6476). Most of the studied voucher specimens were not identified (LISU 3237, 3476, 3492, 4758, 5652, 6476) or were misidentified (PO 197b, LISU 472). This taxon presents a vast morphological variability and requires further study.

Habitat and distribution. – Most studied specimens grow on rock, associated or not with bryophytes, the usual ecology for this species, except a single specimen, LISU 4758, which was found growing on olive trees. However, no morphological or anatomical differences were observed between the corticolous and the saxicolous specimens. First record for Portugal.

Material examined. – MAINLAND PORTUGAL, Alentejo, Vila Viçosa, 1915, leg. G. Sampaio (PO 197b); Estremadura, Prox. da Ericeira, junto à Foz da Ribeira do Porto, sobre o calcário, 22 Jul 1955, leg. C. N. Tavares (LISU 5652); Arred. de Lisboa, próximo do Bairro da Encarnação, 16 Mar 1946, leg. C. N. Tavares (LISU 472); Lisboa, Benfica, 24 Sep 1918, leg. G. Sampaio (PO 1764); entre Trajouce e Manique, sobre o calcário, 8 Mar 1950, leg. C. N. Tavares (LISU 3476); próximo do Cacém, sobre o calcário, 14 Mar 1950, leg. C. N. Tavares (LISU 3492); Óbidos, próx. do Castelo, 9 Feb 1959, leg. C. N. Tavares (LISU 6476); próximo do Esteval, sobre o ritidoma de *Olea*, 29 Jan 1952, leg. C. N. Tavares (LISU 4758); arred. de Lisboa, entre Odrinhas e Alvarinho, sobre o calcário, 3 Jan 1950, leg. C. N. Tavares (LISU 3237); Trás-os-Montes e Alto Douro, Vila Nova de Foz Côa, Foz do Côa, Superfície vertical de xisto, 3 May 2011, leg. J. Marques (PO 9023-L).

Additional material examined. – SPAIN, Lugo, A Fonsagrada, Vilarin de Abaixo, tierra de calizas y musgo, 10 Mar 1987, leg. C. P. Valcárcel (SANT 7861).

Leptogium pulvinatum* (Hoffm.) Otálora var. *pulvinatum

Synonym. – *Leptogium lacerum* subsp. *pulvinatum* (Hoffm.) Cromb., *L. lichenoides* var. *pulvinatum* (Hoffm.) Zahlbr.

Description. – Thallus foliose, striated, glossy brown to dark brown, rarely grey-brown; lobules numerous, upright, (1)1.5–3(4) mm wide at the base and deeply divided with strong lacerate margins; thallus section $65\text{--}90 \mu\text{m}$ thick; cortex paraplectenchymatous, composed of a single layer of cells, $10\text{--}12 \mu\text{m}$. – *Nostoc* cells globose to elliptical $5\text{--}7 \mu\text{m}$ in diameter, arranged in chains of 5–8 cells. – Apothecia not seen.

Observations. – *Leptogium pulvinatum* differs from any other species in the *L. lichenoides* group in lobule morphology. *Leptogium pulvinatum* var. *quercicola* Otálora, Aragon, I. Martinez & M. C. Molina is character-

ized by a small thallus (0.5–2 cm in diameter) and smaller lobules (less than 1.5 mm wide), but there was no specimen among the examined material that could be undoubtedly attributed to this variety, although some present a high number of small lobules (less than 1.5 mm wide) among larger lobules (2–3 mm wide).

Habitat and distribution. – This is a common and abundant species in Europe, growing over mosses on rock, trees and stable dunes (Otálora *et al.* 2008). These authors do not provide information on the precise location of Portuguese specimens. The examined specimens are therefore the first confirmed occurrences of *L. pulvinatum* in the provinces of Algarve, Beira Baixa, Beira Litoral and Trás-os-Montes e Alto Douro.

Material examined. – MAINLAND PORTUGAL, Algarve, Loulé, 12 May 1918, *leg.* R. Jorge (PO 1912); Beira Baixa, Azenhas da Ribeira de Vila Ruiva, Vila Velha de Rodao, PD1191, 100 m a.s.l., *Olea*, Apr 1987, *leg.* M. P. Jones (LISU 200462); Beira Litoral, Ovar, May 1880, *leg.* G. Sampaio (PO 2949); Trás-os-Montes e Alto Douro, Mogadouro, Soutelo, Muscícola sobre rochas ultrabásicas, 11 May 2009, *leg.* J. Marques (PO 9024-L).

Additional material examined. – SPAIN, A Coruña, Corrubedo, 20 May 2000, *leg.* R. Carballal, G. Paz-Bermúdez & M. E. López de Silanes (SANT 10252); Lugo, Fonsagrada, 29TPH5776, sobre musgos, 15 Feb 1987, *leg.* C. P. Valcárcel (SANT 7710); Pontevedra, Illas Cies, illa do N, dunas, 27 May 1996, *leg.* G. Paz-Bermúdez (SANT 9731).

***Leptogium resupinans* Nyl.**

Observations. – Jørgensen & Jones (2012) recently reported this species as new to Europe from southern Portugal. According to existing literature *Leptogium resupinans* is a foliose species easily recognized by the presence of short hairs, up to 1 mm long, on both sides of the thallus and around the thalline exciple (Swinscow & Krog 1988, Jørgensen & Nash 2004, Jørgensen & Jones 2012).

Habitat and distribution. – On bark in montane forests. It is known from Southeast Asia, East Africa, North and South America, the Canary Islands and southern Portugal (Jørgensen & Nash 2004, Jørgensen & Jones 2012).

***Leptogium rivale* Tuck.**

Description. – Thallus foliose, small, 0.5–1.5 cm, olive green, smooth; lobules round, narrow and somewhat inflated, 0.15–0.25(0.3) mm wide; thallus section paraplectenchymatous 50–90 µm thick, of isodiametric cells 12–16 µm; cortex prosoplectenchymatous. – *Nostoc* cells globose, 3–5 µm in diameter, arranged in chains or in clusters. – *Apothecia* rare, 0.3–0.4 mm in diameter, globose; disc concave, dark brown; proper exciple orange-brown; thalline exciple of the same colour as thallus, slightly verrucose; hymenium 100–130 µm high. – *Ascospores* ellipsoid, muriform, 25–30 × 10–12.5 µm.

Observations. – The lower surface of the examined specimen presents 40–60 µm in diameter cephalodia containing *Nostoc* surrounded by groups of 30–90 µm long hairs. It differs from *L. plicatile* by the thickness

and colour of the thallus. *Leptogium ferax* differs in the width of the lobules and ecology. It could be confused with *L. subtorulosum* (Nyl. ex Stizenb.) Degel., but this has cylindrical and at least partially distinctly corticated, isidiate lobules, and is usually calcicolous.

