



A new species and new records of *Leptogium* (Ach.) Gray (*Collema*taeae, *Peltigerales*) from Rio Grande do Sul State with an identification key for the genus

MARCOS J. KITAURA¹, NATÁLIA M. KOCH¹, FABIANE LUCHETA², MÁRCIA I. KÄFFER², JAIRO L. SCHMITT², JULIANA PEDROSO³, SUZANA A. MARTINS⁴, ANDRESSA S. RODRIGUES¹ and LUCIANA S. CANÊZ¹

¹Laboratório de Evolução e Biologia Evolutiva, Programa de Pós-Graduação em Biologia Vegetal, Universidade Federal de Mato Grosso do Sul, Avenida Costa e Silva, s/n, 79070-900 Campo Grande, MS, Brazil

²Laboratório de Botânica, Programa de Pós-Graduação em Qualidade Ambiental, Universidade Feevale, Rodovia ERS 239, 2755, 93525-075 Novo Hamburgo, RS, Brazil

³Instituto de Ciências Biológicas, Universidade Federal do Rio Grande, Avenida Itália, Km 8, 96201-900 Rio Grande, RS, Brazil

⁴Museu de Ciências Naturais, Fundação Zoobotânica do Rio Grande do Sul, Rua Dr. Salvador França, 1427, 90690-000 Porto Alegre, RS, Brazil

Manuscript received on March 27, 2018; accepted for publication on July 24, 2018

How to cite: KITAURA MJ, KOCH NM, LUCHETA F, KÄFFER MI, SCHMITT JL, PEDROSO J, MARTINS SA, RODRIGUES AS AND CANÊZ LS. 2019. A new species and new records of *Leptogium* (Ach.) Gray (*Collema*taeae, *Peltigerales*) from Rio Grande do Sul State with an identification key for the genus. *An Acad Bras Cienc* 91: e20180313. DOI 10.1590/0001-3765201920180313.

Abstract: *Specimens* of *Leptogium* collected in ten localities from the State of *Rio Grande do Sul* were studied. Sixteen species were found of 28 records mentioned to the state, which represents around 57% of the *Leptogium* diversity known for *Rio Grande do Sul*. *Leptogium exaratum* is proposed as a new *species*. *Leptogium atlanticum*, *L. milligranum* and *L. vesiculosum* are reported for the first time to the state. The lectotype of *L. javanicum* is reported here and detailed descriptions are provided to the examined specimens. An identification key is showed with all the 28 mentioned species of *Leptogium*. It is the first published taxonomic key for *Leptogium* from *Rio Grande do Sul*, the State with the highest diversity of this genus in Brazil.

Key words: checklist, diversity, HAS herbarium, HURG herbarium, inflated apothecia.

INTRODUCTION

Leptogium (Ach.) Gray is a genus of jelly lichens that has been studied since Micheli (1729) and Dillenius (1741). Nowadays, the number of species is estimated between 70 (Lücking et al. 2017a) and 180 species (Otálora et al. 2014), but a taxonomical review of the genus is still necessary. *Leptogium*

is widely distributed in tropical regions (Sierk 1964) and was reported for the first time in Brazil by Eschweiler (1833), through of the species: *L. bullatum* (Ach.) Nyl., *L. rivulare* (Ach.) Mont. and *L. tremelloides* (L.f.) Gray.

Leptogium puiggarii Müll. Arg. and *L. dimorphum* Müll. Arg. were the first species described from Brazil and they were reported for the municipality of Apiaí, São Paulo in Müller Argoviensis (1879, 1881), respectively.

Correspondence to: Marcos Junji Kitaura
E-mail: junjimjk@gmail.com
ORCID: <http://orcid.org/0000-0002-2175-3533>

In Rio Grande do Sul, the first *Leptogium* species reported was *L. phyllocarpum* (Zahlbruckner 1908). Almost 20 years after, Malme (1924) mentioned to the state *L. cyanescens* var. *austroamericanum* Malme, *L. marginellum* (Sw.) Mont., *L. megapotamicum* Malme, *L. moluccanum* (Pers.) Vain., *L. phyllocarpum* (Pers.) Nyl., *L. pichneum* (Ach.) Malme, *L. puiggarii* Arg., *L. tremelloides* (L. f.) Gray, and *L. ulvaceum* (Pers.) Vain.

During the decades 1970-2000, a series of contributions was published about lichens from Rio Grande do Sul (Fleig 1988, 1995, Fleig and Grüniger 2000a, 2000b, Mazzitelli et al. 1999, Osorio 1981, 1985, Osorio and Fleig 1982, 1984a, b, Fleig 1985, 1987, 1988, 1989, 1990a, b, 1991, 1994, Osorio et al. 1981, 1983, 1997, Zanette et al. 1981); and posteriorly, all information published was compiled in a checklist by Spielmann (2006).

Furthermore, extensive ecological works with lichens have been developed by the team of Fundação Zoobotânica do Rio Grande do Sul, which required taxa identification (Lucheta and Martins 2014, Käffer et al. 2007, 2015, 2016, Koch et al. 2013, 2016) and new lichen species have been described each year (Kitaura and Marcelli 2012, Aptroot et al. 2014, 2016, Käffer et al. 2014, Kitaura et al. 2014, Feuerstein et al. 2016, Lücking et al. 2017).

This work aims to study the genus *Leptogium* from Rio Grande do Sul State mainly through the HAS and HURG herbaria materials, updating the checklist of the state. We also propose a new species, include two new citations and the first identification key to the genus *Leptogium* for Rio Grande do Sul.

MATERIALS AND METHODS

The specimens were collected during lichenological field works in ten municipalities in the State of Rio Grande do Sul: Campo Bom, Caraá, Maquiné, Parobé, Pelotas, Rio Grande, Rolante, Santo Antônio da Patrulha, São Leopoldo and Taquara.

Forest fragments, urban and rural areas constitute the main landscape of these municipalities, with average altitude varying from 6 to 130 m and climate classified as subtropical humid, Cfa type according to Köppen's classification (Alvares et al. 2013). The original vegetation in most of the municipalities is characterized by semideciduous forests (Anschau 2016) - Campo Bom, Taquara, São Leopoldo, Parobé, Rolante, and Santo Antônio da Patrulha, while some municipalities are composed of Atlantic rainforests, with areas of semideciduous and mixed Araucaria forests (Sevegnani and Baptista 1996) - Caraá and Maquiné; and others are mainly represented by restinga forests and grasslands (Burger and Ramos 2007) - Rio Grande and Pelotas.

Most of the collected specimens are deposited in HAS herbarium and some of them in the HURG and the CGMS herbaria. All studied material was described according to the protocol of Kitaura (2012) and Kitaura et al. (2015).

The term duplicate of lectotype was used to design a true piece of the lectotype specimen, according to Kitaura et al. (2013).

Neither the type material nor the material reported to Rio Grande do Sul of *Leptogium coralloideum* (Meyen and Flot.) Vain., *L. diaphanum* (Sw.) Mont., *L. moluccanum*, *L. pichneum*, *L. puiggarii* and *L. ulvaceum* were revised during the current study, but the original descriptions (protologues) were used to prepare the identification key.

Lichen photographs were taken with a Scanjet 5590 and with a Canon RebelT3i coupled on an Olympus Sz stereomicroscopy and on an Olympus CX22LED microscopy.

RESULTS

All *Leptogium* species names previously reported were grouped in a list, along with the other species found by the authors. The type specimens from

more than 70% of the found species were revised. Most of the mentioned type species was collected originally in tropical regions and all names were considered as good species, except for *Leptogium tremelloides*.

One new species (*L. exaratum*) and three new records including *L. atlanticum*, *L. milligranum* and *L. vesiculosum* to Rio Grande do Sul State were found from revised ca. 120 specimens deposited in HAS and HURG herbaria.

1. *Leptogium atlanticum* Marcelli and Kitaura, *The Bryologist*, 118 (1): 12. 2015. Type: Brazil, São Paulo, municipality of Peruíbe, Reserva Ecológica Juréia-Itatins. Núcleo Guaraúzinho, Sopé da Serra, Arpoador Beach, on rock, 27 Jul. 1993, M.P. Marcelli and O. Yano 23710 (holo-: SP!, iso-: COLO!, H!).

Thallus foliose, ca. 2 cm broad, gray to fluorescent light, opaque, bright to matt, bluish gray under stereomicroscope. Lobes 1.5–2.5 mm wide, agglomerated, adpressed, adnate, upper surface smooth to naked eye, irregular to longitudinal rugulose under 20× magnification; apices usually rounded, plane to ascending, smooth to ornamented; lateral margins irregular, ornamented, crispate; lower side bluish to yellowish, irregular rugulose under 20× magnification. Isidia absent. Lobules usually rounded, laminal and marginal, granular to claviform when young, simple to branched, 0.05–0.625 × 0.05–0.75 mm, firm, erect, concolorous with the thallus, grouped, frequent to abundant. Thallus attached by hapters, frequent, homogeneous. Rhizinae and hairs absent. Apothecia not observed. Anatomy: Thallus ca. 90 µm thick, isodiametric cell of the cortices 5.0 µm diam. Medulla with helicoidal columnar hyphae, 5–7 cells, frequent; cyanobacteria blue to green, frequent, elliptic cells, 3.0 × 2.5 µm diam., ca. 10 cells per filament; gelatinous matrix frequent, colorless. Pycnidia not observed.

Known distribution to RS: It is mentioned here by the first time and previously mentioned to Santa Catarina and São Paulo States.

Specimens examined: Brazil, Rio Grande do Sul: Rio Grande municipality, 01 Apr. 2016, J. Pedroso 245 (HURG); *Ibid.*, 07 Apr. 2016, J. Pedroso 392 (HURG); *Ibid.*, 08 Apr. 2016, J. Pedroso 249 *pr. min. p.* (HURG); *Ibid.*, Taquara municipality, Fazenda dos Búfalos, Bacia Hidrográfica do Rio Sinos (BHRS), area 5, riparian forest, 29°41'09.7"S, 50°47'54.2"W, 16 m alt. 13 May 2016, M.I. Käffer 1030 (HAS).

Notes: *Leptogium atlanticum* is characterized by the upper surface with irregular to longitudinal rugulose under 20× magnification, lobules usually rounded on the lamina and margin of the thallus (Figure 1a). Helicoidal columnar hyphae were observed in the material from Rio Grande do Sul as in the specimens studied by Kitaura et al. (2015).

This species is common in forests near to the coast in São Paulo State (Kitaura et al. 2015), but it is rare in Rio Grande do Sul. *Leptogium atlanticum* was commonly confused with *L. denticulatum*, but it does not have lobules on the thallus and the apothecia are ornamented by denticules (Kitaura et al. 2015).

2. *Leptogium austroamericanum* (Malme) C. W. Dodge, *Ann Missouri Bot Gard* 20: 419. 1933. ≡ *Leptogium cyanescens* var. *austroamericanum* Malme, *Ark Bot* 19(8): 21. 1924. Type: Brazil, Rio Grande do Sul State, Santo Ângelo prope Cachoeira [Agudo municipality], 3 Sep. 1819, G.O.A. Malme 950 B (lecto-: S!, designated in Benatti et al. 2013), duplicates of lecto-: S! Malme 950 A e D.

