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Contribution to the knowledge of lichenized mycota from Southern Brazil. I – Species of *Ramboldia* (Ascomycota: Lecanoraceae)

Contribuição ao conhecimento da micota liquenizada do sul do Brasil. I – Espécies de Ramboldia *(Ascomycota: Lecanoraceae)*

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ABSTRACT
Ramboldia, a genus of lichen-forming fungi, is represented by lecideoid species with a *Lecanora*-type ascus and simple and persistently hyaline ascospores. Although probably common in Brazilian mycota, species of *Ramboldia* remains poorly recorded in the country. The collections and analyses of specimens followed the standard protocols in lichenology. Here are reported five new records to two States of Southern Brazil. *Ramboldia haematites* are new record to State of Santa Catarina and both, *R. heterocarpa* and *R. russula*, are new records to Santa Catarina and to State of Paraná. Descriptions, comments, figures and a key to Brazilian species are given.
Keywords: Crustose thallus; lichen; *Lecidea*, *Pyrrhospora*; taxonomy.

RESUMO
Ramboldia, um gênero de fungos liquenizados, é representado por espécies lecideoides que apresentam ascos tipo-*Lecanora*, bem como ascósporos simples e persistentemente hialinos. Embora provavelmente comuns na micota brasileira, espécies de *Ramboldia* permanecem pobremente registradas para o país. As coletas e as análises dos espécimes seguiram metodologia padrão em liquenologia. Neste artigo são registradas pela primeira vez cinco novas ocorrências para dois estados do sul do Brasil. *Ramboldia haematites* é registrada para Santa Catarina, e *R. heterocarpa* e *R. russula* são novos registros para os estados de Santa Catarina e do Paraná. Descrições, comentários, figuras e uma chave para a identificação das espécies brasileiras são fornecidos.
Palavras-chave: Talo crostoso; líquen; *Lecidea*; *Pyrrhospora*; taxonomia.

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INTRODUCTION

Ramboldia Kantvilas & Elix is represented by lecideoid species with *Lecanora*-type ascus, anastomosing paraphyses, and with simple and persistently hyaline ascospores. Some species have orange to red pigmented apothecia due to the presence of russulone and related anthraquinones (KANTVILAS; ELIX, 1994; KALB *et al.*, 2008). The genus is very similar to *Pyrrhospora* Körb., however, *Ramboldia* have narrowly ellipsoid to bacillar ascospores that remain hyaline, and the apothecial chemistry presents russulone or haematommone, while *Pyrrhospora* have ascospores broadly ellipsoid, hyaline becoming brownish, and the apothecial chemistry presents 7-chloroemodin and xanthones (KALB *et al.*, 2008).

The genus is cosmopolite (KALB *et al.*, 2008; 2009) and occurs in cool-temperate to tropical regions (ELIX, 2009), growing on bark, decorticated wood or rock (KANTVILAS; ELIX, 1994; ELIX, 2009).

There are 26 species distributed around the world of which four are known to Brazil (*e.g.*, KANTVILAS; ELIX, 1994; CÁCERES, 2007; KALB *et al.*, 2008). *Ramboldia russula* (Ach.) Kalb was recorded to States of Bahia (KALB *et al.*, 2008), Minas Gerais (APTROOT, 2002), Pernambuco (CÁCERES, 2007) and Rio Grande do Sul (*e.g.*, OSORIO; HOMRICH, 1978; OSORIO; FLEIG, 1983; FLEIG, 1988; SPIELMANN, 2006); *R. haematites* (Fée) Kalb was recorded to States of Pernambuco, Sergipe (CÁCERES, 2007), Rio de Janeiro, São Paulo (KALB *et al.*, 2008), Alagoas (MENEZES *et al.*, 2011) and Rio Grande do Sul (KÄFFER *et al.*, 2011); *R. quaesitica* Elix & Kalb was recorded to States of Goiás and Rio de Janeiro (KALB *et al.*, 2008); and *R. heterocarpa* (Fée) Kalb was recorded only to State of Rio de Janeiro (KALB *et al.*, 2008).

MATERIAL AND METHODS

The specimens were collected according to Hale (1979) and Cáceres (2007). When necessary, fragments of rocks containing the specimens were collected using chisel and hammer. Specimens were examined using standard stereoscopic (20-40x) and light microscopic (400-1000x) techniques. Sections of thalli, ascomata and pycnidia were mounted in water. Chemical constituents were identified by spot tests, under UV light, microcrystallization and thin layer chromatography (TLC) using solvent system C (HUNECK; YOSHIMURA, 1996; ORANGE *et al.*, 2001).