Habitat and distribution. – The examined specimen was found growing in small crevices of siliceous rock, at an altitude of 1880 m a.s.l., with *Pyrenocarpon thelostomum* (Ach. ex J. Harriman) Coppins & Aptroot, in periodically to sporadically submerged freshwater habitats. Additional information on its European distribution is based on an old collection from western Romania, and recent contributions from the Carpathians in southern Poland and the Giant Mountains in the Czech Republic (Thüs & Schultz 2009). There is only one single record known from mainland Portugal (van den Boom & Jansen 2002) that is indicated below.

Material examined. – MAINLAND PORTUGAL, Beira Alta, Serra da Estrela, 1.2 km NE of top, Rua dos Mercadores, near Cântaro Magro, deep valley, UTM 29TPE189652, 1880 m a.s.l., NW steep granite, near second source, 18 Jul 1995, leg. P. v. d. Boom, (hb. P. v. d. Boom 17281).

Leptogium saturninum (Dicks.) Nyl. – Figs. 3, 6, 29.

Synonym. – *Leptogium myochroum* (Ehrh.) Nyl.

Description. – Thallus foliose, smooth or slightly striated, dark brown to black, becoming swollen, olive-green translucent, when wet; lobules (5)6–10 mm wide; isidia black, small, granular or cylindrical, simple or, rarely, coralloid, darker than the thallus, initially marginal but may eventually cover the entire thallus; thallus section (200)250–260 μm ; lower surface with numerous white to creamy-white hairs, simple or branched, (100) 150–250 μm long, composed mainly of 10–22 \times 3–5 μm cylindrical cells, more or less globose at the base. – *Nostoc* cells elliptical to cylindrical 5–6 \times 3–4 μm , arranged in chains of 9–11 cells. – Apothecia not seen.

Observations. – This taxon resembles an acyphellate *Sticta fuliginosa*. *Leptogium hibernicum* is distinguished by the morphology of tomentum cells. *Leptogium burnetiae* Dodge has not been found in Portugal to date, but was included in this key due to the fact that it can be difficult to separate from undeveloped specimens of *L. saturninum*. *Leptogium burnetiae* is characterized by a foliose, shiny and slightly swollen, translucent thallus; surface blue-grey when dry, becoming dark olive-green when wet; isidia somewhat darker than the thallus, cylindrical to coralloid; tomentum usually white. It is widely distributed in the tropics entering the temperate region. In Europe, it is known from Russia, France and Spain (Nimis 1993, Aragón & Otálora 2004). The voucher specimen LISU 200494 shows transitional characters between *L. saturninum* and *L. burnetiae*: thallus blue-brown 5–10 mm wide; isidia coralloid, striated, bluish at the base and brown at tips, with an apical depression; thallus section 200 μm ; *Nostoc* cells 6–5 \times 3–5 μm in diameter, in chains of 8–11 cells; tomental hairs 100–200 μm long,

with cylindrical cells. This specimen was included under *L. saturninum* due to its lobule width, thallus thickness, and size and number of *Nostoc* cells. *Leptogium saturninum* can also be confused with *L. furfuraceum*, but the latter species presents a wrinkled and ridged thallus. It is also similar to *L. hildenbrandii*, but this species is not isidiate and has not been found in Portugal to date.

Habitat and distribution. – Corticolous in old forests. It is known from Central and North America, Europe, Macaronesia, Asia and Africa (Gilbert & Jørgensen 2009). In mainland Portugal, besides the provinces mentioned below, it was found in Estremadura, Beira Litoral (Colmeiro 1889), Minho, Ribatejo (Jones 1999, 2002) and Baixo Alentejo (Jones 2002). First record for the province of Beira Alta.

Material examined. – MAINLAND PORTUGAL, Algarve, in village Vilarinhos, *Ficus*, Aug 1876, *leg.* M. P. Jones (BM 762885); Loulé, Vale de Boa Hora, near old house, *Ficus*, Mar 1977, *leg.* M. P. Jones (BM 762886); top of Vale de Covo, on road from Querenca to Barranco do Velho, 300 m a.s.l., *Ficus*, Aug 1973, *leg.* M. P. Jones (BM 762887); Alto Alentejo, prox. de Évora, *Fraxinus* sp., 24 Dec 1953, *leg.* C. N. Tavares (LISU 5431); PNSSM, Azinhal de Porto da Espada, 600 m a.s.l., *Quercus ilex*, 11 Nov 1994, *leg.* P. Carvalho (LISU 8c); 3 km S. of Arraiolos, open grove, 350 m a.s.l., *Olea*, Aug 1983, *leg.* M. P. Jones (BM 762883); Beira Alta, Serra da Estrela Seia, árvores, 17 Nov 1947, *leg.* C. N. Tavares (LISU 5089); Trás-os-Montes e Alto Douro, in valley leading to Romeu, Mirandela, PF69, 450 m a.s.l., on *Olea*, May 1991, *leg.* M. P. Jones (LISU 200494); E Braganca, fondo de valle, 29TPG738299 en *Alnus glutinosa*, 8 Sep 2006, *leg.* G. Paz-Bermúdez (SANT 11045).

Additional material examined. – SPAIN, Lugo, Caurel, Moreda, 29TPM5521, 700 m a.s.l., *Betula pendula*, 13 Sep 89, *leg.* J. Álvarez (SANT 7358, 7461); Málaga, Serranía de Ronda, 30SUF06, *Olea*, May 2001, *leg.* M. P. Jones (LISU 1581); Oviedo, Abhäge des Cordal de la Mesa N unter dem Puerto de Ventana, 1340 m a.s.l., Fagetum mit einzelnen Silikatblöcken, Sep 1980, *leg.* J. Hafellener (GZU 140–83); Salamanca, Vallejera, on the road to El Barco de Ávila, 1000 m a.s.l., *Quercus pyrenaica*, Aug 1984, *leg.* M. P. Jones (BM 762884).

***Leptogium schraderi* (Bernh.) Nyl.** – Figs. 2, 35.

Description. – Thallus brown, striated, wrinkled, gelatinous or rubbery when wet, with cylindrical young lobules or lobule margins; lobules 0.5–1.3 mm wide, the widest sometimes reaching 3 mm, usually grey-blue and flattened towards the base; isidia or verrucae striated and with flattened tips; upper and lower cortex paraplectenchymatous, usually brown, 5 µm thick, composed of a layer of cells that are isodiametric in cross section but irregular, puzzle-like, when observed from above; medullar zone lax, disappearing towards the center of the thallus. – *Nostoc* chains of 13–20 cells, situated near the cortex; thallus section 225 µm thick. – Apothecia approximately 0.5 mm in diameter; epithecium brown; hymenium hyaline, 130 µm high; hypothecium paraplectenchymatous, hyaline, 50–70 µm high; thalline exciple with the same characteristics of the thallus. – Ascospores hyaline, muriform to submuriform, 32.5–37.5 × 15 µm.