Thallus foliose, 2.0–10.0 cm broad, grayish to fluorescent light, opaque, matt, gray with yellowish regions under stereomicroscope. Lobes 2.0–5.0 mm wide, agglomerated, attached in points, irregular, upper surface smooth at naked eye, irregularly wrinkled under 20× magnification; apices rounded to irregular, ascending, smooth to ornamented; lateral margins ascending and

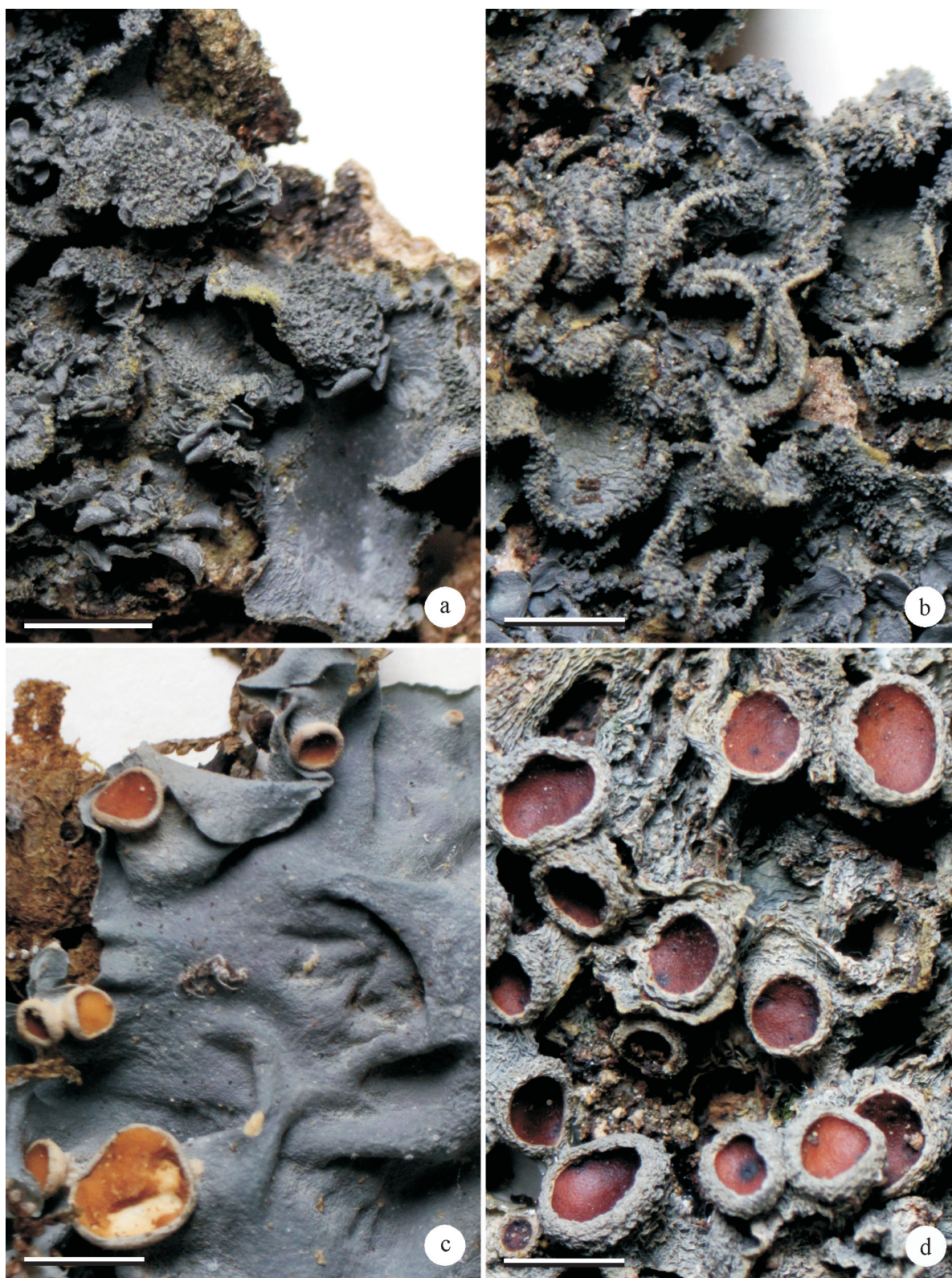


Figure 1 - *Leptogium* species (a) ornamented thallus of *Leptogium atlanticum*. (b) irregular wrinkles of *L. austroamericanum*. (c) pedicellate apothecia of *L. azureum*. (d) submarginal apothecia of *L. chloromelum*. Bars = 2.0 mm.

involute, usually ornamented, crispate; lower side grayish to yellowish, rugulose under 20× magnification. Isidia usually cylindrical, withered appearance, simple to irregular branched, laminal to marginal, 0.05–0.40 × 0.05–0.15 mm, firm to caducous, erect, grouped, abundant. Lobules rounded, usually simple, laminal and marginal, 0.3 × 0.5 mm, scarce, grouped. Thallus attached by hapters, frequent, homogeneous. Rhizinae and hairs absent. Apothecia not observed. Anatomy: Thallus ca. 100 µm thick, cortices of isodiametric cells, 5.0 µm diam. Medulla with columnar hyphae sinuous, ca. 5 cells, frequent; cyanobacteria green, frequent, 10–15 cells per filament, spherical cells 5.0 µm diam.; gelatinous matrix frequent, colorless and yellowish near the upper cortex. Pycnidia absent.

Known distribution to RS: See Spielmann (2006), including São Francisco de Paula (Käffer et al. 2007), Porto Alegre (Käffer et al. 2011) and Santana do Livramento (Käffer et al. 2015).

Specimens examined: Brazil, Rio Grande do Sul: Rio Grande municipality, Restinga APP6, 01 Apr. 2016. J. Pedroso 221, 224, 227, 230, 232, 243, 244, 247, 249 252 (HURG); *Ibid.*, 07 Apr. 2016 J. Pedroso 257, 259, 260, 261 (HURG); *Ibid.*, 19. Apr. 2016, J. Pedroso 391 (HURG); *Ibid.*, 22 Apr. 2016, J. Pedroso 411 (HURG); *Ibid.*, 05 May 2016, J. Pedroso 513 (HURG); *Ibid.*, Santo Antônio da Patrulha municipality, Sítio Estrada Arroio Grande, BHRS, area 6, 29° 46' 57.2"S, 50° 28' 25.5"W, 33 m alt., 24 Sep. 2016, M. I. Käffer 1032 (HAS).

Notes: *Leptogium austroamericanum* is characterized by the upper surface irregularly wrinkled under 20× magnification (Figure 1b) and isidia usually cylindrical with withered appearance.

This species is common in Rio Grande do Sul State, but the specimens were collected sterile.

3. *Leptogium azureum* (Sw.) Mont., *Historie Naturelle des Iles Canaries* 3: 129. 1840. ≡ *Lichen azureus* Sw., *Lichenographiae Suecicae Prodromus*: 137. 1798. Type: Jamaica, on montain, leg. O.

Swartz s/n (lecto-: H-ACH!, duplicate of lecto-: BM!, designated by Jørgensen and James (1983)).

Thallus foliose, ca. 6 cm broad, bluish gray under fluorescent light, opaque, matt, bluish under stereomicroscope. Lobes up to 8.5 mm wide, agglomerated, attached in points, adnate, upper surface smooth at naked eye and under 20× magnification; apices rounded, ascending, smooth; lateral margins smooth, irregular, undulated; lower side smooth, bluish. Isidia and lobules absent. Thallus attached by hapters, frequent, homogeneous distribution. Rhizinae and hairs absent. Apothecia up to 3.0 mm diam., submarginal to laminal, pedicellate, disc reddish, usually plane; margin cream, smooth; amphithecia beige, smooth; corona absent; pedicel 0.3–1.5 mm high, originated by the thallus, smooth. Anatomy: Thallus 50–60 µm thick, cortices with isodiametric cells, ca. 5.0 µm diam. Medulla with columnar hyphae straight, 2–3 cells, frequent; cyanobacteria blue, ca. 10 spherical cells per filaments, 2.5–5.0 µm diam.; gelatinous matrix scarce, colorless. Apothecia with hymenium 150–170 µm high; subhymenium ca. 25 µm thick, colorless; hypothecium ca. 25 µm thick, colorless, prosoplectenchymatous of irregular cells; parahymenium tissue continuous with hypothecium, prosoplectenchymatous; proper exciple absent; thalline exciple cortex with paraplectenchymatous cells, 45 µm (4 cells) at the apices, 25–40 µm (2–4 cells) at the mid-height, 50–65 µm (3–7 cells) thick at the base; basal paraplectenchymatous tissue 100–115 µm (8–10 cells) thick. Ascospores fusiform, 17.5–25.0 × 5.0–7.5 µm, apices acute, submuriform to muriform. Pycnidia not observed.

Known distribution to RS: See Spielmann (2006) and Käffer et al. (2007), including Porto Alegre (Käffer et al. 2011) and Santana do Livramento (Käffer et al. 2015).

Specimens examined: BRAZIL: RIO GRANDE DO SUL: Caraá, Localidade Fraga, APA Municipal. 03 Apr. 2008. S.A. Martins 2140 *pr. p.* (HAS -

sterile); *Ibid.*, 19 Jun. 2008. S.A. Martins 2210; *Ibid.*, Rio Grande municipality, Restinga APP6, 05 May 2016. J. Pedroso 528 (HURG).

Notes: *Leptogium azureum* is characterized by the smooth thallus and apothecia with pedicel originated from the thallus, with 0.3–1.5 mm high (Figure 1c).

This species has wide distribution (Aragón et al. 2004), but it is a complex of species and further studies are necessary.

4. *Leptogium brebissonii* Mont., Histoire Naturelle des Iles Canaries 3(2): 130. 1840. Type: Canary Islands, Cumbre de Erjos, P.B. Webb (lecto-: FI-WEBB!), designated by Galloway and Jørgensen (1995).

Description: See Galloway and Jørgensen (1995) and Kitaura (2012).

Known distribution to RS: See Spielmann (2006).

Notes: *Leptogium brebissonii* has ridged upper surface, isidia granular to short cylindrical, transversely septate ascospores, $57\text{--}75 \times 5\text{--}(7) \mu\text{m}$, 7–10 cells (Galloway and Jørgensen 1995, M.J. Kitaura, unpublished data).

5. *Leptogium chloromelum* (Sw.) Nyl., Mém Soc Nati Sci Cherbourg 5: 333. 1857. \equiv *Lichen chloromelus* Sw., Fl Ind Occid 3: 1892. 1806. Type: Jamaica, leg. Swartz s/n (holo-: H-NYL 41252! (?)), Mexico, Borrejo, leg. Fr. Müller s/n (epi-: H-NYL 41247!).

Thallus foliose, 2.0–4.0 cm broad, grayish under fluorescent light, opaque, matt, grayish and yellowish under stereomicroscope. Lobes 1.5–4.0 mm wide, agglomerated, adnate to attached in points, adpressed, upper surface ridges at naked eye, longitudinal ridged under 20 \times magnification; apices rounded, ascending, irregular to crispate, smooth; lateral margins ascending, smooth, crispate; lower side yellowish gray, ridged under 20 \times magnification. Isidia and lobules absent. Apothecia up to 3.0 mm diam., submarginal, subpedicellate, disc reddish, usually plane;

margin concolorous with the thallus, circular ridges, smooth; amphithecia concolorous with the thallus, irregular ridges, without ornamentation; corona absent; pedicel very short, originated by the thallus. Anatomy: Thallus 200–400 μm thick; one layer of isodiametric cells of cortical layers, $2.5\text{--}5.0 \times 5.0\text{--}7.5 \mu\text{m}$. Medulla with columnar hyphae not observed; cyanobacteria green, 12–20 spherical to elliptical cells per filaments, $2.5\text{--}5.0 \times 5.0 \mu\text{m}$ cell; gelatinous matrix colorless, abundant. Apothecia with hymenium 125 μm high; subhymenium 25–37.5 μm , colorless; hypothecium 25 μm thick, prosoplectenchymatous, colorless to yellowish; proper exciple paraplectenchymatous, 100–115 μm (10–14 cells) thick at the base; parahymenial tissue continuous with proper exciple, paraplectenchymatous, 50 μm (7 cells) at the apices; thalline exciple cortex with one layer of isodiametric cells, 5.0–7.5 μm diam. Pycnidia not observed.

Known distribution to RS: See Spielmann (2006).

Specimens examined: BRAZIL: RIO GRANDE DO SUL: Caraá municipality, Área de Proteção Ambiental, Nascente do Rio dos Sinos, BHRS, riparian forest, area 7, 29°42'05.8"S, 50°17'46.1"W, 508 m alt., 15 Apr. 2016. M.I. Käffer 1035 b (HAS); *Ibid.*, Rio Grande municipality, Restinga APP6, 01 Apr. 2016, J. Pedroso 255 (HURG); *Ibid.*, 14 Apr. 2016, J. Pedroso 325, 327, 329 (HURG); *Ibid.*, 19 Apr. 2016, J. Pedroso 374, 400, 401 (HURG); *Ibid.*, 20 Apr. 2016, J. Pedroso 436, 470 (HURG); *Ibid.*, 22 Apr. 2016. J. Pedroso 408 *pr. min. p.*, 467 (HURG); *Ibid.*, 05 May 2016, J. Pedroso 505, 506, 507 (HURG); *Ibid.*, 27 Sep. 2016, J. Pedroso 491 (HURG); *Ibid.*, São Leopoldo municipality, ecology base, BHRS, riparian forest, area 1, 29° 45' 50.6"S, 51° 10' 49.7"W, 8 m alt. 23 Jan. 2016. M.I. Käffer 1029 (HAS); *Ibid.*, Pelotas municipality, Dunas das Acácias, corticícola, árvore na beira da estrada de acesso as dunas, 03 Apr. 2017, A.S. Rodrigues 150, 152.

Notes: *Leptogium chloromelum* is characterized by ridged thallus, and apothecia submarginal and subpedicellate (Figure 1d).

It is frequently found in the Brazilian savanna (cerrado) in São Paulo and Mato Grosso do Sul States.

6. *Leptogium cochleatum* (Dicks.) P.M. Jørg. and P. James, *Lichenologist*, 15(2): 113. 1983. ≡ *Lichen cochleatum* Dicks., *Fasc Pl Crypt Brit* 1: 13. 1785. Type: England, Dickson 1784 (lecto-: LINN-SM, designed by Jørgensen and James (1983)).

Description: See Aragón et al. (2005).

Known distribution to RS: See Spielmann (2006), including Santana do Livramento (Käffer et al. 2015).