RESULTS AND DISCUSSION

Three species of *Ramboldia* were found, of which *R. haematites* is a new record to State of Santa Catarina; and both *R. heterocarpa* and *R. russula* are new records to State of Paraná and Santa Catarina. All species are similar in thallus morphology and apothecial anatomy, however, chemical constituents allied with substrate features help to distinguish the species.

Key to the species of *Ramboldia* recorded to Brazil
1. Thallus saxicolous, rimose-areolate, up to 650 µm thick ..... *R. heterocarpa*
1. Thallus corticolous, mainly continuous, up to 330 µm thick 2
2. Thallus K+ yellow turning red; norstictic acid present ..... *R. haematites*
2. Thallus K- or K+ dirty yellowish; fumarprotocetraric acid present 3
3. Thallus up to 30 cm wide, with quaesitic acid ..... *R. quaesitica* (not treated here)
3. Thallus up to 6 cm wide, without quaesitic acid ..... *R. russula*

RAMBOLDIA HAEMATITES (FÉE) KALB, LUMBSCH & ELIX, NOVA HEDWIGIA 86(1-2): 33. 2008 ≡ *LECIDEA HAEMATITES* FÉE, BULL. SOC. BOT. FR. 20: 317. 1873; *FIDE* KALB *ET AL*. (2008) (FIGURE 1)

Brief description: Thallus grayish-white to greenish-white, mainly continuous to smoothly rimose, 90-150 µm thick, up to 1.2 cm wide; upper surface smooth to rough. Vegetative propagules absent. Prothallus not seen. Apothecia sessile, mainly round, plane to convex, 0.1-1.3 mm wide; disc orange-red to red-brown, epruinose; margin concolorous with the disc; exciple red, K+ purple. Epihymenium 10-

14 µm thick, reddish; hymenium 30-45 µm thick, colourless; subhymenium 20-35 µm thick, colourless; hypothecium 56-105 µm thick, pale brown. Ascospores colourless, simple, ellipsoid, 8-11 x 3-4 µm. Pycnidia not found.

Chemistry: K+ yellow → red or K-, C–, UV+ yellow. Lichexanthone, secalonic acid A (±), norstictic acid, connorstictic acid (±) and russulone detected by TLC.

Distribution: This species is known to America, Africa, Australia and to New Caledonia (KALB *et al.*, 2008; ELIX, 2009).

Ramboldia haematites is characterized by the mainly continuous thallus, up to 150 µm thick and by the production of norstictic acid. The specimens were found in open places on cortex of palm trees in a disturbed area.

Cáceres (2007, as *Pyrrhospora haematites* (Fée) Kalb *nom. nudum*) and Kalb *et al.* (2008) asserted that *Ramboldia haematites* shows a preference to exposed situations (like in savannas and monsoon forests), while *R. russula* prefers somewhat shady places in rain forests or in gallery forests, what agree with the collections of both species.

Specimens examined: BRAZIL, State of Santa Catarina, Municipality of Fraiburgo, margin of the highway SC 453, corticolous, on palm tree, 18.VII.2013, E. Gumboski 4751 (UPCB), 4752 (JOI).

Additional specimen examined: BRAZIL, State of São Paulo, Municipality of Botucatu, cerrado, corticolous, 15.VII.2009, E. Gumboski 1538 (JOI).

Figure 1 – *Ramboldia haematites* (E. Gumboski 4752). Scale bars = 1.0 cm

RAMBOLDIA HETEROCARPA (FÉE) KALB, LUMBSCH & ELIX, NOVA HEDWIGIA 86 (1-2): 34. 2008 ≡ *LECIDEA HETEROCARPA* FÉE, BULL. SOC. BOT. FR. 20: 316. 1873; *FIDE* KALB *ET AL*. (2008)
(figures 2 and 3)

Brief description: Thallus greenish-white to yellowish-white, rimose-areolate, 320-650 µm thick, up to 8.5 cm wide; upper surface rough to verruculose. Vegetative propagules absent. Prothallus not seen. Apothecia sessile, round to irregular, concave to convex, 0.2-1.6 mm wide; disc orange-red to red, epruinose; margin concolorous with the disc; exciple red, K+ purple. Epihymenium 15-24 µm thick, reddish; hymenium 45-72 µm thick, colourless; subhymenium 38-50 µm thick, colourless; hypothecium 60-110 µm thick, pale brown to brow. Ascospores colourless, simple, ellipsoid, 8-12 x 3-4 µm. Pycnidia not found.