Observations. – Voucher specimens LISU 484, 485 should correspond to the records of Tavares (1944) for the provinces of Beira Litoral and Es-

tremadura. Although this author missed to indicate a voucher code, the remaining data, namely location, ecology, collector, year and herbarium agree with his description.

Habitat and distribution. – Found on exposed crevices and earth banks in the vicinity of schist and limestone outcrops. It is known from Europe and North America (Gilbert & Jørgensen 2009) always in open situations. In mainland Portugal, besides the provinces mentioned below, it was found in Alto Alentejo (Carvalho 1997). First record for the Portuguese provinces of Baixo Alentejo and Trás-os-Montes e Alto Douro.

Material examined. – MAINLAND PORTUGAL, Algarve, Portimão, praia da Rocha, na terra, 6 Apr 1917, *leg.* G. Sampaio (PO 1437); Baixo Alentejo, Sra da Arrabida, Gariques, S exponierter Kalkfels, 8 Aug 1971, *leg.* A. Hessen 217751 & D. Schäfer (BM 762878, GZU 38-P3); Beira Litoral, Serra da Lousã, Sra. da Piedade, sobre os musgos cobrindo o xisto argiloso, 3 Sep 1943, *leg.* C. N. Tavares (LISU 484); Estremadura, entre o Grafanil e a Póvoa de S. Adrião (arred. de Lisboa), sobre a terra musgosa, 25 Apr 1943, *leg.* C. N. Tavares (LISU 485); Sintra, Seteais, sobre um muro musgoso, 19 Mar 1944, *leg.* C. N. Tavares (LISU 5286); Trás-os-Montes e Alto Douro, Vila Nova de Foz Côa, Vale do Forno, Fenda larga em xisto, 4 May 2011, *leg.* J. Marques (PO 9025-L).

***Leptogium subtile* (Schrad.) Torss. – Fig. 36.**

Synonyms. – *Leptogium minutissimum* (Flörke) Fr., nom. illeg.

Description. – **Thallus** foliose, minute, fragile; upper surface light to dark brown, smooth; lobules cylindrical, very narrow, 0.2–0.5 mm wide, with upright cylindrical to flattened extensions; upper and lower cortex well delimited, of isodiametric cells; thallus in section 50 µm high, paraplectenchymatous. – **Apothecia** 0.2–0.4 mm in diameter, slightly globose; disc orange, flat to concave; thalline exciple with cylindrical extensions. – **Ascospores** ellipsoid, hyaline, 5-septate to muriform, 20–25 × 9–10 µm.

Observations. – Could be mistaken for *L. tenuissimum* which lacks cylindrical extensions, has wider lobules, up to 2 mm and a different ecology. It has also been confused with *L. teretiusculum* which is isidiate and usually sterile.

Habitat and distribution. – Corticolous, the two specimens included here were found growing on *Olea*. It is known from Europe, Central and North America, reaching the Polar Circle (Gilbert & Jørgensen 2009). In Portugal it was recorded in the provinces of Trás-os-Montes e Alto Douro (Sampaio 1918) and Estremadura (Colmeiro 1889, Jones 2002). First record for the Portuguese province of the Algarve.

Material examined. – MAINLAND PORTUGAL, Algarve, Riverbank, Ribeira de Aljibre, NB8217, *Olea*, Mar 2003, *leg.* M. P. Jones (LISU 200498); Estremadura, Arredores de Setúbal, Esteyal, *Olea*, 26 Sep 1943, *leg.* C. N. Tavares (LISU 492).

***Leptogium tenuissimum* (Dicks.) Körb. – Fig. 37.**

Description. – **Thallus** foliose, small, matt blue-grey, smooth to finely striated; lobules flat 0.5–2(5) mm wide, with fimbriate or incised margins,

naked; thallus section paraplectenchymatous, 50–80(140) μm thick, with somewhat thicker cell walls than cortex cells; upper and lower cortex composed of well-differentiated cells 4–6 μm in diameter. – *Apothecia* numerous, 0.3–1(1.5) mm in diameter; disc orange-brown, flat to concave; thalline exciple slightly rugose, sometimes with small lobules; epithecium brown; hypothecium colourless; hymenium hyaline, 75 μm high. – *Ascospores* hyaline ellipsoid, submuriform with one longitudinal septa to muriform with 3–5 transverse septa, 16–28(30) \times 7.5–10(12) μm .

Observations. – One of the specimens (PO 542) identified as *L. subtile*, differs primarily in lobule width.

Habitat and distribution. – On granitic rocks, soil and mossy ground. It extends throughout Europe, Scandinavia, Arctic, North and South America (Gilbert & Jørgensen 2009). Rare in Portugal, it is known from the provinces of Trás-os-Montes e Alto Douro (Sampaio 1916) and Beira Alta (van den Boom & Giralt 1999).

Material examined. – MAINLAND PORTUGAL, Trás-os-Montes e Alto Douro, Bragança, 10 Sep 1915, *leg.* G. Sampaio (PO 542).

Additional material examined. – SPAIN, A Coruña, Pontedeume, Caaveiro, 26THJ7607, 90 m a.s.l., en rocas graníticas del suelo próximas al Monasterio, 19 Apr 85, *leg.* M. E. López de Silanes (SANT 2295).