Notes: *Leptogium cochleatum* is characterized by the darker bluish thallus, 100–150 µm thick, upper surface notably finely striate, and margin of apothecia with persistent wrinkles (Jørgensen and James 1983).

The apothecia have euparaplectenchymatous proper margin (Jørgensen and James 1983) that gives a yellowish color to the amphithecia.

The image of *Leptogium cochleatum* published by Jørgensen and James (1983) shows one specimen with subpedicellate apothecia, which differs from *L. azureum* that is constituted by pedicellate apothecia. Aragón et al. (2005), however, described *L. cochleatum* as having sessile apothecia, but it is indeed subpedicellate, as shown by Jørgensen and James (1983).

The type is part of Linnaeus collection from LINN herbarium, and the material must be studied on the museum.

7. *Leptogium coralloideum* (Meyen and Flot.) Vain., *Ann Acad Sci Fenn, Ser A*, 6(7): 110. 1915. ≡ *Leptogium diaphanum* f. *coralloideum* Meyen and Flot., *Nova Acta Acad Caes Leop - Carol Germ Nat Cur* 19: 226. 1843. Type: not traced (Jørgensen (1994), Galloway and Jørgensen (1995)).

Description: See Verdon (1992).

Distribution known to RS: See Spielmann (2006).

Notes: *Leptogium coralloideum* is characterized by the wrinkled and isidiate upper surface. The apothecia have paraplectenchymatous subhymenial tissue with various layers and thalline exciple cortex constituted by one layer of cells (Verdon 1992).

8. *Leptogium corticola* (Taylor) Tuck. ex Lea, *Catalogue of Plants Native and Naturalized collected in the Vicinity of Cincinnati*: 47. 1847. ≡ *Collema corticola* Taylor, *London J Bot* 5: 195. 1847. Type: U.S.A., Ohio, Leg. T.G. Lea s/n (holo-: US, iso-: BM!).

Description: See Kitaura (2012).

Known distribution to RS: Santana do Livramento (Käffer et al. 2015).

Notes: *Leptogium corticola* is characterized by the bullate thallus, ridged to wrinkled and amphithecia concolorous with the thallus due to cortex of thalline exciple with 15–25 µm thick. The apothecia are subpedicellate and they are also constituted by proper exciple of coloplectenchymatous cells (M.J. Kitaura, unpublished data).

9. *Leptogium cyanescens* (Rabenh.) Körb., *Systema Lichenum Germaniae*: 420. 1855. ≡ *Collema cyanescens* Rabenh. *Deutsch. Krypt. Fl.*: 50, 1845. Type: Switzerland, Ticino, Schaerer - *Lich. Helv. N.* 409 (lecto-: BM!, designed by Jørgensen and James (1983)).

Thallus foliose, 3.0–7.0 cm broad, bluish gray to fluorescent light, opaque, matt to slightly bright, bluish under stereomicroscope. Lobes 2.0–6.0 mm wide, overlapping, adnate, adpressed, upper surface smooth to naked eye, smooth to slightly ridged under 20× magnification; apices rounded, usually plane, smooth; lateral margins plane to ascending, undulated and sinuous, smooth to ornamented; lower side bluish gray, smooth to slightly ridged under 20× magnification. Isidia cylindrical, withered appearance, 0.05–0.2 × 0.025–0.1 mm,

firm, erect, concolorous with the thallus, usually laminal. Lobules rounded, 0.15–0.4 mm diam., firm, erect, concolorous with the thallus, scarce, marginal. Thallus attached by hapters, frequent, homogeneous. Rhizinae and hairs absent. Apothecia not observed. Anatomy: Thallus 35.0–50.0 µm thick, isodiametric cells of cortices 5.0 µm diam. Medulla with columnar hyphae usually straight, 2–3 cells, frequent; cyanobacteria yellow to blue, frequent, spherical cells 5.0 µm diam., number of cells per filament undetermined; gelatinous matrix scarce, hyaline. Pycnidia not observed.

Known distribution to RS: See Spielmann (2006), including Santana do Livramento (Käffer et al. 2015).

Specimens examined: Brazil, Rio Grande do Sul: Campo Bom municipality, Chácara dos Tachettos, BHRS, riparian forest, area 2, 29°42'01.0"S, 51°00'12.6"W, 17 m alt. 03 Feb. 2016. M.I. Käffer 1026 (HAS); *Ibid.*, Caraá municipality, 04 Jun. 2013, M. Käffer 985; *Ibid.*, Localidade Fraga, APA municipal, 19 Nov. 2008, S.A. Martins 2216 (HAS); *Ibid.*, Área de Proteção Ambiental, Nascente do Rio dos Sinos, BHRS, riparian forest, area 7, 29°42'05.8"S, 50°17'46.1"W, 508 m alt., 15 Sep. 2016. M.I. Käffer 1035 (HAS); *Ibid.*, 01 Apr. 2016, J. Pedroso 216, 217, 218 (HURG); *Ibid.*, 07 Apr. 2016, J. Pedroso 278 (HURG); *Ibid.*, 08 Apr. 2016, J. Pedroso 286 (HURG); *Ibid.*, 14 Apr. 2016, J. Pedroso 311, 324 (HURG); *Ibid.*, 22 Apr. 2016, J. Pedroso 439, 463 (HURG); *Ibid.*, 27 Apr. 2016, J. Pedroso 478, 479 (HURG); *Ibid.*, Parobé municipality, 29°37'45.3"S, 50°49'59.7"W, 10 Jul. 2015, F. Lucheta 336 (HAS); *Ibid.*, 29°37'48.5"S, 50°50'0.6"W, 10 Jul. 2015, F. Lucheta 337 (HAS); *Ibid.*, 29°37'46.2"S, 50°50'0.6"W, 10 Jul. 2015, F. Lucheta 339 (HAS); *Ibid.*, Rolante municipality, 29°39'5.5"S, 50°34'33.1"W, 07 Apr. 2016, F. Lucheta 342 (HAS); *Ibid.*, F. Lucheta 343; *Ibid.*, Santo Antônio da Patrulha municipality, Fazenda da Marca, BHRS, riparian forest, area 4, 29°43'62.5"S, 50°38'23.2"W, 18 m. alt., 11

May 2016, M. I. Käffer 1021 (HAS); *Ibid.*, area 6, 29°46'57.2"S, 50°28'25.5"W, 33 m alt. 16 Aug. 2016. M.I. Käffer 1034 (HAS); *Ibid.*, São Leopoldo municipality, Ecology base, BHRS, riparian forest, area 1, 29°45'50.6"S, 51°10'49.7"W, 8 m alt., 23 Jan. 2016. M.I. Käffer 1027 (HAS); *Ibid.*, Taquara municipality, Fazenda dos Búfalos, BHRS, riparian forest, area 5, 29°41'09.7"S, 50°47'54.2"W, 16 m alt., 13 May 2016. M.I. Käffer 1031 (HAS); *Ibid.*, Pelotas municipality, mata do Totó, mata ciliar, 26 Mar. 2017. A.S. Rodrigues 098.

Notes: *Leptogium cyanescens* is characterized by the upper surface smooth to slightly ridged under 20× magnification (Figure 2a), and cylindrical isidia with withered appearance.

Leptogium cyanescens differs from *L. austroamericanum* by the type of upper surface. The upper surface of *L. cyanescens* is usually smooth whereas the upper surface is irregularly wrinkled in *L. austroamericanum*. Both species have cylindrical isidia with withered appearance.

10. *Leptogium denticulatum* Nyl., Ann Sci Nat, Bot Biol Vég 7: 302. 1867. Type: Nova Granada [Colombia], San Jil, 1300 m. alt., 1863, A. Lindig sub no. 48 (holo-: H-NYL 41427!).

Description: See Kitaura et al. (2015).

Known distribution to RS: Porto Alegre (Käffer et al. 2011) and Santana do Livramento (Käffer et al. 2015).

Notes: *Leptogium denticulatum* has smooth upper surface when observed to naked eye and denticules restrict only to the margin of apothecia. Lobules and denticules are lacking on the thallus.

11. *Leptogium diaphanum* (Sw.) Mont., Ann Sci Nat, Bot Biol Vég 10: 134. 1848. ≡ *Lichen diaphanus* Sw., Nov Gen Sp [HBK]: 147. 1788. Type: Jamaica, India Occidentalis, in montobus altissinus, inter musco. (PC (I.P.R. Cunha, unpublished data)).

Thallus foliose, 3–7 cm broad, bluish to gray to fluorescent light, opaque, matt, bluish under stereomicroscope. Lobes 2.5–4.0 mm wide,

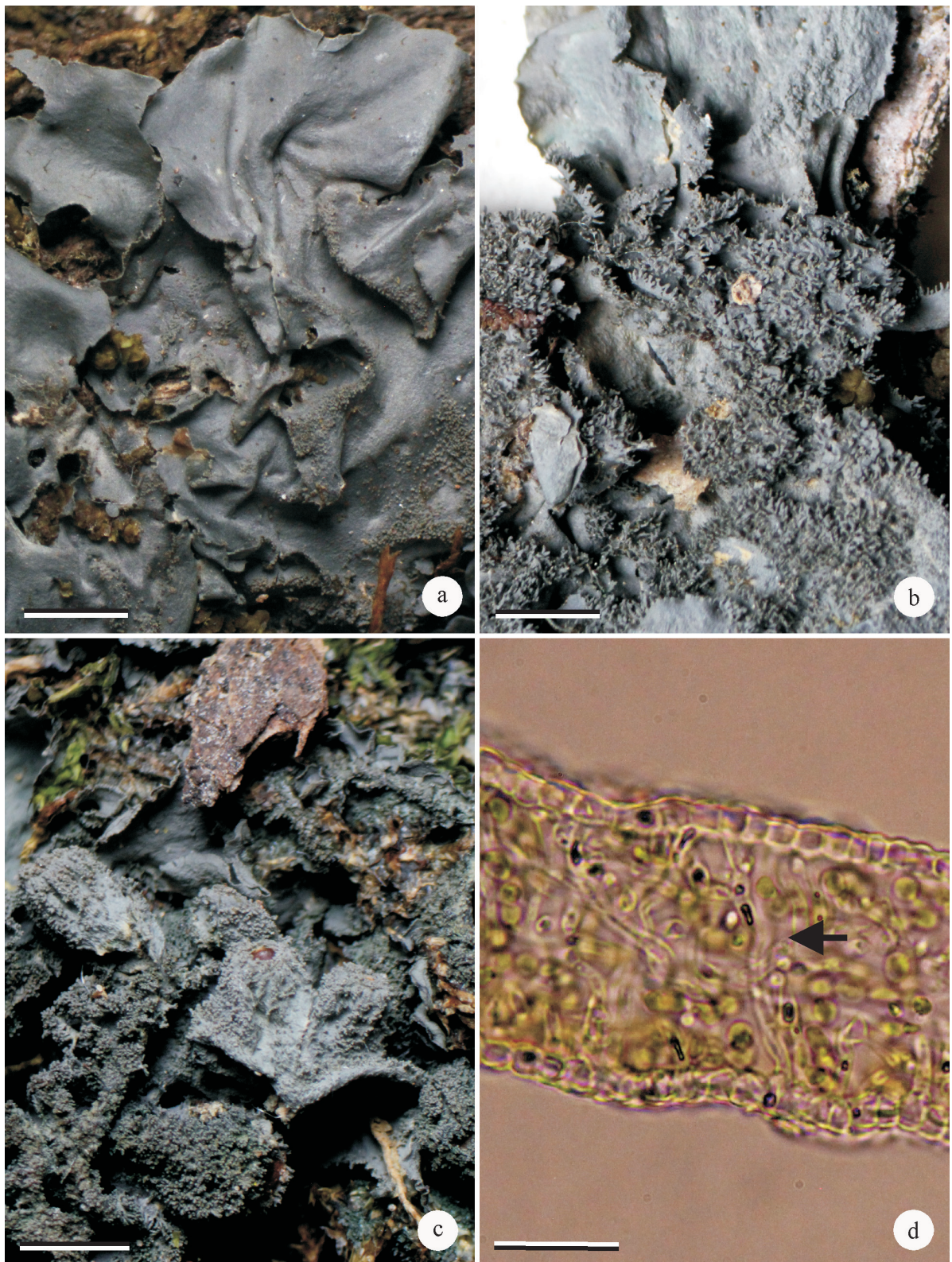


Figure 2 - *Leptogium* species (a) thallus of *L. cyanescens*. (b) thallus of *L. diaphanum*. (c) thallus of *L. exaratum*. (d) transversal section of the thallus of *L. exaratum* (black arrow = columnar hyphae). Bars a, b, c = 2 mm and d = 100 μ m.

overlapping, adpressed, adnate, upper surface usually smooth to naked eye, minutely irregular ridges under 20× magnification; apices rounded, plane to ascending, smooth to ornamented; lateral margins ascending, undulate and sinuous, ornamented; lower side yellowish gray to bluish, smooth to slightly ridges under 20× magnification. Isidia absent. Lobules elongated, simple to irregular branched, 0.25–0.5 × 0.1–0.2 mm, firm, erect, concolorous with the thallus to yellowish, laminal and marginal. Thallus attached by hapters, abundant, homogeneous. Rhizinae and hairs absent. Apothecia not observed. Anatomy: Thallus 25–35 µm thick, cortices 5.0–7.5 µm diam. Medulla with columnar hyphae straight to slightly inclined, 2 cells, scarce; cyanobacteria green, spherical cells 5.0 µm diam., cells per filament undetermined; gelatinous matrix scarce, hyaline. Pycnidia not observed.