Chemistry: K-, C–, UV+ yellow. Lichexanthone, secalonic acid A, fumarprotocetratic acid, protocetratic acid (±) and russulone detected by TLC.

Distribution: This species is known to Central and South America and to Africa (KALB *et al.*, 2008; BUNGARTZ *et al.*, 2013).

The rimose-areolate thallus up to 650 µm thick (sometimes exceeding 1 mm thick according to Kalb *et al.*, 2008) with production of lichexanthone and fumarprotocetraric acid are the main features that distinguish *R. heterocarpa* from the other species discussed here.

Kalb *et al.* (2008) mentioned that *Ramboldia heterocarpa* is chemically similar to *R. russula*. However, *R. heterocarpa* presents a thicker and rimose-areolate thallus while *R. russula* presents a thinner and continuous thallus. The authors complement asserting that *R. heterocarpa* is a species

of open sclerophyll forests where it is growing on or near the tops of acidic boulders fully exposed up to 3.500 m alt., while *R. russula* has its main occurrence on bark of trees in or at the margins of rainforests.

The specimens of *Ramboldia heterocarpa* studied here were found only in high-altitude environments ("campos de altitude") from 1.000 up to 1.300 m alt., and the specimens of *R. russula* were found from sea level up to 1.000 m alt.

Specimens examined. BRAZIL, State of Paraná, Municipality of Guaratuba, Morro dos Perdidos, aprox. 1300 m alt., 25º53'11''S, 48º57'33''O, saxicolous, campos de altitude, 03.IV.2013, E. Gumboski; A.C.L. Gerlach & S. Eliasaro 4547, 4554 (UPCB); State of Santa Catarina, Municipality of Santo Amaro da Imperatriz, Parque Estadual do Tabuleiro, floresta ombrófila densa montana, saxicolous, 26º14'S, 48º50'W, 13.VIII.2011, E. Gumboski; F. Beilke; A. M. Charnei & A. C. L. Gerlach 2357, 2448 (JOI); Municipality of Campo Alegre, Campos do Quiriri, saxicolous, campos de altitude, 30.IV.2012, E. Gumboski 3570, 3571, 3582, 3601, 3604, 3612, 3622 (JOI), ibid., 17.XI.2012, E. Gumboski 4191 (JOI).

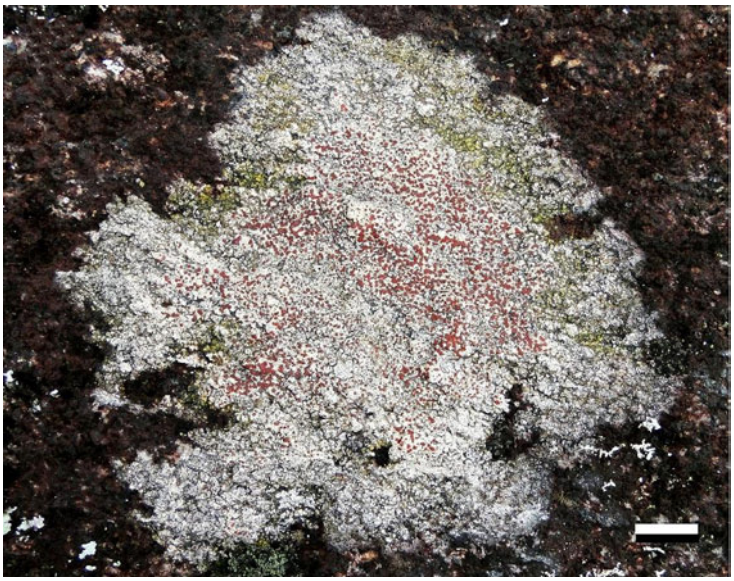

Figure 2 – *Ramboldia heterocarpa* in field. Scale bars = 1.0 cm.