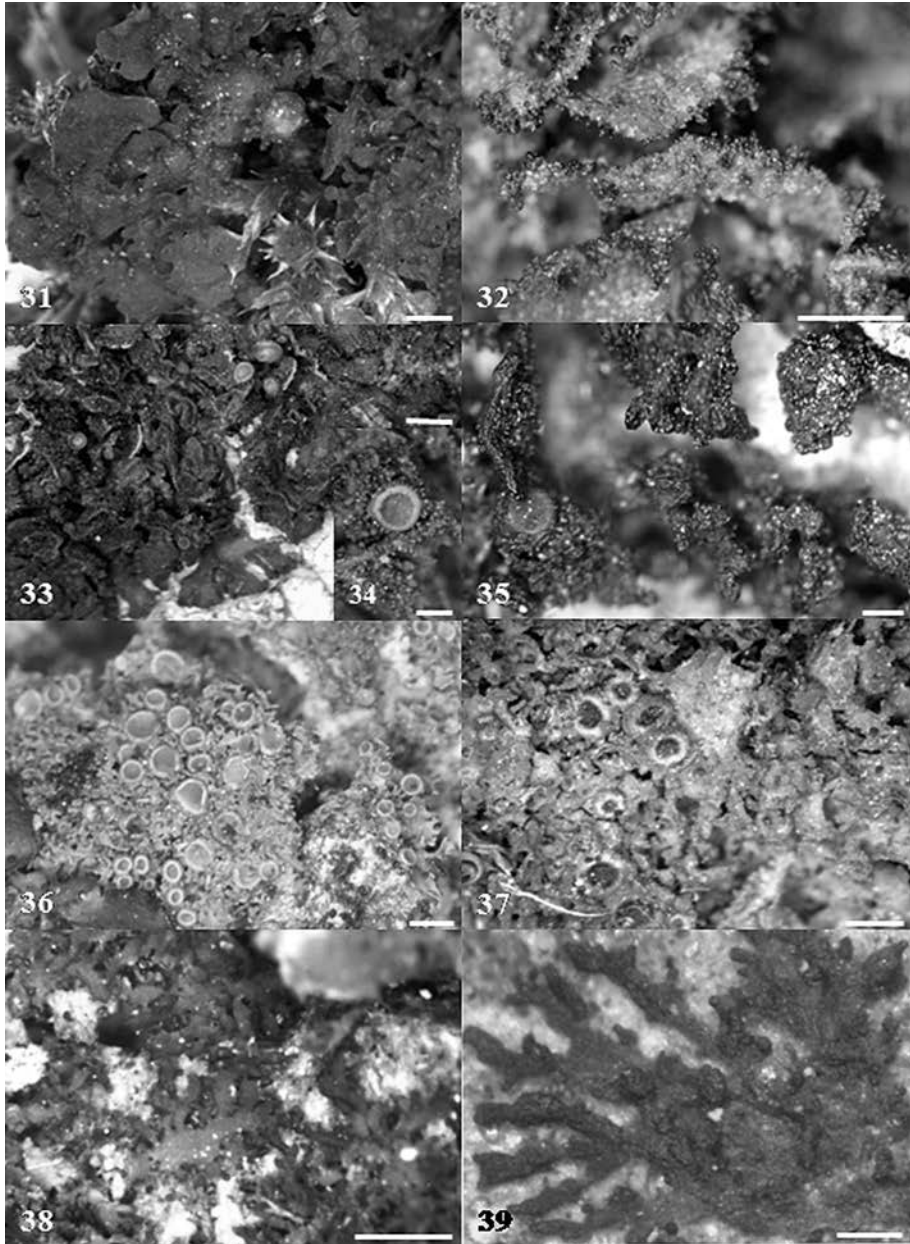
Leptogium teretiusculum (Flörke) Arnold – Figs. 38, 39.

Synonyms. – *Leptogium microscopicum* Nyl.

Description. – Thallus very small, 1–2 cm, bluish-grey or brownish grey, sometimes very dark brown, smooth, basal lobules flattened, 0.1–0.2(0.3) mm wide; lobules branched towards apices, developing long and narrow extensions, 0.05–0.17 mm wide, flat or \pm cylindrical, with upright darker tips; isidia numerous, 30 μm wide, darker than the lobules, granular to papillary, narrowing or not at the base; thallus section paraplectenchymatous 37–62.5 μm thick; upper and lower cortex paraplectenchymatous, yellowish brown, composed of one or more layers of 6–8 μm in diameter cells in the tips of the isidia or of small lobules. – *Nostoc* cells frequently angular, occasionally globose or elliptical, 5–8 \times 7–8 μm , in clusters or in short chains of 4–6(8) cells. – *Apothecia* rare, though in some specimens isolated and immature apothecia are present.

Observations. – Examination under the microscope revealed the occurrence of filamentose algae on the thallus surface of some specimens, penetrating through the interior. No morphological or anatomical differences were observed between the corticolous and the saxicolous specimens. Further comments under *L. microphylloides*.

Habitat and distribution. – Usually corticolous among mosses, it can also grow directly on siliceous rocks. It is known from Europe, Macaronesia, North and Central America and Asia (Gilbert & Jørgensen 2009). Fre-



Figs. 31–39. *Leptogium* species with lobules smaller than 5 mm. **31.** *L. ferax*. **32.** *L. magnussonii*. **33, 34.** *L. plicatile*. **35.** *L. schraderi*. **36.** *L. subtile*. **37.** *L. tenuissimum*. **38, 39.** *L. tertiusculum*. Bars: 33. 2 mm. 31, 32. 1 mm. 34, 35, 36, 37, 38. 0.5 mm. 39. 2 mm.

quent and abundant in Portugal. It has been cited for the provinces of Alto Alentejo (Jones 1999, van den Boom & Giralt 1999) and Ribatejo (Jones 1999), in addition to the provinces mentioned below.

Material examined. – MAINLAND PORTUGAL, Algarve, 1 km W of Monchique on the road to Foia, 500 m a.s.l., NB3829, Mar 1996, *Olea*, leg. M. P. Jones (LISU 200502); Serra de Monchique, Caldas, na Mata, 26 Feb 1946, sobre as rochas dos taludes, leg. C. N. Tavares (LISU 1471); Baixo Alentejo, 3 km W of Moura, PC3425, 500 m a.s.l., *Olea*, Mar 1976, leg. M. P. Jones (LISU 200500); Mina da Somincor, Monte Novo, *Quercus ilex*, 9 Jun 2000, leg. P. Carvalho, M. P. Jones & C. Branquinho (LISU S1000); Beira Alta, Serra da Estrela, S of Manteigas, ENE of top, Albarcas, near Albergaria, 29TPE202652, 1420 m a.s.l., mature *Quercus pyrenaica* on N slope, 18 Jul 1995, leg. P. v. d. Boom, (hb. P. v. d. Boom 17264); Beira Litoral, Curia, 150 m a.s.l., ad cortices *Eucalypti globuli*, 150 m a.s.l., 16 Aug 1966, Tavares: Lichenes Lusitaniae selecti exsiccati n° 233, (GZU PO-P1); Serra da Lousã, a Leste da Quinta de Alcofeira, à beira dum caminho, sobre as cascas de *Olea europaea*, 13 Aug 1943, leg. C. N. Tavares (LISU 494); Serra do Bussaco, Cruz Alta, *Quercus suber*, 15 Jun 1944, leg. C. N. Tavares (LISU 491); Estremadura, 1 km SW of Pedrógão, 250 m a.s.l., *Olea*, Oct 1981, leg. M. P. Jones (BM 762877); entre Birre e Areia, *Pinus halepensis*, 8 May 1966, leg. C. N. Tavares. (LISU 6994A); Serra de Monsanto, em face ao Estádio Nacional, *Olea*, Dec 1943, leg. C. N. Tavares (LISU 493); Minho, Sá, Anho-Bô, 17 Nov 1920, leg. G. Sampaio (PO 8339); Ponte de Lima, Sá, granito, 13 Nov 1920, leg. G. Sampaio (PO 2458); Trás-os-Montes e Alto Douro, Bragança, 29TPG799245, 955 m a.s.l., rocas básicas, anfíbolitas, 6 Sep 2006, leg. G. Figueras & E. Llop (BCN 15252).