Known distribution to RS: Santana do Livramento (Käffer et al. 2015).

Specimens examined: Brazil, Rio Grande do Sul: Caraá Municipality, APA do Caraá, 03 Dec. 2008, S.A. Martins 2258 (HAS); *Ibid.*, 12 Dec. 2012. M. Käffer 966 (HAS); *Ibid.*, 04 Jun. 2013. M. Käffer 981 *p. min. pr.* (HAS); *Ibid.*, Rio Grande municipality, Restinga APP6, 31 Mar. 2016, J. Pedroso 203 (HURG); *Ibid.*, 07 Apr. 2016, J. Pedroso 273, 274, 279 (HURG); *Ibid.*, Santo Antônio da Patrulha municipality, BHRS, riparian forest, Area 6, 29° 46' 57.2"S, 50° 28' 25.5"W, 33 m. alt. 24 Aug. 2016, M.I. Käffer 1033 (HAS); *Ibid.*, Caraá municipality, 29° 47' 4"S, 50° 25' 38", 15 Nov. 2014, N.M. Koch 927 (HAS); *Ibid.*, N.M. Koch 925 (HAS). *Ibid.*, Fraga locality, APA Municipal. 19 Jun. 2008. S.A. Martins 2211 (HAS); *Ibid.*, Área de Proteção Ambiental, Nascente do Rio dos Sinos, BHRS, riparian forest, area 7, 29°42'05.8"S, 50°17'46.1"W, 508 m alt., 15 Sep. 2016. M.I. Käffer 1035 a (HAS); *Ibid.*, Santo Antônio da Patrulha municipality, Fazenda Marca, BHRS, riparian

forest, area 4, 29°43'62.5"S, 50°38'23.2"W, 18 m alt., 11 May 2016, M.I. Käffer 1024 (HAS).

Notes: *Leptogium diaphanum* is characterized by the thin thallus (25–35 µm thick), with upper surface with minutely irregular ridges under 20× magnification, and elongated lobules, simple to irregularly branched (Figure 2b).

The lobules are flattened and differ from the cylindrical isidia of *L. austroamericanum* and *L. cyanescens*.

Leptogium diaphanum was mentioned to São Paulo and Paraná States (I.P.R. Cunha, unpublished data), but the new citation was not published.

The type is probably deposited in PC herbarium, but we were not able to make contact with its curator.

12. *Leptogium exaratum* M.J. Kitaura and F. Lucheta, sp. nov.

Similar to *L. granulans*, but apothecia ornamented with isidia usually cylindrical, that can be simple to irregular branched. Type: Brazil, Rio Grande do Sul, Parobé municipality, 29°37'48.5"S, 50°50'0.6"W, 10 Jul. 2015, F. Lucheta 340 (holo- and iso-: CGMS).

MycoBank: 826724

Thallus foliose, ca. 7 cm broad, muscicolous, dark gray under fluorescent light, matt, opaque, gray to bluish gray under stereomicroscope. Lobes 2.0–4.5 mm, agglomerated, attached in points, loosely attached, upper surface smooth to wrinkled at naked eye, irregular wrinkled under 20× magnification; apices rounded, ascending to revolute, smooth to ornamented; lateral margins ascending, sinuous and undulated, ornamented; lower side brownish, smooth at naked eye, irregular branched and isidiate under 20× magnification. Isidia 0.05–0.5 × 0.05–0.1 mm, usually cylindrical, simple to irregular branched, firm, erect, concolorous with the thallus, grouped, abundant, on the laminal, marginal, pedicel and apothecia. Lobules absent. Thallus attached by hapters, frequent, homogeneous. Apothecia up to 1.5 mm diam., pedicellate, disc

concave, reddish; margin smooth, yellowish, isidiate or not ornamented; amphithecia constituted by thallus, concolorous with the thallus, which is inserted on the lateral of amphithecia, ornamented by isidia; corona absent; pedicel ca. 1.0 mm high, inflated, longitudinal ridges, isidiate. Anatomy: Thallus 35–85 μm thick, cortices with isodiametric cells, 5.0 μm diam. Medulla with columnar hyphae inclined, ca. 5 cells, scarce, usually near the margin; cyanobacteria cells per filament not determined, spherical, ca. 2.5–5.0 μm diam., greenish; gelatinous matrix scarce. Apothecia with hymenium 135–150 μm thick; subhymenium 35–50 μm thick, colorless; hypothecium 50–75 μm thick, colorless, irregular cells prosoplectenchymatous; parahymenium tissue continuous with the hypothecium, elongated to paraplectenchymatous cells, ca. 50 μm at the base and the apices; proper exciple absent; thalline exciple covered by thallus; basal paraplectenchymatous tissue present, cortex with paraplectenchymatous cells, 25 μm (4 cells) thick at the apices, 50 μm (5 cells) thick at the mid-height and base. Ascospores rare, usually immature, fusiform, 15–20 \times 5.0–7.5 μm , apices acute, submuriform. Pycnidia not observed.

Known distribution to RS: Locality type.

Notes: *Leptogium exaratum* (Figure 2c, d and a) is characterized by the presence of apothecia with inflated pedicel, which has deep longitudinal ridges. The thallus, pedicel and apothecia are usually covered by cylindrical isidia (Figure 2c).

Leptogium granulans as well as *L. exaratum* are isidiate species, but *L. granulans* have isidia restrict to the margin and lamina of the thallus, whereas *L. exaratum* have isidia on the thallus, pedicel and apothecia. Furthermore, the form of the isidia is distinct between *L. granulans* and *L. exaratum*. The isidia of *L. granulans* are granular, moniliform (piled up) to irregular branched (M.J. Kitaura, unpublished data), whereas the isidia of *L. exaratum* is usually cylindrical, simple to irregular branched.

Leptogium javanicum has inflated pedicel as *L. exaratum* and *L. granulans*, but *L. granulans* and *L. exaratum* are isidiate species whereas *L. javanicum* does not have isidia.

The epithet *exaratum*, from Latin, refers to deep ridges like the deep longitudinal ridges found on the pedicel of *L. exaratum*, *L. granulans* and *L. javanicum*.

13. *Leptogium hibernicum* M.E. Mitch. ex P.M. Jørg., *Herzogia* 2: 462. 1973. Type: Ireland, Kerry, Killarney, Torc cascade, on mossy trees, 4 Aug. 1933, G. Degelius s/n (holo-: UPS!).

Thallus up to 10 cm broad, bluish gray under fluorescent light at naked eye, opaque, matt, light gray to bluish gray under the stereomicroscope. Lobes 2–7 (–9) mm wide, overlapping, adpressed, adnate; upper surface smooth with longitudinal wrinkles at naked eye, rugulose with usually longitudinal wrinkles under 20 \times magnification; apices rotund, involute, smooth; lateral margin usually smooth, plane to involute, straight to sinuous; lower side beige, wrinkled at naked eye, velvety appearance under 20 \times magnification. Isidia usually cylindrical, ca. 0.05–0.40 \times 0.05 mm, usually simple to branched next to apex, erect, firm, whitish or concolorous with the thallus base and blackish apices, usually laminal, grouped, abundant proximal part. Lobules absent. Thallus attached by hairs these are unbranched, simple to agglutinated, up to 50 μm (ca. 10 spherical cells) long, beige, on lower cortex, abundant to dense. Hapters and rhizinae absent. Apothecia absent. Anatomy: Thallus 350–550 μm thick, quadratic cells of upper cortex 2.5 \times 5.0 μm , one layer, quadratic cells of lower cortex, 5.0 \times 5.0 μm , one layer. Medulla with long hyphae that connect the cortices, branched, number of cells undetermined, 2.5 μm thick; columnar hyphae absent; cyanobacteria greenish, frequent to scarce, filament with 10–20 elliptic cells, 5.0 \times 2.5 μm ; gelatinous matrix abundant, colorless. Pycnidia not observed.

Known distribution to RS: See Spielmann (2006).

Specimens examined: Brazil, Rio Grande do Sul: Caraá municipality, Fraga locality, APA Municipal, 19 Nov. 2008, S.A. Martins 2206 (HAS); *Ibid.*, 03 Jul. 2008, S.A. Martins 2142 (HAS).

Notes: *Leptogium hibernicum* (Figure 3b) is characterized by the wrinkled upper surface with isidia and hairs constituted by spherical cells.

Specimens from Rio Grande do Sul are attached mainly by agglutinated hyphae (rhizine-like), despite the presence of hairs, whereas that the type specimen (Degelius s/n) is attached only by hairs on the substrate. The rhizinae are constituted by cylindrical hyphae, while the hairs are composed by spherical hyphae. This is the first record of hairy species constituted by spherical cells, with rhizinae. Previously, there was only the record of beard-like hairs constituted by cylindrical and spherical cells, like in *L. velutinum* (Kitaura et al. 2014).

The development of isidium was considered an important taxonomical characteristic in *Leptogium saturninum* group (Stone et al. 2016). We found different isidia in Rio Grande do Sul specimens, when compared to *L. hibernicum* type, but further studies are necessary. The isidia from Rio Grande do Sul specimens are spherical when young and cylindrical with age, branching on the apices, whereas the isidia of *L. hibernicum* are granular when young, remaining granular to branching with age.

The type of *Leptogium hibernicum* also has lobuloid or cerebroid structures on the lamina that are not found in Rio Grande do Sul specimens.

Leptogium mantiqueirensis Kitaura and Marcelli and *L. digitatum* (A. Massal.) Zahlbr. have wrinkled surfaces, but lack isidia. The thallus of *Leptogium burgessii* (L.) Mont. and *L. ethiopicum* C.W. Dodge are smooth and without isidia, whereas *L. laceroideus* B. de Lesd. and *L. nylanderii*

Kitaura and Marcelli have smooth upper surface and ornaments (Kitaura and Marcelli 2013).

14. *Leptogium involutum* Kitaura, Kaffer and S.M. Martins, *Herzogia* 2: 462. 1973. Type: Brazil, Rio Grande do Sul State, municipality of Santana do Livramento, APA do Ibirapuita, Estancia Sao Mauricio, riparian forest in a native grassland matrix, 30°37'77.9"S, 55°33'92.9"W, 871 m of altitude, on a tree trunk, 14 Nov. 2012, leg. M. Kaffer and S.M. Martins 437 (holo-: HAS 89100!).

Description: see Kitaura et al. (2014).

Known distribution to RS: Santana do Livramento, only to type locality (Kitaura et al. 2014, Kaffer et al. 2015).

Notes: *Leptogium involutum* has involute lobe margins, ridged upper surface and hairs with cylindrical cells.

Leptogium hibernicum is an isidiate species and differs from *L. involutum* that is a non-isidiate species.

15. *Leptogium isidiosellum* (Riddle) Sierk, *Bryologist* 67(3): 282. 1964. ≡ *Leptogium marginellum* var. *isidiosellum* Riddle, *Brooklyn Bot Gard Mem* 1: 115. 1918. Type: West Indies. St. Jon, 1913, Britton and Shafer 276 (holo-: FH, iso-: MICH!).

Thallus foliose, ca. 4.0 cm broad, bluish gray under fluorescent light, opaque, matt, bluish gray to green under stereomicroscope. Lobes 2.5–5.0 mm wide, agglomerated, adpressed, adnate, upper surface smooth to ridged at naked eye; irregular to longitudinal ridges under 20× magnification; apices irregular, ascending, ornamented; lateral margins plane to ascending, crenulated, smooth to ornamented; lower side bluish, ridged. Isidia irregular, withered appearance, simple to irregular branched, marginal and laminal on the ridges, 0.075–0.375 × 0.075–0.10 mm, firm erect, concolorous with the thallus. Lobules absent. Apothecia (Sierk, 1964, Kitaura, 2012) not observed. Anatomy: Thallus 125–250 μm thick, isodiametric cells of the cortices, 2.5 × 2.5–5.0 μm. Medulla with columnar



Figure 3 - *Leptogium* species (a) transversal section of the apothecia (black arrow = cortex of basal paraplectenchymatous tissue). (b) wrinkled upper surface with hairs of *L. hibernicum* (white arrow = hairy lower side). (c) ridged thallus with irregular isidia of *L. isidiosellum*. (d) inflated pedicellate of *Leptogium javanicum*. Bars a = 100 μ m, b, c and d = 2 mm.

hyphae not observed; cyanobacteria green, 12–17 ellipsoid cells per filaments, $2.5 \times 5.0 \mu\text{m}$, frequent; gelatinous matrix abundant, colorless. Pycnidia absent.