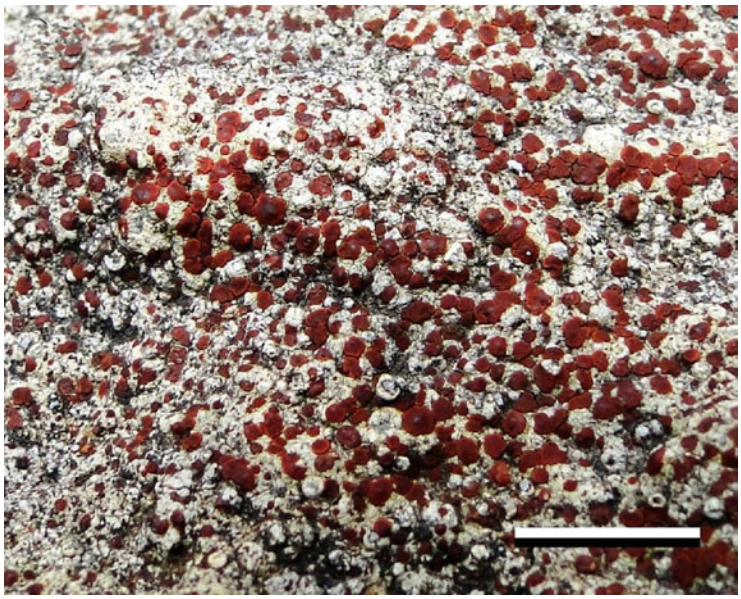

Figure 3 – *Ramboldia heterocarpa* (E. Gumboski *et al*. 4547). Scale bars = 1.0 cm.

RAMBOLDIA RUSSULA (ACH.) KALB, LUMBSCH & ELIX, NOVA HEDWIGIA 86(1-2): 37. 2008 ≡ *LECIDEA RUSSULA* ACH., METHOD. LICH.: 61. 1803; *FIDE* KALB *ET AL*. (2008)
(figure 4)

Brief description: Thallus pale green to grayish, continuous, 80-330 µm thick, up to 2.6 cm wide; upper surface smoothly rough to verruculose. Vegetative propagules absent. Prothallus not seen. Apothecia sessile, round to mainly irregular, plane to convex, 0.3-1.5 mm wide; disc orange-red to bright red, epruinose; margin concolorous with the disc; exciple red, K+ purple. Epihymenium 6-12 µm thick, reddish; hymenium 40-52 µm thick, colourless; subhymenium 22-40 µm thick, colourless, hypothecium 55-112 µm thick, pale brown to brown. Ascospores colourless, simple, ellipsoid, 8-12 x 3-4 µm. Pycnidia black, infrequent; conidia filiform, colourless, smooth to clearly curved, 20-25 x 1 µm.

Chemistry: K- or K+ dirty yellow, C–, UV+ yellow. Fumarprotocetratic acid, lichexanthone, secalonic acid A (±) and russulone detected by TLC.

Distribution: The species is known to America, Africa and Asia (*e.g.*, WEI, 1991; CALVELO; LIBERATORE, 2002; RYAN *et al.*, 2004; BOCK *et al.*, 2007; KALB *et al.*, 2008).

Ramboldia russula is characterized by the fumarprotocetratic chemotype (absence of norstictic acid) allied with a continuous and a thin thallus. For more comments see in *R. haematites* and *R. heterocarpa*.

Specimens examined: BRAZIL, State of Paraná, Municipality of Paranaguá, Parque Estadual da Ilha do Mel, restinga, corticolous, 27.VIII.2009, E. Gumboski & S. Eliasaro IM 89, IM 101 (JOI); Municipality of Guaratuba, Morro dos Perdidos, aprox. 1.000 m alt. 25º52'57''S, 48º57'48''W, corticolous, 03.VI.2013, E. Gumboski 4410 (JOI); State of Santa Catarina, Municipality of São Bento do Sul, Sertãozinho road, near to church of Vila Piltz, rural area, corticolous, 20.VII.2012, E. Gumboski 3664 (JOI); Municipality of Major Vieira, perpendicular road to the BR-116 highway, 23.IX.2012, E. Gumboski 4044 (JOI).

Additional specimens examined: BRAZIL, State of Minas Gerais, Municipality of Belo Horizonte, Parque Mangabeiras, 11.VIII.1993, Equipe Brandt s.n. (UPCB).

Figure 4 – *Ramboldia russula* (E. Gumboski 3664). Scale bars = 1.0 cm.

CONCLUSION

Although the presence of species of *Ramboldia* appears to be relatively common in several Brazilian environments (see comments in Cáceres, 2007, p. 142), the first records of the species for both States (Paraná and Santa Catarina) highlights the lack of data on Brazilian lichenized mycota, and reinforces the need for inventories.

Due to the similarities of the species and the recent recircumscription of the genus (KALB *et al.*, 2008), many citations of Brazilian specimens of *Ramboldia russula* requires revision [like in Vainio

(1890) and several citations for the State of Rio Grande do Sul [see Spielmann, 2006, as *Pyrrhospora russula* (Ach.) Hafellner)], because it is very probable that more species have been retained under the name of *R. russula*.

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