Additional material examined. – SPAIN, Ciudad Real, Fuencaliente, Río Valmayor 30SUH9454, 780 m a.s.l., on *Quercus ilex* subsp. *ballota*, 22 Jan 1998, leg. F. J. Sarrión (GZU 03-99); A Coruña, Pontedeume, Caaveiro, 29TNJ7507, 40 m a.s.l., *Fraxinus excelsior*, Jul 1986, leg. R. Carballal & M. E. López de Silanes (SANT 2296); Lugo, A Fonsagrada, San Pedro, 29TPN5679, sobre tierra en cuarcitas, 19 Jul 1991, leg. C. P. Valcárcel (SANT 7863); Ourense, Sierra de invernoiro, cerca de Ribeira Grande, 29TPG4165, 900 m a.s.l., sobre viejos troncos de *Quercus pyrenaica*, 1 Jun 1990, leg. R. Carballal (SANT 7676); Oviedo, desfiladero río Ponga N von Beleño, Consejo de Ponga, S von Cangas de Onis, 300 m a.s.l., a) Silikatfelswände in Schlucht, b) besonnte Blöcke ober der Schlucht, 2 Sep 1980, leg. J. Hafellner (GZU 140-83); Tenerife, Foot of Monte de las Mercedes, 500 m a.s.l., *Cupressus*, 17 Apr 1978, leg. P. Topham (BM 762876).

Excluded taxa

Leptogium azureum (Sw. Ex Ach.) Mont.

Synonyms. – *Leptogium tremelloides* (L. fil.) S. F. Gray, nom illeg.

Observations. – Species cited by Coutinho (1916) from the province of Estremadura and by Tavares (1950 b) in the province of Minho. None of the examined herbarium specimens were found to correspond to these specimens. However, two voucher specimens (GZU PO-P1, WB 762923), both from n° 87 in Lichenes Lusitaniae Selecti Exsiccati (Tavares 1956), previously identified as *Leptogium azureum*, were reidentified as *L. cochleatum*. No fresh material was found.

Habitat and distribution. – View comments under *Leptogium cochleatum*. Jørgensen & James (1983) indicated its absence in Europe and later on Aragón *et al.* (2004) cited it from the Spanish province of Cádiz.

***Leptogium caesium* Vain.**

Observations. – Most specimens previously identified as *L. caesium*, were reidentified as *L. cyanescens*, sometimes considered a synonym of *L. caesium* (Clauzade & Roux 1985). Tavares (1941 b) cited *L. caesium* from Serra da Arrábida but did not indicate any voucher specimen. Therefore, it was not possible to confirm the identification of the corresponding species.

***Leptogium chloromelum* (Ach.) Nyl.**

Observations. – Species cited by Sampaio (1917) for Póvoa de Lanhoso in the province of Minho, without indicating a voucher specimen. Specimen PO198 is likely to be the one used by Sampaio, since both agree in date, location and collector. This specimen was reidentified as *L. hibernicum*. Currently, it is known only from the American continent (Jørgensen & Nash III 2004). It was cited for the Portuguese province of Estremadura (Coutinho 1916, Tavares 1939) also without indication of voucher specimens, but in this case, not matching any of the studied specimens. Considering the known distribution of this taxon, those records were most likely a result of misidentification.

***Leptogium hildenbrandii* (Garov.) Nyl.**

Observations. – This species was cited by Tavares (1950a, 1950b) for Serra do Gerês. In its description of the specimen the author states that the thallus is ± densely isidiate. This observation excludes *L. hildenbrandii*, since this is a non-isidiate species. The Portuguese specimens in exsiccata n° 152 by Tavares (1962) from different herbaria (GZU Inv. n° PO-P1 and PO 5235) were revised and are here regarded as *L. furfuraceum*. Records of *L. hildenbrandii* by Tavares (1950 a, 1950 b) are therefore considered to be erroneous. Colmeiro (1889) cited this taxon for Porto and Sampaio (1922) did the same for Moncorvo, none of them indicating voucher specimens. However, the latter agrees with specimen PO 2555 in location, collector, and belongs to the author's personal collection. This specimen was also reidentified as *L. furfuraceum*. The westernmost records of this species in Europe are from the east of Spain, in the provinces of Girona, Lleida (Gómez-Bolea 1985), Castellón and Huesca (Aragón *et al.* 2005). Therefore it is quite possible that this species is not present in mainland Portugal.

Material examined. – Lichenes Pyrenaei, Collegit R. Spruce, Churchill Babington 1996, (BM 762892); SPAIN, Huesca, Ordesa, National Park, Jul 1975, *leg.* S. Davey (BM 762893); ITALY, Vercelli, Circa Riva di Valsesia in vicin. Mtis. Rosa ad *Fraxinus* 1856, Rabenhorst, Lichenes europaei, 221, *leg.* A. Abbé Carestia (BM 762891).

***Leptogium intermedium* (Arnold) Arnold**

Observations. – The voucher specimen BCN 15252 (Paz-Bermúdez *et al.* 2009) includes two specimens of the genus *Leptogium*. One of them is, as

indicated by the label, an undeveloped specimen of *L. teretiusculum* but the other specimen resembles a young thallus of *L. palmatum*. Therefore the presence of *L. intermedium* in Portugal could not be confirmed.

***Leptogium microphyloides* Nyl.**

Observations. – This is a very misunderstood species, characterized by a poorly developed cortex and *Nostoc* cells arranged in chains (P. M. Jørgensen, personal communication). Some authors rely on isidia morphology as a diagnostic character for *L. microphyloides*, but there is considerable variation regarding this character within the same individual specimen. The specimen LISU 472, previously identified as *L. microphyloides*, was revised by P. M. Jørgensen in 2006 and then included under the *L. plicatile* complex. Jørgensen & Tønsberg (1999) had already indicated *L. microphyloides* as a corticolous taxon of the *L. plicatile* complex. Tavares (1949) cited this species for the provinces of Estremadura, a record that agrees with LISU 472, and Alto Alentejo, of which no specimen could be found. The absence of subsequent records supports the removal of this taxon from the list of Portuguese species, until further notice.

***Leptogium quadratum* (Lahm ex Körb.) Nyl.**

Observations. – This is a taxon cited by Gonçalo Sampaio for Bom Jesus do Monte in Braga (Sampaio 1916), and for the gardens of Queluz National Palace around Lisbon (Sampaio 1917). *L. quadratum* should be referred to as *Collema occultatum* Bagl. (Degelius 1954) but as voucher specimens could not be traced, their identity remains doubtful.