Known distribution to RS: São Francisco de Paula (Käffer et al. 2007) and Santana do Livramento (Käffer et al. 2015).

Specimens examined: Brazil, Rio Grande do Sul: Campo Bom municipality, Chácara dos Tachettos, riparian forest, (BHRS) - Area 2, $29^{\circ}42'01.0''\text{S}$, $51^{\circ}00'12.6''\text{W}$, 17 m alt., 03 Feb. 2016, M. I. Käffer 1025 (HAS); Caraá municipality, APA do Caraá, 04 Nov. 2013. S.A. Martins 2852 (HAS); *Ibid.*, Parobé municipality, $29^{\circ}37'48.5''\text{S}$, $50^{\circ}50'0.6''\text{W}$, 10 Dec. 2015, F. Lucheta 338 (HAS); *Ibid.*, Rolante municipality, $29^{\circ}39'5.5''\text{S}$, $50^{\circ}34'33.1''\text{W}$, 07 Apr. 2016, F. Lucheta 341 (HAS); *Ibid.*, Santo Antônio da Patrulha municipality, Fazenda Marca, BHRS, riparian forest, Area 4, $29^{\circ}43'62.5''\text{S}$, $50^{\circ}38'23.2''\text{W}$, 18 m alt., 26 Jun. 2016, M.I. Käffer 1022 (HAS); *Ibid.*, Santo Antônio da Patrulha, on trunk of *Ligustrum* sp., $29^{\circ}49'13''\text{S}$, $50^{\circ}31'5''\text{W}$, 16 Apr. 2014. N.M. Koch 924 *p.p.* (HAS).

Notes: *Leptogium isidiosellum* is characterized by the ridged upper surface with irregular isidia (Figure 3c). Apothecia were not found in Rio Grande do Sul material, but they are constituted by thalline exciple with thick paraplectenchymatous cortex, 50–90 μm (6–10 cells) thick (M.J. Kitaura, unpublished data).

Leptogium isidiosellum and *L. coralloideum* are ridged species with isidia, but differ mainly by the tissues of apothecia. The type of *L. coralloideum* was not studied yet and other differences could be found. *Leptogium isidiosellum* has a thick cortex on the thalline exciple whereas *L. coralloideum* has a thalline exciple constituted by one layer of cells as the apothecia of *L. phyllocarpum*.

16. *Leptogium javanicum* Mont., Syll Gen Sp Crypt: 379. 1856. Type: Java, Sindoro, ad truncos

et ramos *Gnaphalii* sp. (*Nec aliorum*) in summon, leg. F.W. Junghuhn s/n (lecto-: L!, designated here).

Thallus foliose, ca. 7 cm broad, bluish gray to fluorescent light, opaque to translucent, matt, bluish under stereomicroscope. Lobes 3–5 mm wide, agglomerated, attached in point, slightly adnate, upper surface smooth at naked eye, minutely bullate to irregular wrinkled under $20\times$ magnification; apices rounded, ascending, smooth; lateral margins ascending, smooth, undulate and sinuous; lower side bluish to yellowish, irregular wrinkled under $20\times$ magnification. Isidia and lobules absent. Thallus attached by hapters, frequent, homogeneous. Rhizinae and hairs absent. Apothecia up to 2.5 mm diam., laminal, pedicellate, disc usually plane, reddish; margin smooth, beige; amphithecia concolorous with the thallus, covered by pedicel, when young with bullate projections on the apex; corona slightly present, usually on mature apothecia; pedicel 0.5–2.5 mm high, without constrict base, inflated when young and more wider than apothecia, irregular longitudinal ridges. Anatomy: Thallus 35–40 μm thick, cortices with isodiametric cells 5 μm diam. Medulla with columnar hyphae straight, frequent, 2 cells; cyanobacteria blue, number of cells per filament undetermined, 5.0 μm diam.; gelatinous matrix scarce, yellow. Apothecia with hymenium 110–140 μm high; subhymenium 62.0–75.0 μm thick, hyaline; hypothecium 62.0–75.0 μm diam., prosoplectenchymatous cells, hyaline; parahymenial tissue continuous with hypothecium, collo- to paraplectenchymatous; proper exciple absent; thalline exciple cortex with paraplectenchymatous cells, 5.0 μm (1 cell) thick at the apices, 25 μm (3–4 cells) thick at the mid-height, thallus inserted at the base; basal paraplectenchymatous tissue 100–140 μm (9–14 cells) thick. Ascospores fusiform, acute apices, $32.5\text{--}45.0 \times 7.5\text{--}12.5 \mu\text{m}$, $4\text{--}6 \times 2\text{--}3$ cells, submuriform to muriform. Pycnidia not observed.

Known distribution to RS: See Spielmann (2006).

Specimens examined: Brazil, Rio Grande do Sul: Caraá, Localidade Fraga, APA Municipal. 03 Sep. 2008. S.A. Martins 2140 *pr. p.* (HAS); *Ibid.*, 08 Oct. 2008, S.A. Martins 2184 (HAS).

Notes: *Leptogium javanicum* has inflated pedicel with longitudinal ridges, and bullate projections on the apices of young apothecia (Figure 3d).

The material Junghuhn s/n, designated as holotype of *Stephanephorus javanicus* Mont. is a syntype with two different species of *Leptogium*, and one lectotype must be selected according to the ICN. The specimens in type collection of *L. javanicum* were reported as 1 and 2. The fragment 1 is designated as the lectotype of *L. javanicum*, whereas the fragment 2 is *L. cf. cyanescens*.

Aino Henssen, on the label of the material, selected specimen 1 as the lectotype in 1966, but she did not publish her choice.

The specimens from Rio Grande do Sul have prosoplectenchymatous hypothecium and ascospores $32.5\text{--}45.0 \times 7.5\text{--}12.5 \mu\text{m}$, whereas the Java specimen has hypothecium with irregular colloplectenchymatous cells and ascospores $15\text{--}25\text{--}(30) \times 7\text{--}10 \mu\text{m}$ (M.J. Kitaura, unpublished data). Despite the differences, the specimens from Rio Grande do Sul were considered *Leptogium javanicum*, but further studies are required.

17. *Leptogium marginellum* (Sw.) Gray, Nat Arr Brit Pl 1: 401. 1821. \equiv *Lichen marginellus* Sw., Nov Gen Sp Pl [HBK]: 147. 1788. Type: Jamaica, Blue Ridge Mt., (musci intermixtis innascitur, in jugo montium caeruleorum), leg. Swartz s/n (lecto-: H-ACH 1917!).

Thallus up to 5.0 cm broad, gray under fluorescent light, matt, opaque, yellowish gray under stereomicroscope. Lobes 1.5–2.5 mm wide, agglomerated, attached in points, adnate, upper cortex smooth at naked eye, longitudinally slightly ridged under 20 \times magnification; apices rounded, ascending to revolute, smooth to ornamented; lateral margins ascending, undulated and sinuous,

usually ornamented; lower side gray to yellowish, minutely ridged under 20 \times magnification. Isidia absent. Lobules rounded, 0.2–0.35 mm diam., firm, erect, concolorous with the thallus, usually on apothecia. Thallus attached by hapters, frequent, homogeneous. Apothecia 0.1–0.4 mm diam., subpedicellate, disc plane to slightly concave, reddish; margin of apothecia beige, smooth or ornamented; amphithecia beige, ornamented; corona absent; pedicel very short. Anatomy: Thallus 50–75 μm thick, isodiametric cells of the cortices 5.0 μm diam. Medulla with columnar hyphae straight to inclined, frequent, ca. 5 cells; cyanobacteria 8–14 spherical cells per filament, 2.5–5.0 μm diam.; gelatinous matrix scarce to frequent, colorless. Apothecia with hymenium 110–125 μm high; subhymenium 20–25 μm thick, colorless; hypothecium 25–33 μm , colloplectenchymatous, colorless; parahymenial tissue continuous with hypothecium, colloplectenchymatous of irregular cells; proper exciple absent; thalline exciple cortex with paraplectenchymatous cells, 5.0–10.0 μm (1–2 cells) thick at the apices, ca. 25 μm (3–5 cells) thick at the mid-height, 35–50 μm (5–7 cells) thick at the base, with cyanobacteria duct that originate the lobules. Ascospores and pycnidia not observed.

Known distribution to RS: Spielmann (2006), São Francisco de Paula (Käffer et al. 2007).

Specimens examined: Brazil, Rio Grande do Sul: Caraá municipality, APA do Caraá, 04 Nov. 2013. S.A. Martins 2851 (HAS); *Ibid.*, Santo Antônio da Patrulha municipality, Fazenda Marca, BHRS, Area 4, 29°43'62.5"S, 50°38'23.2"W, 18 m alt., 29 Jun. 2016. M.I. Käffer 1023 (HURG); *Ibid.*, São Leopoldo municipality, Ecology base, BHRS, riparian forest, Area 1, 29°45'50.6"S, 51°10'49.7"W, 8 m alt., 23 Jan. 2016. M.I. Käffer 1028 (HURG).

Notes: *Leptogium marginellum* has upper surface longitudinally slightly ridged under 20 \times magnification and marginal apothecia with lobules (Figure 4a).

The apothecia of *L. marginellum* are abundant, but the ascospores are usually not observed.

18. *Leptogium megapotamicum* Malme, Ark Bot 19: 8 (1924). Type: Brazil, Rio Grande do Sul, Porto Alegre, Parthenon, Malme 574 (holo-: S!).

Thallus foliose, up to 10 cm broad, gray to dark gray under fluorescent light, opaque, matt, gray to yellowish gray under stereomicroscope. Lobes 1.5–7.0 mm wide, irregular, adnate, adpressed, upper surface ridged at naked eye, irregular to longitudinal ridges under stereomicroscope; apices irregular, plane to ascending, inflated or not inflated, smooth; lateral margins plane to ascending, undulated, smooth. Isidia and lobules absent. Apothecia up to 4 mm, marginal to laminal, subpedicellate to pedicellate, disc reddish, plane when young to convex; margin concolorous with the thallus and yellowish, smooth to slightly crenulated; amphithecia concolorous with the thallus and yellowish or only concolorous with the thallus, slightly crenulated to ridged; corona absent; pedicel 0.5–3.0 mm long, originated by the ridges (smaller) or margin of the lobes. Anatomy: Thallus 120–350 µm thick, isodiametric cells of the cortices 5.0 µm diam. Medulla with columnar hyphae absent; cyanobacteria green, near the cortices, spherical to ellipsoid, 2.5–5.0 × 2.5 µm; gelatinous matrix abundant, colorless. Apothecia with hymenium 80 µm high; subhymenium 20.0–37.5 µm thick, colorless; hypothecium 50 µm, colorless, proso- to colloplectenchymatous; parahymenial tissues continuous with hypothecium, proso- to colloplectenchymatous, 37.5 µm at the base, 25 µm at the apex; proper exciple absent; thalline exciple cortex with one layer, 5.0 µm (1 cell) at the apices, 5.0–75 µm (1–6 cells) thick at the mid-height, 75 µm (6 cells) at the base. Ascospores transversely septate, 60–75 × 5 µm, 9–12 × 1 cells, apices acute, acicular. Pycnidia not observed.

Known distribution to RS: See Spielmann (2006).

Specimens examined: Brazil, Rio Grande do Sul: Caraá, Localidade Fraga, APA Municipal, near the trip, sunny place, 03 Sep. 2008. S.A. Martins 2140 (HAS); *Ibid.*, 08 Oct. 2008. S.A. Martins 2198 pr. p.; *Ibid.*, 03 Dec. 2008, S.A. Martins 2233, 2234, 2267 (HAS); *Ibid.*, 27 Apr. 2009, S.A. Martins 2276 (HAS).

Notes: *Leptogium megapotamicum* has ridged upper surface (Figure 4b) under naked eye and transversely septate ascospores.

In Rio Grande do Sul, *L. brebissonii* and *L. megapotamicum* have transversely septate ascospores. However, *L. brebissonii* has isidia and *L. megapotamicum* is a non-isidiate species.

19. *Leptogium milligranum* Sierk, Bryologist 67: 290. 1964. Type: U.S.A., New Jersey, Pasadena, on bark, leg. G.G. Nearing s/n (holo-: F!).

Thallus foliose, ca. 4 cm broad, blackish to fluorescent light, opaque, matt, light gray under stereomicroscope. Lobes 2.0–4.0 mm wide, agglomerated, attached in point, slightly adnate, upper surface wrinkled to the naked eye, wrinkled under 20× magnification; apices rounded to irregular, ascending, ornamented; lateral margins ascending, irregular, ornamented; lower side light gray to yellowish, irregular ridges. Isidia granular, 0.075–0.1 mm diam., firm, erect, blackish, simple, moniliform to grouped, laminal. Lobules absent. Thallus attached by hapters, frequent, homogeneous. Rhizinae and hairs absent. Apothecia not observed. Anatomy: Thallus 200–280 µm thick, isodiametric cells of the cortices 5.0 µm diam. Medulla without columnar hyphae; cyanobacteria green, spherical, ca. 5 µm diam.; gelatinous matrix abundant, colorless. Pycnidia not observed.

Known distribution to RS: New record to Rio Grande do Sul, but previously mentioned to São Paulo State.

Specimens examined: Brazil, Rio Grande do Sul: Santo Antônio da Patrulha, on trunk of *Ligustrum* sp., 29°49'13"S, 50°31'5"W, 16 Apr. 2014. N.M. Koch 924 *pr.p.* (HURG).



Figure 4 - *Leptogium* species (a) marginal apothecia with lobules of *L. marginellum* (white arrow). (b) ridged upper surface of *Leptogium megapotamicum*. (c) granular isidia of *L. milligranum*. (d) subpedicellate apothecia of *L. moluccanum*. Bars = 2 mm.

Notes: *Leptogium milligranum* is characterized by the wrinkled upper surface at naked eye and granular isidia (Figure 4c). The isidia are blackish, simple, moniliform to grouped.

Leptogium brebissonii and *L. milligranum* can be differentiated by the ascospores type. *Leptogium brebissonii* has transversely septate ascospores, whereas *L. milligranum* has submuriform ascospores.

Therefore, *Leptogium brebissonii* and *L. milligranum* are usually found sterile and they can be differentiated by the type of isidia. *Leptogium milligranum* has isidia granular, simple, moniliform to grouped whereas *L. brebissonii* has isidia granular to short cylindrical, simple to branched at the apices.

Leptogium milligranum can be confused as *L. isidiosellum*. The first is constituted by moniliform isidia that has cylindrical appearance, whereas the last is constituted by cylindrical to irregular isidia.

Leptogium milligranum was recently mentioned to Brazil and São Paulo State (Kitaura et al. 2017).

20. *Leptogium moluccanum* (Pers.) Vain., Étude sur la Classification Naturelle et la Morphologie des Lichens du Brésil 1: 223. 1890. ≡ *Collema moluccanum* Pers., Voy. Uranie, Bot 203 (1826). Type: Mullucann Island [Maluku Islands], Rawak, 1817–1820, leg. C. Gaudichaud s/n (holo-: PC).

Thallus foliose, up to 10 cm broad, light gray to fluorescent light, opaque, matt, gray to bluish under stereomicroscope. Lobes 2.0–5.0 µm wide, agglomerated to overlapping, attached in point, adnate, upper surface smooth to naked eye, smooth to slightly ridged under 20× magnification; apices rounded, plane to ascending, smooth; lateral margins smooth, plane to ascending, sinuous to undulated; lower side bluish to gray, smooth to slightly ridged under 20× magnification. Isidia and lobules absent. Thallus attached by hapters, frequent, homogeneous. Rhizinae and hairs absent. Apothecia

1.0–2.0 mm diam., laminal, subpedicellate, disc plane, concave or convex, reddish; margin and amphithecia smooth, beige; corona absent; pedicel very short. Anatomy: Thallus ca. 50 µm thick, cortices with isodiametric cells 5.0 µm diam. Medulla with columnar hyphae straight, 2–3 cells, frequent to abundant; cyanobacteria blue, number of cells per filament undetermined, 2.5–5.0 µm diam.; gelatinous matrix scarce, hyaline. Apothecia with hymenium ca. 125 µm high; subhymenium 35.0–40.0 µm thick, hyaline; hypothecium ca. 50 µm, hyaline, prosoplectenchymatous; parahymenial tissue continuous with hypothecium, subparaplectenchymatous; proper exciple absent; thalline exciple cortex paraplectenchymatous 5.0–15.0 µm (2–3 cells) thick at the apices, 35.0–50.0 µm (6–8 cells) thick at the mid-height, 100–120 µm (8–10 cells) thick at the base. Ascospores fusiform, apices obtuse and acuminate, 25–30 × 7.5–12 µm (4–6 × 2–4 cells), muriform. Pycnidia not observed.

Known distribution to RS: See Spielmann (2006).

Specimens examined: Brazil, Rio Grande do Sul: Carará municipality, APA do Carará. 03 Sep. 2008, S.A. Martins 2248 (HAS); *Ibid.*, 08 Nov. 2008, S.A. Martins 2198 *pr. p.* (HAS); *Ibid.*, 12 Dec. 2012, N.M. Koch 407 (HAS); *Ibid.*, 04 Jun. 2013. M. Käffer 980, 981 (HAS); *Ibid.*, Área de Proteção Ambiental, Nascente do Rio dos Sinos, BHRS, riparian forest, Area 7, 29°42'05.8"S, 50°17'46.1"W, 508 m alt., 15 Sep. 2016. M.I. Käffer 1035 d (HAS); *Ibid.*, Mata de restinga APP6, 14 Apr. 2016. J. Pedroso 317 (HURG).

Notes: *Leptogium moluccanum* is characterized by the upper surface smooth to slightly ridged under 20× magnification and apothecia subpedicellate, 1.0–2.0 mm diam. (Figure 4d).

Leptogium azureum has pedicellate apothecia and differs from *L. moluccanum* that has subpedicellate apothecia.

Leptogium cochleatum has subpedicellate apothecia as well as *L. moluccanum*, but the first is constituted by thallus with 100–150 µm thick, notably finely striate upper surface and persistent wrinkles on the margin of the apothecia (Jørgensen and James 1983), whereas *L. moluccanum* has thallus ca. 50 µm thick, upper surface smooth to slightly ridged and apothecia and amphithecia with smooth margins.

21. *Leptogium phyllocarpum* (Pers.) Mont., Ann Sci Nat, Bot Biol Vég 3, 10: 134. 1848. ≡ *Collema phyllocarpum* Pers., Voy Uranie, Bot: 204. 1826. Type: Brazil, Rio Grande do Sul, Serra dos Vallos per Cruz Alta, in Arbore solitária ripae rivuli, 21 Apr. 1893, G.A. Malme 1265 (neo-: S!, designated by Jørgensen (2002)).

Thallus foliose, 4.0–10.0 cm broad, gray to fluorescent light, opaque, matt, grayish under stereomicroscope. Lobes up to 2.0 mm wide, agglomerated, adpressed, adnate, upper surface wrinkled at naked eye, irregular minutely wrinkles under 20× magnification; apices rounded, ascending, smooth; lateral margins ascending, sinuous and undulated, smooth; lower side gray, wrinkled under 20× magnification. Isidia absent. Lobules without constrict base, ca. 0.25–0.5 mm diam., firm, erect, only on amphithecia, concolorous with the thallus. Thallus attached by hapters, frequent, homogeneous. Rhizinae and hairs absent. Apothecia (only young) 0.3–0.4 mm diam., laminal, subpedicellate, disc concave, reddish to brown; margin smooth, concolorous with the thallus; amphithecia ornamented with collar, concolorous with the thallus; corona absent; pedicel very short, concolorous with the thallus. Anatomy: Thallus 120–450 µm thick, isodiametric cells of the cortices 5.0 µm diam. Medulla without columnar hyphae; cyanobacteria green, 5–10× 2.5–5 µm, 7–12 elongated cells per filament; gelatinous matrix abundant, colorless. Apothecia (young) with hymenium 125 µm high; subhymenium 25 µm thick, colorless;

hypothecium 25 µm, prosoplectenchymatous; proper exciple subparaplectenchymatous, 100–125 µm (10–14 cells) thick; parahymenial tissue continuous with the proper exciple, 100 µm (ca. 25 cells) at the base, 25 µm (10 cells) at the apices, subparaplectenchymatous; thalline exciple cortex with one layer, 5.0 µm (one cell) thick at the apices, mid-height and base. Ascospores not observed. Pycnidia not observed.

Known distribution to RS: See Spielmann (2006), including Santana do Livramento (Käffer et al. 2015).

Specimens examined: Brazil, Rio Grande do Sul: Caraá, Localidade Fraga, APA Municipal, 08 Oct. 2008. S.A. Martins 2197 (HAS); *Ibid.*, 04 Jun. 2013. M. Käffer 983 (HAS - sterile); *Ibid.*, 04 Nov. 2013. S.A. Martins 2847 (HAS).

Notes: *Leptogium phyllocarpum* is constituted by wrinkled upper surface; and apothecia subpedicellate, laminal and ornamented (Figure 5a).

Apothecia ornaments were found of various sizes and forms (Martins 2197 and 2847). They vary from high ridges to collar structures (lobules with fused base on the apices of the apothecia). Probably, the specimens of Rio Grande do Sul are not *L. phyllocarpum stricto sensu*, but further studies are still necessary.

22. *Leptogium pichneum* (Ach.) Malme, Ark Bot 19(8): 20 (1924). ≡ *Collema tremelloides* var. *pichneum* Ach., Syn Meth Lich: 343. 1814. Type: Nova Hollandia and America Borealis habitats (H-ACH).

Description: See Acharius (1814), Malme (1924).

Known distribution to RS: See Spielmann (2006) and São Francisco de Paula (Käffer et al. 2007).

Notes: *Leptogium pichneum* is characterized by the upper surface slightly smooth, lower side distinctly rugulose, and isidia simple and cylindrical



Figure 5 - *Leptogium* species (a) ornamented apothecia of *L. phyllocarpum* with. (b) pedicel originated by the thallus of *L. vesiculosum*. Bars = 2 mm.

when young to branched with age (Acharius 1814, Malme 1924).

Leptogium pichneum differs from *L. cyanescens* mainly by the lower surface. *Leptogium pichneum* has lower side distinctly rugulose and *L. cyanescens* has lower cortex smooth to slightly ridged under 20× magnification. The type of *L. pichneum* was still not described by our protocol and other differences cannot be related.

23. *Leptogium puiggarii* Müll. Arg., Flora (Regensburg) 62: 161. 1879. Type: Brazil, São Paulo State, Apiahy (Apiaí) municipality, Meridional Region mountain, J.J. Puiggari 145 [Unknown type].

Description: See Müller Argovienensis (1879).

Known distribution to RS: See Spielmann (2006).

Notes: *Leptogium puiggarii* is characterized by thallus smooth to minutely bullate at naked eye,

and lower side with cyphella- or urn-like cavities (Müller Argovienensis 1879).

24. *Leptogium sessile* Vain. Ann Acad Sci Fenn, Ser A, IV, Biol 6(7): 108. 1915. Type: Dominica (Ocidental India), Shawford State, ad corticem arboris, 1896, leg. W.R. Elliott 1594 p.p. (holo-: TUR-V 10791!, iso-: TUR-V 10792!, FH?).

Description: See Vainio (1890), Kitaura (2012).

Known distribution to RS: See Spielmann (2006).

Notes: *Leptogium sessile* is characterized by thallus with longitudinal wrinkles higher than irregular wrinkles, apothecia immerse to sessile, and circular wrinkles on the apices of apothecia.

The amphithecia is concolorous with the thallus and the thalline exciple is constituted by one layer of isodiametric cells.

Leptogium sessile is the only species reported to Rio Grande do Sul with immersed to sessile apothecia. *Leptogium cochleatum* and *L. moluccanum* have subpedicellate apothecia and *L. azureum* has pedicellate apothecia, all species with thick cortex on the thalline exciple.

25. *Leptogium subjuresianum* Marcelli and Kitaura, Mycotaxon 120: 218. 2012. Type: Brazil, Rio Grande do Sul State, municipality of Tapes, on trunk of a tree, 5 m alt, 29 Jan. 1994, leg. M.P. Marcelli 26459 (holo-: SP!).

Description: See Kitaura and Marcelli (2012).

Known distribution to RS: Tapes, only type locality (Kitaura and Marcelli 2012).

Notes: *Leptogium subjuresianum* is characterized by the presence of hairs constituted by cylindrical cells with arachnoid appearance. *Leptogium subjuresianum* has rounded lobules on the margin of the thallus and differs from *L. juresianum* that has lacinules, elongated ornaments (Kitaura and Marcelli 2012).

Leptogium involutum has usually hairs on the lower side with velvety appearance, whereas *L. subjuresianum* has hairy upper surface with arachnoid appearance.

The hairs of *L. subjuresianum* are constituted by cylindrical cells, which differ from the hairs of *L. hibernicum* that are constituted by spherical cells.

26. *Leptogium tuckermanii* C.W. Dodge, Ann Missouri Bot Gard 20: 436. 1933. Type: Cuba, Monte Verde, C. Wright 56 (Type not traced).

Description: See Dodge (1933).

Known distribution to RS: See Spielmann (2006).

Notes: *Leptogium tuckermanii* is characterized by upper surface smooth at naked eye, apothecia 0.5–0.9 mm wide and ascospores $18\text{--}22 \times 10\text{--}12 \mu\text{m}$ (Dodge 1933).