Key to *Leptogium* species in mainland Portugal

1. Thallus foliose, with a clearly visible tomentum (at magnifying glass). 2
- 1*. Thallus foliose to squamose, without any visible tomentum 12
2. Tomentum arachnoid (hairs ± parallel to thallus surface and loosely woven giving the surface a cotton-like appearance) 3
- 2*. Tomentum not arachnoid (hairs ± perpendicular to thallus surface and non-interlaced) 5
3. Lobules rounded, 3–6 mm wide *L. juressianum*
- 3*. Lobules elongated, 1–2(3) mm wide 4
4. Thallus isidiate *L. lichenoides*
- 4*. Thallus not isidiate *L. aragonii*
5. Thallus isidiate 6
- 5*. Thallus not isidiate 7
6. Thallus without striations; tomental hairs 20–55(80) µm long, of globose cells *L. burgessii*
- 6*. Thallus visibly striated; tomental hairs over 100 µm long, of cylindrical cells (*L. hildenbrandii*)

7. Tomental hairs very short, up to 1 mm long, on both sides of the thallus and exciple *L. resupinans*
- 7*. Tomental hairs at least 10 mm long, mostly on lower surface 8
8. Tomental hairs composed of globose cells 9
- 8*. Tomental hairs composed of cylindrical cells 10
9. Thallus striated and presenting scattered wrinkles; lobules 5–7 mm wide *L. hibernicum*
- 9*. Thallus smooth or weakly striated; lobules 3–5 mm wide .. *L. lacerooides*
10. Thallus wrinkled and plicate *L. furfuraceum*
- 10*. Thallus smooth or slightly striated 11
11. Thallus bluish-grey; isidia blue to slate-grey, cylindrical to coralloid (*L. burnetiae*)
- 11*. Thallus dark brown to black; Isidia black, granular, cylindrical and sometimes coralloid *L. saturninum*
12. Thallus not paraplectenchymatous in section 13
- 12*. Thallus paraplectenchymatous in section 28
13. Lobules more than 5 mm wide 14
- 13*. Lobules less than 5 mm wide 20
14. Thallus isidiate; without marginal extensions 15
- 14*. Thallus not isidiate; occasionally with marginal extensions or incisions 17
15. Thallus smooth, bluish to bluish-grey *L. cyanescens*
- 15*. Thallus distinctly wrinkled 16
16. Isidia very small, granular, darker than thallus *L. brebissonii*
- 16*. Isidia cylindrical to coralloid, the same colour as thallus *L. coralloideum*
17. Thallus smooth, brown; lobule apices corniculate *L. palmatum*
- 17*. Thallus bluish, bluish-green or lead-gray; lobule apices not corniculate 18
18. Thallus bluish-grey, smooth or finely striated, 70–100 µm thick; lobules up to 5 mm wide (*L. azureum*)
- 18*. Thallus finely striated or wrinkled, over 100 µm thick; lobules more than 5 mm wide 19
19. Thallus lead-grey, finely striated, 100–150 µm thick; lobules 5–8(10) mm wide *L. cochleatum*
- 19*. Thallus blue-green, markedly wrinkled, 125–200 µm thick (*L. corticola*)
20. Cortex paraplectenchymatous 21
- 20*. Cortex poorly defined, or of one or few layers of globose cells, or pseudo-cortex 26
21. Young lobules cylindrical, 0.5–1.5(3) mm wide; medulla very lax or hollow *L. schraderi*
- 21*. Lobules flat, (1)2–5 mm wide; medulla not lax 22
22. Thallus smooth to finely striated, very dark brown; isidia cylindrical, shiny, with darker tips *L. magnussonii*
- 22*. Thallus markedly striated, blue-grey to brown; isidiate or not 23
23. Lobules flat with cylindrical or coralloid isidia *L. lichenoides*

- 23*. Lobules without cylindrical isidia 24
24. Lobules semi-erect, with deeply devided to lacerate margins; apothecia rare *L. pulvinatum*
- 24*. Lobules flat or semi-erect, with smooth to crenate or finely divided margins; apothecia few to abundant 25
25. Thallus usually shiny; lobules semi-erect, margins with small flat simple or branched extension; apothecia abundant *L. gelatinosum*
- 25*. Thallus mate; lobules flat with smooth to crenate margins; without or with few apothecia, over pleurocarpuos mosses *L. aragonii*
26. Lobules long and narrow, 0.1–0.2(0.3) mm wide; thallus smooth (*L. microphyloides*) see *L. teretiusculum*
- 26*. Lobules more than 0.5 mm wide; thallus smooth to wrinkled..... 27
27. Thallus wrinkled, dark brown to black, 175–250 µm thick; isidia present; apothecia few or absent *L. plicatile* complex
- 27*. Thallus smooth, with fringed margins, 75–90 µm thick; isidia absent; apothecia numerous, sometimes with lobulate thalline exciple. *L. ferax*
28. Without isidia, granules or other projections 29
- 28*. With isidia, granules or cylindrical projections 31
29. Cortex paraplectenchymatous; thallus matt greyish-blue; lobules flat 0.5–2(5) mm, with finely fringed margins; apothecia concave, numerous, up to 1.5 mm wide, disk orange-brown..... *L. tenuissimum*
- 29*. Cortex of globose cells or pseudocortex 30
30. Thallus olive green; lobules 0.2–1.5 mm wide; apothecia rare.... *L. rivale*
- 30*. Thallus dark grey; lobules 1–2.5 mm wide; apothecia numerous ... *L. ferax*
31. Thallus matt greyish-blue; lobules flat 0.5–2(5) mm, with finely fringed margins; apothecia concave, numerous, up to 1.5 mm wide, disk orange-brown *L. tenuissimum*
- 31*. Lobules or squamules 0.3–0.5 mm wide, with granular margins; thallus 160–180 µm thick *L. biatorinum*
- 31*. Lobules 0.1–0.3 mm wide; thallus less than 100 µm thick 32
32. With cylindrical or flattened projections from thallus and thalline exciple; isidia absent; apothecia globose, frequent..... *L. subtile*
- 32*. Without cylindrical projections but with narrow and ± cylindrical ascending lobes; isidia numerous; apothecia rare
..... *L. teretiusculum* (see *L. microphyloides*)

Discussion

The only currently known location of *Leptogium laceroides* in Europe is in mainland Portugal. Fertile specimens of *Leptogium brebissonii*, *L. palmatum* and *L. teretiusculum* are very rarely found in Europe but common amongst the Portuguese material or otherwise, particularly in the case of *L. teretiusculum*, with few immature apothecia. The presence of apothecia is also rare or occasional in the European material of *L. plicatile* complex and *L. schraderi*, while a large amount of the examined Portuguese specimens are well-fruited.

The only known references to *L. biatorinum*, *L. burgessii* and *L. juresianum* for the Iberian Peninsula come from Portugal. *Leptogium azureum*, *L. burnetiae*, *L. hildenbrandii*, *L. massiliense*, *L. microphylloides* and *L. turgidum* were, on the other hand, cited for Spain and have not been found in Portuguese territory.