The specimens of *Leptogium moluccanum* sensu Vainio (1890) were included in a synonymy list of *L. tuckermanii* (Dodge 1933). Both species

have almost the same measures of apothecia and ascospores: *Leptogium moluccanum* sensu Vainio has apothecia with 0.2–0.7 mm diam. and ascospores with $18\text{--}22 \times 6\text{--}12 \mu\text{m}$, whereas *L. tuckermanii* has apothecia 0.5–0.9 mm diam. and ascospores $18\text{--}22 \times 10\text{--}12 \mu\text{m}$ (Dodge 1933).

Therefore, *Leptogium moluccanum* (Pers.) Vain. was kept as good species (Dodge 1933) and we also considered them as two distinct species. The type material of both species, *Leptogium tuckermanii* and *L. moluccanum*, were still not studied and *Leptogium moluccanum* is probably a complex of species.

27. *Leptogium ulvaceum* (Pers.) Vain., Lichenes Insularum Philippinarum III: 38. 1921. \equiv *Collema ulvaceum* Pers., Voy Uranie, Bot.: 203. 1826. Type: Mariana Islands, ad arborum truncos, C. Gaudichaud s/n (Type not traced).

Description: See Persoon (1826), I.P.R. Cunha, unpublished data.

Known distribution to RS: See Spielmann (2006).

Notes: *Leptogium ulvaceum* is characterized by the thallus with upper surface smooth, black green, and lobes with crenulate margin.

Leptogium ulvaceum is similar to *L. tuckermanii* and *L. moluccanum*. The first has lobes with crenulate margin and the other two, lobes with smooth margin.

28. *Leptogium vesiculosum* (Sw.) Malme, Ark Bot 19(8): 14. 1924. \equiv *Lichen vesiculosus* Sw., Nov Gen Sp [HBK]: 147. 1788. Type: Jamaica, on tops of mountains, O. Swartz (Dodge 1933) (Type not traced, H?).

Description: Thallus foliose, 3.5 cm broad, grayish to fluorescent light, opaque, matt, bluish gray under stereomicroscope. Lobes 2–6 mm wide, slightly overlapping to agglomerated, attached in point, adnate, upper surface smooth at naked eye, finely rugulose under $20\times$ magnification; apices rounded, ascending, smooth; lateral margins ascending, smooth, undulate and sinuous; lower

cortex bluish gray, irregular wrinkles under 20× magnification. Isidia and lobules absent. Thallus attached by hapters, frequent, homomerous. Rhizinae and hairs absent. Apothecia up to 2.0 mm diam., submarginal to laminal, pedicellate, disc plane, reddish; margin smooth, concolorous with the thallus; amphithecia concolorous with the thallus, without ornaments; corona absent; pedicel 0.5–3.0 mm high, without constrict base, inflated, as wide as the apothecia, slightly wrinkles to longitudinal ridges. Anatomy: Thallus 75–80 µm thick, cortices with isodiametric cells 5 µm diam. Medulla with columnar hyphae sinuous, 5–7 cells long; cyanobacteria green, 10–15 cells per filament, ca. 5.0 µm diam.; gelatinous matrix frequent to scarce, hyaline. Apothecia with hymenium ca. 225 µm high, subhymenium ca. 75 µm thick, prosoplectenchymatous cells, hyaline to slightly yellowish; hypothecium 50 µm thick, irregular hyphae with intracellular space, slightly yellowish; parahymenial tissue continuous with subhymenium, coloplectenchymatous, ca. 50 µm thick; proper exciple absent; thalline exciple as basal tissue; basal paraplectenchymatous tissue with paraplectenchymatous cells, 75 µm (7cells) at the margin, 140 µm (7–9 cells) at the mid-height, thallus inserted near the apice of thalline exciple. Ascospores fusiform, acute, 25–30 × 7.5–10.0 µm, 4–6 × 1–2 (–3) cells, muriform. Pycnidia not observed.

Known distribution to RS: New record to Rio Grande do Sul, but previously mentioned to Mato Grosso, Minas Gerais and Santa Catarina States.

Specimens examined: Brazil, Rio Grande do Sul: Maquiné Municipality, Encantada locality, 29°36'20.98"S, 50°12'57.60"W, 30 Mar. 2010, N.M. Koch 980.

Note: *Leptogium vesiculosum* is characterized by the smooth thallus at naked eye, the inflated pedicel and the smooth amphithecia that is concolorous with the thallus (Figure 5b).

Leptogium vesiculosum differs from *L. javanicum* by the margin of the apothecia and the type of amphithecia. *Leptogium vesiculosum* has the margin of apothecia concolorous with the thallus and amphithecia smooth whereas that *L. javanicum* has margin of apothecia beige, and bullate projections on the apex of amphithecia.

EXCLUDED SPECIES

Leptogium tremelloides was excluded from the species list of Rio Grande do Sul. Nowadays, *Leptogium tremelloides* was combined in *Scytinium lichenoides* (L.) Otálora, P.M. Jørg. and Wedin (Otálora et al. 2014) and is considered a European species (Otálora et al. 2008).

The material identified by Malme (1924) as *Leptogium tremelloides*, Malme 492 B, Malme 534, Malme 849 B and Malme 951, were not revised by us, but they were re-determined as *L. azureum* by Marcelli (2002).

Identification key to *Leptogium* in Rio Grande do Sul State, Brazil

- | | |
|--|------------------------|
| 1a. Thallus with hairs, tomentose | 2 |
| 1b. Thallus without hairs, not tomentose | 4 |
| 2a. Hairs constituted by spherical cells | <i>L. hibernicum</i> |
| 2b. Hairs constituted by cylindrical cells | 3 |
| 3a. Hairs usually on the upper surface with cobwebby appearance | <i>L. subjussianum</i> |
| 3b. Hairs usually on the lower surface with velvety appearance | <i>L. involutum</i> |
| 4a. Surface smooth to finely rugulose or bullate (smooth at naked eye) | 5 |
| 4b. Surface ridged or wrinkled (not smooth at naked eye) | 21 |
| 5a. Lower surface with cavities (cyphella- or urn-like) | <i>L. puiggarii</i> |
| 5b. Lower surface without cavities | 6 |

6a. Thallus with isidia or lobules	7	18b. Upper surface not finely rugulose	19
6b. Thallus without isidia or lobules	12	19a. Thallus black green, margin of lobes crenulate	<i>L. ulvaceum</i>
7a. Cylindrical isidia present	8	19b. Thallus light gray to blackish gray, margin of lobes smooth	20
7b. Lobules present	10	20a. Apothecia 0.5–0.9 mm wide, ascospores 18–22 × 10–12 µm (Dodge 1933)	<i>L. tuckermanii</i>
8a. Upper surface smooth, thallus bluish	<i>L. cyanescens</i>	20b. Apothecia 0.5–2.0 mm wide, ascospores 28–36 × 7–10 µm (Verdon 1992)	<i>L. moluccanum</i>
8b. Upper surface rugulose, thallus grayish to bluish-gray or black-green	9	21a. Thallus with isidia	22
9a. Isidia with withered appearance, thallus grayish to bluish-gray	<i>L. austroamericanum</i>	21b. Thallus without isidia	26
9b. Isidia without withered appearance, thallus black-green to lead-blue	<i>L. pichneum</i>	22a. Isidia granular to short cylindrical, blackish	23
10a. Lobules only on apothecia	<i>L. marginellum</i>	22b. Isidia others forms, concolorous with the thallus	24
10b. Lobules on the thallus and apothecia	11	23a. Ascospores submuriform to muriform	<i>L. milligranum</i>
11a. Rounded lobules on the lamina	<i>L. atlanticum</i>	23b. Ascospores transversely septate	<i>L. brebissonii</i>
11b. Flattened and elongated lobules on the lamina	<i>L. diaphanum</i>	24a. Pedicel inflated	<i>L. exaratum</i>
12a. Apothecia sessile	<i>L. sessile</i>	24b. Pedicel not inflated	25
12b. Apothecia subpedicellate to pedicellate	13	25a. Apothecia with thin (1 cell-thick) thalline exciple, with subhymenial paraplectenchymatous tissue	<i>L. coralloideum</i>
13a. Pedicel inflated	14	25b. Apothecia with thick (more than 1 cell) thalline exciple, without subhymenial paraplectenchymatous tissue	<i>L. isidiosellum</i>
13b. Pedicel not inflated	15	26a. Ascospores transversely septate	<i>L. megapotamicum</i>
14a. Margin of apothecia smooth	<i>L. vesiculosum</i>	26b. Ascospores submuriform to muriform	27
14b. Margin of apothecia with bullate projections	<i>L. javanicum</i>	27a. Apothecia submarginal to marginal, amphithecia with wrinkles that originate lobules	<i>L. phyllocarpum</i>
15a. Apothecia pedicellate	<i>L. azureum</i>	27b. Apothecia usually submarginal, amphithecia smooth without lobules	<i>L. chloromelum</i>
15b. Apothecia subpedicellate	16		
16a. Amphithecia concolorous with the thallus	<i>L. corticola</i>		
16b. Amphithecia beige to yellowish	17		
17a. Margin of amphithecia ornamented with denticules	<i>L. denticulatum</i>		
17b. Margin of amphithecia without ornaments	18		
18a. Upper surface notably finely rugulose (striate)	<i>L. cochleatum</i>		

DISCUSSION

Total of 16 species were documented during the study of *Leptogium* specimens from HAS and HURG Herbaria from Rio Grande do Sul, southern Brazil, representing ca. 57% of *Leptogium* diversity of the state. The descriptions of found species were provided by us, confirming that the species have not a wide morphological variability as thought previously. The jelly lichens have fragile appearance, but the taxonomical characteristics are keeping through special hyphae and tissues, e.g. columnar hyphae and paraplectenchymatous tissues, during the dehydration and hydration process.

Leptogium exaratum is proposed as a new species; *L. atlanticum*, *L. milligranum* and *L. vesiculosum* are reported by the first time to the state; and the lectotype of *L. javanicum* was determined after being indicated by Aino Henssen in the label of the type specimen.

Leptogium fleigiae, *L. conglutinatum* and *L. paulistanum* were also recorded in the list of *Leptogium* at the HAS Herbarium (SpeciesLink), but these species are not published and are considered as invalid names, although they are good species. The SpeciesLink website will be updated soon.

The State of Rio Grande do Sul has the highest known diversity of *Leptogium* from Brazil with 28 cited species, but further studies are necessary and the diversity can be higher than showed here.

ACKNOWLEDGMENTS

The authors thank the curators of BM, COLO, H, SP, TUR and UPS for their effective and timely support, as well as the reviewers. The authors MJK and NMK received scholarships from Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) as post-doctorate (PNPD Program) and ASR as master degree at Universidade Federal de Mato Grosso do Sul (UFMS).

REFERENCES

- ACHARIUS E. 1814. Synopsis methodica lichenum, sistens omnes hujus ordinis naturalis detectas plantas, quas, secundum genera, species et varietates disposuit, caracteribus et differentiis emendatis definivit, nec non synonymis et observationibus selectis illustravit auctor. Lund, 392 p.
- ALVARES CA, STAPE JL, SENTELHAS PC, GONÇALVES JLM AND SPAROVEK, G. 2013. Köppen's climate classification map for Brazil. *Meteorol Z* 22(6): 711-728.
- ANSCHAU C. 2016. Atlas do Projeto VerdeSinos. Editora do Autor. Porto Alegre, 116 p.
- APTROOT A, SIPMAN HJM, KÄFFER M, MARTINS SM, FERRARO LI AND CÁCERES MES. 2014. A world key to *Stirtonia* (*Arthoniaceae*), with three new *Stirtonia* species and one new *Cryphonina* species from the Neotropics. *Lichenologist* 46(5): 673-679.
- ARAGÓN G, MARTÍNEZ I AND OTÁLORA MAG. 2004. New data on the distribution of *Leptogium azureum* (Swartz) Mont. *Lichenologist* 36(5): 345-347.
- ARAGÓN G, OTÁLORA MAG AND MARTÍNEZ I. 2005. New data on the genus *Leptogium* (lichenized *Ascomycetes*) in the Iberan Peninsula. *Nova Hedwigia* 80(1-2): 199-226.
- BENATTI MN, KITAURA MJ, DIAS IPRC AND MARCELLI MP. 2013. Cianoliquens dos gêneros *Coccocarpia*, *Collema* e *Leptogium* do Parque Estadual da Cantareira, SP, Brazil, depositados no herbário SP. *Hoehnea* 40: 131-141.
- BURGER MI AND RAMOS RA. 2007. Áreas importantes para conservação na Planície Costeira do Rio Grande do Sul. In: Becker FG et al. (Eds), *Biodiversidade. Regiões da Lagoa do Casamento e dos Butiazais de Tapes, planície costeira do Rio Grande do Sul*. Ministério do Meio Ambiente, Brasília, p. 46-56.
- DILLENIIUS JJ. 1741. *Historia Muscorum. Oxonii e Theatro Sheldoniano*, 576 p.
- DODGE CW. 1933. The foliose and fruticose lichens of Costa Rica. I. *Ann Missouri Bot Gard* 20: 373-467.
- ESCHWEILER F. 1833. *Flora Braziliensis*. Vol. I, Pars Prior. Algae, Lichenes, *Hepaticae*. Stuttgartiae et Tubingae, 292 p.
- FEUERSTEIN SC, KOCH NM, LUCHETA F, VARGAS VMF AND SILVEIRA RMB. 2016. A new species of *Graphis* (*Graphidaceae*: Lichenized *Ascomycota*) and a revised key of the genus in Rio Grande do Sul, southern Brazil. *Phytotaxa* 289(3): 271-278.
- FLEIG M. 1988. Lichens da Estação Ecológica do Taim, Rio Grande, RS, Brazil. *Napaea* 6: 916.
- FLEIG M. 1995. Lichens from "Casa de Pedra" and surrounds, Bagé, Rio Grande do Sul, Brazil. In: Fred JAD et al. (Eds), *Flechten Follmann. Contributions to lichenology in Honour*