In Portugal, *L. brebissonii*, *L. burgessii*, *L. hibernicum*, *L. juresianum*, *L. saturninum* and *L. coralloideum* colonize the bark of broad-leaved trees, usually in mature or only slightly disturbed woodlands, while *L. furfuraceum*, *L. laceroides*, *L. magnussonii* and *L. subtile* were found growing on old olive trees, often associated with bryophytes. Disruption of such habitats is likely to have a strong impact on the abundance of these species, some of them with already declining populations.

The following taxa are here considered doubtful to the Portuguese flora: *L. azureum*, *L. caesium*, *L. chloromelum*, *L. hildenbrandii*, *L. intermedium* and *L. microphylloides*.

Acknowledgements

The authors would like to thank the curators and respective institutions of several herbaria that sent specimens on loan, both official (BCN, BM, COI, G, GZU, LISU, PO and SANT) and personal (Herbarium P. v. d. Boom). The authors are especially indebted to Dr. Elisa Folhadela, curator of the herbarium of Porto, for all the help; and to Dr. Per M. Jørgensen for all the relevant information provided, the revision of the specimen LISU 472 as well as helpful comments and suggestions on the manuscript. This study was financially supported by DGI and FEDER through Flora Liquenológica Ibérica projects (CGL2004-04795-C04-03/BOS and CGL2007-66734-C03-03). JM is currently funded by Fundação para a Ciência e Tecnologia (FCT) through grant SFRH/BD/42248/2007.

References

- Aragón G., Otálora M. A. G. (2004) Ecological and chorological novelties of the genus *Leptogium* in the Iberian Peninsula. *Nova Hedwigia* **78**: 353–366.
- Aragón G., Martínez I., Otálora M. A. G. (2004) New data on the distribution of *Leptogium azureum* (Swartz) Mont. *The Lichenologist* **36**: 345–347.
- Aragón G., Otálora M. A. G., Martínez I. (2005) New data on the *Leptogium* (lichenized ascomycetes) in the Iberian Peninsula. *Nova Hedwigia* **80**: 199–226.
- Arvidsson L. (1984) Two new records of *Leptogium ferax*. *The Lichenologist* **16**: 91–92.
- Awasthi D. D., Akhtar P. (1977) The genus *Leptogium* (sect. *Mallotium*) in India. *Norwegian Journal of Botany* **24**: 49–71.
- Awasthi D. D., Akhtar P. (1979) The lichen genus *Leptogium* (sect. *Leptogium*, *Leptogiopsis* and *Homodium*) in India. *Geophytology* **8**: 189–204.
- Brodo I. M., Sharnoff S. D., Sharnoff S. (2001) *Lichens of North America*. Yale University Press, New Haven & London.
- Carballal R., López de Silanes M. E., Bahillo L., Álvarez J. (1995) Recopilación bibliográfica de citas líquénicas de Galicia (1851–1993). *Nova Acta Científica Compostelana (Biología)* **5**: 49–134.
- Carvalho P. (1997) Flora líquénica do Parque Natural da Serra de S. Mamede. *Portugaliae Acta Biologica (série B)* **97**: 57–95.

- Carvalho P. (1998) Contribution to the lichen flora of Portugal: Lichens from Serra de S. Mamede Natural Park. *Sauteria* **9**: 103–109.
- Carvalho P., Jones M. P. (1997) New and interesting lichens from Portugal. *Cryptogamie, Bryologie, Lichénologie* **18**: 291–294.
- Carvalho P., Figueira R., Jones M. P., Sérgio C., Sim-Sim M. (2002) Biodiversidade da vegetação epifítica liquénica no litoral alentejano. Area de Sines. *Portugaliae Acta Biologica* **20**: 225–248.
- Clauzade G., Roux C. (1985) *Likenoj de Okcidenta Europo: Ilustrita Determinlibro*. Société Botanique du Centre-Ouest, Royan.
- Colmeiro M. (1889) *Enumeracion y revision de las plantas de la península Hispano-Lusitana y Islas Baleares*, Madrid: 758–875.
- Coutinho A. X. P. (1916) *Lichenum Lusitanorum Herbarii Universitatis Olisiponensis Catalogus*. M. L. Torres, Lisboa.
- Degelius G. (1941) Lichens from the Azores, mainly collected by Dr. H. Persson. *Göteborgs Kungliga Vetenskaps-och Vitterhets-samhälles Handlingar, Sjätte Följden, ser. B* **1**: 1–46.
- Degelius G. (1954) The lichen genus *Collema* in Europe. *Symbolae Botanicae Upsalienses* **13**: 1–499.
- Galloway D. J. (1999) Notes on the lichen genus *Leptogium* (Collemales, Ascomycota) in New Zealand. *Nova Hedwigia* **69**: 317–355.
- Gilbert O. L., Jørgensen P. M. (2009) *Leptogium*. In: *The Lichens of Great Britain and Ireland* (eds. Smith C.W., Aptroot A., Coppins B. J., Fletcher A., Gilbert O. L., James P. W., Wolseley P. A.), The British Lichen Society, London: 541–551.
- Gómez-Bolea A. (1985) *Liquenes Epifitos en Catalunya*. PhD Thesis, University of Barcelona, Spain.
- Guttová A. (2000) Three *Leptogium* species new to central Europe. *The Lichenologist* **32**: 291–303.
- James P. W., Jørgensen P. M. (2009): *Epiphloea*. In: *The Lichens of Great Britain and Ireland* (eds. Smith C.W., Aptroot A., Coppins B. J., Fletcher A., Gilbert O. L., James P. W., Wolseley P. A.), The British Lichen Society, London: 395.
- Jones M. P. (1983) Epiphytic macrolichens of the Sines area, Alentejo, Portugal. *Revista de Biologia* **12**: 313–325.
- Jones M. P. (1999) Notes on the distribution and composition of epiphytic lichen communities with *Nephroma laevigatum* Ach. in Portugal. *Portugaliae Acta Biologica (série B)* **18**: 51–120.
- Jones M. P. (2002) Some information on the distribution of lichens in Portugal. *Portugaliae Acta Biologica* **20**: 121–224.
- Jørgensen P. M. (1973) On some *Leptogium* species with short *Mallotium* hairs. *Svensk Botanisk Tidskrift* **67**: 53–58.
- Jørgensen P. M. (1975) Contribution to a monograph of the *Mallotium*-hairy *Leptogium* species. *Herzogia* **3**: 433–460.
- Jørgensen P. M. (1977) *Leptogium*. In: *Bestimmungsschlüssel europäischer Flechten. Ergänzungsheft I* (eds. Poelt J., Vezda A.), J. Cramer, Vaduz: 151–155.
- Jørgensen P. M. (1994) Further notes on European taxa of the lichen genus *Leptogium*, with emphasis on the small species. *The Lichenologist* **26**: 1–29.
- Jørgensen P.M. (1997) Further notes on hairy *Leptogium* species. *Symbolae Botanicae Upsalienses* **32**: 113–130.
- Jørgensen, P. M. (2007) *Collemales*. In: *Nordic Lichen Flora* Vol. 3, *Cyanolichens* (eds. Ahti T., Jørgensen P. M., Kristinsson H., Moberg R., Søchting U., Thor G.), Nordic Lichen Society, Uddevalla: 14–42.
- Jørgensen P. M., James P. W. (1983) Studies on some *Leptogium* species of Western Europe. *The Lichenologist* **15**: 109–125.
- Jørgensen P. M. & Jones M. P. (2012) *Leptogium resupinans* Nyl. New to Europe from Portugal. *Herzogia* **25**: (in press).