- of Gerhard Follmann. Published by the Geobotanical and Phytotaxonomical Study Group: Germany, p. 415-426.
- FLEIG M AND GRÜNINGER W. 2000a. Levantamento preliminar dos líquens do Centro de Pesquisas e Conservação da Natureza Pró-Mata, São Francisco de Paula, Rio Grande do Sul, Brazil. *Napaea* 12: 5-20.
- FLEIG M AND GRÜNINGER W. 2000b. Líquens do Pomar Cisne Branco e arredores, São Francisco de Paula, Rio Grande do Sul, Brazil. *Iheringia Série Botânica* 53: 67-78.
- GALLOWAY DJ AND JØRGENSEN PM. 1995. The lichen genus *Leptogium* (*Collemataceae*) in Southern Chile, South America. In: Daniels FJA et al. (Eds) *Flechten Follmann. Contribution to Lichenology in Honour of Gerhard Follmann*. Published by the Geobotanical and Phytotaxonomical Study Group: Germany, p. 227-247.
- JØRGENSEN PM. 1994. Further notes on European taxa of the lichen genus *Leptogium*, with emphasis on the small species. *Lichenologist* 26(1): 1-29.
- JØRGENSEN PM. 2002. Proposals to reject the name *Collema proboscoidale* and to conserve the name *Collema phyllocarpum* with a conserved type, thereby stabilizing nomenclature of some tropical *Leptogium* species (*Collemataceae*, *Lecanorales*). *Taxon* 51(3): 567-568.
- JØRGENSEN PM AND JAMES PW. 1983. Studies on some *Leptogium* species of Western Europe. *Lichenologist* 15(2): 109-125.
- KÄFFER MI, DANTAS RV AND MARTINS SMA. 2016. Characterization of the epiphytic lichen vegetation in a riparian forest in southern Brazil. *Pl Ecol Evol* 149(1): 92-100.
- KÄFFER MI, GANADE G AND MARCELLI MP. 2007. Interações entre líquens e forófitos em quatro ambientes na FLONA de São Francisco de Paula. *Revista Brasil Bioci* 5(2): 216-218.
- KÄFFER MI, KOCH NM, APTROOT A AND MARTINS SMA. 2015. New records of corticolous lichens for South America and Brazil. *Pl Ecol Evol* 148(1): 111-118.
- KÄFFER MI, MARTINS SMA, ALVES C, PEREIRA VC, FACHEL J AND VARGAS MF. 2011. Corticolous lichens as environmental indicators in urban areas in Southern Brazil. *Ecological Indicators* 11: 1319-1332.
- KÄFFER MI, MARTINS SMA, CÁCERES MES AND APTROOT A. 2014. A New, Locally Common *Graphis* (*Graphidaceae*) species from Southern Brazil. *Cryptog Mycol* 35(3): 233-237.
- KITAURA MJ, AUGUSTO BO AND BENATTI MN. 2017. New records of *Leptogium* species in Brazil with identification key to insular species from São Paulo. *Current Research in Environmental and Applied Mycology* 7(2): 129-143.
- KITAURA MJ AND MARCELLI MP. 2012. The *Leptogium juressianum* complex in southeastern Brazil. *Mycotaxon* 120: 215-221.
- KITAURA MJ AND MARCELLI MP. 2013. A revision of *Leptogium* species with spherical-celled hairs (section *Mallotium* p.p.). *Bryologist* 116: 15-27.
- KITAURA MJ, MARCELLI MP, HORA BR AND JUNGBLUTH P. 2015. *Leptogium denticulatum* (*Collemataceae*, lichenized *Ascomycota*) and some morphologically related species. *Bryologist* 118: 11-21.
- KITAURA MJ, MARCELLI MP, JUNGBLUTH P AND HORA BR. 2013. Five supposedly well-known species of *Leptogium* section *Mallotium*. *Mycosphere* 4(3): 520-530.
- KITAURA MJ, MARCELLI MP, KÄFFER MI AND MARTINS SMA. 2014. A new hairy *Leptogium* (section *Mallotium*) from Rio Grande do Sul State, Brazil. *Hoehnea* 41: 305-308.
- KOCH NM, BRANQUINHO C, MATOS P, PINHO P, LUCHETA F, MARTINS SMA AND VARGAS VM. 2016. The application of lichens as ecological surrogates of air pollution in the subtropics: a case study in South Brazil. *Environ Sci Pollut Res Int* 23(20): 20819-20834.
- KOCH NM, MARTINS SMA, LUCHETA F AND MÜLLER SC. 2013. Functional diversity and traits assembly patterns of lichens as indicators of successional stages in a tropical rainforest. *Ecol Indic* 34: 22-30.
- LUCHETA F AND MARTINS SMA. 2014. Líquens foliosos e fruticosos corticícolas do Jardim Botânico de Porto Alegre, RS, Brasil. *Iheringia Série Botânica* 69(1): 29-35.
- LÜCKING R ET AL. 2017a. Turbo-taxonomy to assemble a megadiverse lichen genus: seventy new species of *Cora* (*Basidiomycota: Agaricales: Hygrophoraceae*), honouring David Leslie Hawksworth's seventieth birthday. *Fung Diversity* 84(1): 139-207.
- LÜCKING R, HODKINSON BP AND LEAVITT SD. 2017b. Corrections and amendments to the 2016 classification of lichenized fungi in the *Ascomycota* and *Basidiomycota*. *Bryologist* 120(1): 58-69.
- MALME GOA. 1924. Die Collematazeen des Regnellischen Herbars. *Ark Bot* 19(8): 1-29.
- MARCELLI MP. 2002. Checklist of lichens and lichenicolous fungi from Brazil. Version 1. Available at: http://www.uni-hamburg.de/biologie/ialb/herbar/brazi_f2.htm. Accessed on August, 2004.
- MAZZITELLI SMAM, KÄFFER MI AND CARDOSO N. 1999. Líquens corticícolas de Porto Alegre, Rio Grande do Sul, Brazil. *Iheringia Série Botânica* 52: 55-63.
- MICHELI PA. 1729. *Nova Plantarum Genera*. Florentiae, 234 p.
- MÜLLER ARGOVIENSIS J. 1879. *Lichenologische Beiträge* VIII, IX. *Flora* 62(11): 161-169.
- MÜLLER ARGOVIENSIS J. 1881. *Lichenologische Beiträge*, XII. *Flora* 64: 81-88.
- OSORIO HS. 1981. Contribution to the lichen Flora of Brazil. VIII. Lichens from Morro do Coco, Viamão, Rio Grande do Sul. *Phytologia* 48(1): 72-76.

- OSORIO HS. 1985. Contribution to the lichen Flora of Brazil. XIV. Lichens from Gramado, Rio Grande do Sul State. *Int J Mycol Lichenol* 2(1): 43-50.
- OSORIO HS, AGUIAR LW AND HOMRICH MH. 1981. Contribution to the lichen Flora of Brazil. VI. New or additional records from Rio Grande do Sul State. *Bryologist* 84(1): 79-81.
- OSORIO HS, AGUIAR LW AND MARTAU L. 1997. Contribuição à Flora líquenica do Brasil XXXIII. Líquens do Estado do Rio Grande do Sul: Depressão Central. *Iheringia Série Botânica* 49: 11-20.
- OSORIO HS, BAGINSKI LC AND PINHEIRO LP. 1983. Contribution to the lichen Flora of Brazil. XII. Lichens from São Jerônimo, Rio Grande do Sul. *Phytologia* 53(3): 194-196.
- OSORIO HS AND FLEIG M. 1982. Contribution to the lichen Flora of Brazil. IX. Lichens from the municipality of Torres, Rio Grande do Sul. *Mycotaxon* 14(1): 347-350.
- OSORIO HS AND FLEIG M. 1984a. Contribution to the lichen Flora of Brazil. XV. Lichens from Torre Sul and Morro Itapeva, Torres, Rio Grande do Sul State. *Comun Bot Mus Hist Nat Montevideo* 67(IV): 1-7.
- OSORIO HS AND FLEIG M. 1984b. Contribution to the lichen Flora of Brazil. XIII. *Int J Mycol Lichenol* 1(3): 273-279.
- OSORIO HS AND FLEIG M. 1985. Contribution to the lichen Flora of Brazil. XVI. Lichens from the vicinity of Rio Grande City, Rio Grande do Sul State. *Comun Bot Mus Hist Nat Montevideo* 70(IV): 1-7.
- OSORIO HS AND FLEIG M. 1987. Contribution to the lichen Flora of Brazil. XIX. New or additional records from Santa Maria, Rio Grande do Sul. *Comun Bot Mus Hist Nat Montevideo* 81(V): 1-8.
- OSORIO HS AND FLEIG M. 1988. Contribution to the lichen Flora of Brazil. XX. Additional records from São Francisco de Paula, Rio Grande do Sul State. *Comun Bot Mus Hist Nat Montevideo* 85(V): 1-7.
- OSORIO HS AND FLEIG M. 1989. Contribution to the lichen Flora of Brazil. XXV. Lichens from Parque Nautico, Santa Maria, Rio Grande do Sul. *Comun Bot Mus Hist Nat Montevideo* 89(V): 1-4.
- OSORIO HS AND FLEIG M. 1990b. Contribution to the lichen Flora of Brazil. XXIV. Lichens from Nova Petrópolis, Rio Grande do Sul. *Mycotaxon* 36(2): 325-327.
- OSORIO HS AND FLEIG M. 1991. Contribution to the lichen Flora of Brazil. XXVIII. Lichens from northern Santa Maria, Rio Grande do Sul State. *Comun Bot Mus Hist Nat Montevideo* 96(V): 1-7.
- OSORIO HS AND FLEIG M. 1994. Contribution to the lichen Flora of Brazil. XXXI. Lichens from Júlio de Castilhos, Rio Grande do Sul State. *Comun Bot Mus Hist Nat Montevideo* 101(V): 1-7.
- OTÁLORA MAG, JØRGENSEN PM AND WEDIN M. 2014. A revised generic classification of the jelly lichens, *Collemataceae*. *Fung Diversity* 64: 275-293.
- OTÁLORA MAG, MARTÍNEZ I, MOLINA MC, ÁRAGON G AND LUTZONI F. 2008. Phylogenetic relationship and taxonomy of the *Leptogium lichenoides* group (*Collemataceae*, *Ascomycota*) in Europe. *Taxon* 57(3): 907-921.
- PERSOON CH. 1826. Lichens et Champignons. In: Freycinet ML (Ed), *Voyage autour du monde, exécuté sur les corvettes l'Uranie et la Physicienne, sur les ordres du Cap. L. de Freycinet, en 1817-1820: Partie botanique*. Paris, p. 203.
- SEVEGNANI L AND BAPTISTA LMR. 1996. Composição florística de uma floresta secundária no âmbito da Floresta Atlântica, Maquiné, RS. *Sellowia* 45-48: 47-71.
- SIERK HA. 1964. The genus *Leptogium* in North America North of Mexico. *Bryologist* 67(3): 245-317.
- SPIELMANN AA. 2006. Checklist of lichens and lichenicolous fungi of Rio Grande do Sul (Brazil). *Caderno de Pesquisa. Série Biologia* 18(2): 7-125.
- STONE DF, HINDS JW, ANDERSON FL AND LENDEMER JC. 2016. A revision of the *Leptogium saturninum* group in North America. *Lichenologist* 48(5): 387-421.
- VAINIO EA. 1890. Étude sur la classification naturelle et la morphologie des lichens du Brésil. *Acta Soc Fauna Fl Fenn.* 236 p.
- VERDON D. 1992. *Leptogium*. In: *Flora of Australia* 54. Available at: http://www.anbg.gov.au/abrs/lichenlist/FLORA%2054/Leptog_molluc.html. Accessed on July 5, 2017.
- ZAHLBRUCKNER A. 1908. Beiträge zur Flechtenflora Brazieliens. *Bull Herb Boissier* 8: 459-468.
- ZANETTE VC, AGUIAR LW, MARTAU L, MARIATH JEA AND OSORIO HS. 1981. Estudo fitossociológico de líquens numa área localizada nos Municípios de Montenegro e Triunfo, Rio Grande do Sul, Brazil. *Iheringia Série Botânica* 28: 107-140.