- Jørgensen P. M., Nash III T. H. (2004) *Leptogium*. In: *Lichen Flora of the Greater Sonoran Desert Region* Vol. 2 (eds. Nash III T. H., Ryan B. D., Diederich P., Gries C., Bungartz F.), Lichens Unlimited, Tempe: 330–350.
- Jørgensen P. M., Tonsberg T. (1999) Notes on some small species of *Leptogium* from Pacific North America. *The Bryologist* **102**: 412–417.
- Lendemer J. C., Kocourková J., Knudsen K. (2008) Studies in lichens and lichenicolous fungi: Notes on some taxa from North America. *Mycotaxon* **105**: 379–386.
- Nimis P. L. (1993) *The lichens of Italy*. Museo Regionale di Scienze Naturali, Torino.
- Otálora M. A. G., Martínez I., Molina M. C., Aragón G., Lutzoni F. (2008) Phylogenetic relationships and taxonomy of the *Leptogium lichenoides* group (Collemataceae, Ascomycota) in Europe. *Taxon* **57**: 907–921.
- Otálora M. A. G., Aragón G., Molina M. C., Martínez I., Lutzoni F. (2010) Disentangling the *Collema-Leptogium* complex through a molecular phylogenetic study of the Collemataceae (Peltigerales, lichen-forming Ascomycota). *Mycologia* **102**: 279–290.
- Paz-Bermúdez G., López de Silanes M. E., Terrón A., Arroyo R., Atienza V., Brime S. F., Burgaz A. R., Carvalho P., Figueras G., Llop E., Marcos B., Pino-Bodas R., Prieto M., Rico V. J., Fernández-Salegui A. R., Serriñá E. (2009) Lichens and lichenicolous fungi in the Montesinho Natural Park, the Serra da Nogueira and the Ríó Sabor Valley (Portugal). *Cryptogamie, Mycologie* **30**: 279–303.
- Sampaio G. (1916) Líquenes novos para a flora portuguesa. *Brotéria, série botânica* **14**: 65–84.
- Sampaio G. (1917) Líquenes novos para a flora portuguesa: 2 & 3 serie. *Brotéria, série botânica* **15**: 12–29, 128–145.
- Sampaio G. (1918) Contribuições para o estudo dos líquenes Portugueses. *Annaes Scientificos da Academia Polytechnica do Porto* **13**: 24–38.
- Sampaio G. (1921) Novas contribuições para o estudo dos líquenes portugueses. *Brotéria, série botânica* **19**: 12–35.
- Sampaio G. (1922) Materiais para a liquenologia portuguesa. *Brotéria, série botânica* **20**: 147–163.
- Sierk H. A. (1964) The genus *Leptogium* in North America North of Mexico. *The Bryologist* **67**: 245–317.
- Swinscow T. D., Krog H. (1988) *Macrolichens of East Africa*. British Museum (Natural History), London.
- Tavares C. N. (1939) Notes lichénologiques I. *Bulletin de la Societé Portugaise des Sciences Naturelles* **13**: 53–60.
- Tavares C. N. (1941b) Notes lichénologiques II. *Bulletin de la Societé Portugaise des Sciences Naturelles* **13**: 157–167.
- Tavares C. N. (1944) Notes lichénologiques IV: Lichens nouveaux ou intéressants pour le Portugal. *Boletim da Sociedade Broteriana* **19**: 163–179.
- Tavares C. N. (1945) Líquenes da Serra da Estrêla (Contribucao para o seu estudo). *Brotéria: ciencias naturais* **14**: 14–60
- Tavares C. N. (1949) Notes lichenologiques VII. *Portugaliae Acta Biologica (série B) Julio Henriques*: 154–164.
- Tavares C. N. (1950a) Líquenes da Serra do Gerês. *Portugaliae Acta Biologica (série B)* **3**: 1–188.
- Tavares C. N. (1950b) Líquenes da Serra do Gerês: Catálogo. *Agronomia Lusitana* **12**: 123–163.
- Tavares C. N. (1956) *Lichenes Lusitaniae Selecti Exsiccati, Editi ab Instituto Botanico Universitatis Olistiponensis, Fasciculus IV*. Instituto Botânico, Lisboa.
- Tavares C. N. (1962) *Lichenes Lusitaniae Selecti Exsiccati, Editi ab Instituto Botanico Universitatis Olistiponensis, Fasciculus VII*. Instituto Botânico, Lisboa.
- Thüs H., Schultz M. (2009) *Fungi 1: Lichens*. In: *Freshwater Flora of Central Europe* 21 (eds. Büdel B., Gärtner G., Krienitz L., Verdonreisig H. R. P., Schagerl M.), Spektrum Akademischer Verlag, Heidelberg.

- van den Boom P. P. G. (2005) Contribution to the flora of Portugal, lichens and lichenicolous fungi IV. *Cryptogamie, Mycologie* **26**: 51–59.
- van den Boom P. P. G., Jansen J. (2002) Lichens in the upper belt of the Serra da Estrela (Portugal). *Österreichische Zeitschrift für Pilzkunde* **11**: 1–28.
- 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. (1999) Contribution to the flora of Portugal, lichens and lichenicolous fungi II. *Nova Hedwigia* **68**: 183–195.
- van den Boom P. P. G., Aptroot A., van der Knapp W. O. (1990) New and interesting lichen records from Portugal. *Nova Hedwigia* **50**: 463–472.
- Verdon D. (1992) *Leptogium*. In: *Flora of Australia* Vol. 54 (ed. McCarthy, P. M.), ABRIS/CSIRO, Melbourne: 173–192.

(Manuscript accepted 8 May 2012; Corresponding Editor: I. Krisai-Greilhuber)

ZOBODAT - www.zobodat.at

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Sydowia](#)

Jahr/Year: 2012

Band/Volume: [64](#)

Autor(en)/Author(s): Lopez de Silanes M. E., Paz-Bermudez Graciela, Carballal R., Marques J.

Artikel/Article: [The genus Leptogium \(Collemataceae, Ascomycotina\) in mainland Portugal. 67-102](#)