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Tian QING

Center of Excellence in Fungal Research, Mae Fah Luang University 333 M. 1 T.Tasud Muang District, Chiang Rai 57100 (Thailand)

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Franck RICHARD

Université de Montpellier II, CEFE/CNRS Campus du CNRS, 1919, route de Mende, 34293 Montpellier Cedex 5 (France)

Naritsada THONGKLANG

Center of Excellence in Fungal Research, Mae Fah Luang University, 333 M. 1 T.Tasud Muang District, Chiang Rai 57100 (Thailand)

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CAS Key Laboratory for Plant Diversity and Biogeography of East Asia, Kunming Institute of Botany, Chinese Academy of Sciences, Lanhei Road 132, Kunming 650201, P. R. (China)

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New crustose lichens from a tropical coastal area in Paraná (Brazil)

André APTROOT
Maria Fernanda SOUZA

Universidade Federal de Mato Grosso do Sul, Instituto de Biociências, Laboratório de Botânica
Liquenologia, Av. Costa e Silva, s/n, 79070-900, Campo Grande, MS (Brazil)
andreaptroot@gmail.com (corresponding author)

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ABSTRACT

Four new crustose lichens are described from the coastal area in Paraná (Brazil): *Cryptothecia duplofluorescens* Aptroot & M.F.Souza, sp. nov., *Herpothallon purpureum* Aptroot & M.F.Souza, sp. nov., *Myriostigma xanthominiatum* Aptroot & M.F.Souza, sp. nov., and *Wirthiotrema xanthopustulatum* Aptroot & M.F.Souza, sp. nov. In addition, a list is given of the 111 species that were newly recorded from the state, including nine species that are first records from Brazil. The significance of lichexanthone is discussed.

RÉSUMÉ

Nouveaux lichens crustacés d'une zone côtière tropicale du Paraná (Brésil).

Quatre nouveaux lichens crustacés sont décrits de la zone côtière de Paraná (Brésil): *Cryptothecia duplofluorescens* Aptroot & M.F.Souza, sp. nov., *Herpothallon purpureum* Aptroot & M.F.Souza, sp. nov., *Myriostigma xanthominiatum* Aptroot & M.F. Souza, sp. nov., et *Wirthiotrema xanthopustulatum* Aptroot & M.F.Souza, sp. nov. En outre, une liste des 111 espèces qui ont été nouvellement enregistrées dans l'État, y compris neuf espèces qui sont les premiers enregistrements du Brésil, est donnée. L'importance de la lichexanthone est discutée.

KEY WORDS

Graphidaceae,
Arthoniaceae,
lichexanthone,
Atlantic rain forest,
new species.

MOTS CLÉS

Graphidaceae,
Arthoniaceae,
lichexanthone,
forêt tropicale atlantique,
espèces nouvelles.

INTRODUCTION

Tropical trees are often almost totally covered with lichens (and other epiphytes). One of the common elements are the white, usually largely sterile, crusts. The taxonomy of these is still badly known, and most of the species are probably still undescribed. We investigated the lichen flora on a small farm (“chácara”) in Guaraqueçaba in the a coastal region of Paraná state in Brazil, which is situated inside a reserve of Atlantic rain forest, viz. Area de Proteção Ambiental Guaraqueçaba and contains small patches of such forest. Fewer collections were made in adjacent areas and in Curitiba proper. Among the species found, were found several crustose lichens that are new to science, mostly belonging to the above-mentioned sterile white crusts.

MATERIAL AND METHODS

Specimens were distinguished in the field by a Leuchtlupe with 365 nm UV and LED, and collected using Opinel knives, and subsequently air dried in a room with air conditioning. Specimens were examined with AK3ST stereomicroscope and sections observed under a Motic compound microscope. Pictures were made with an iPhone 11, sometimes through the Leuchtlupe. Lugol’s solution was applied for IKI, and 10 % KOH in water for K, commercial thick bleach for C, and stable Steiner’s solution for P. All specimens are preserved in herbarium CGMS, with a few duplicates in ABL.

RESULTS

Four new species are described below. All of them were already recognized as undescribed species in the field, based on the combination of their morphology and fluorescence in UV light. The species are described below. In addition, a list of the 111 species is given, which were identified but have not previously been recorded from the state, including nine species that are first records from Brazil. So far, 504 lichen species were reported from Paraná, mostly macrolichens (e.g. Eliasaro & Adler 2000), Graphidaceae (e.g. Feuerstein & Eliasaro 2015) and foliicolous lichens (e.g. Lücking 2008). The foliicolous lichens are from the Iguaçu area, and were mostly reported erroneously to originate from Santa Catarina state by Lücking (2008). Apparently no more or less complete lichen inventories, including microlichens, have been previously published from any locality in Paraná, but some large microlichen are reported by Eliasaro *et al.* (2012). Therefore, for instance no species of common and conspicuous genera like *Calicium* Pers., *Candelaria* A. Massal., *Coniocarpon* DC., *Diploschistes* Norman, or *Hyperphyscia* Müll. Arg. seem to have been previously reported. In addition, in Table 1 a list is given of the 118 further species that were identified but have not previously been recorded from the state of Paraná, including ten species that are first records from Brazil.

Family ARTHONIACEAE Rchb.
Genus *Cryptothecia* Stirt.

Cryptothecia duplofluorescens
Aptroot & M.F. Souza, sp. nov.
(Fig. 1A-C)

Corticolous sterile *Cryptothecia* with thallus pale ochraceous, dull, thin, containing lichexanthone, soralia delimited, containing 2'-O-methylmicrophyllinic acid, soredia globose to short ellipsoid, c. 25-40 µm diam, often with thin protruding hyphae.

MYCOBANK. — MB839446.

TYPE. — Brazil, Paraná, Guaraqueçaba, Tagaçaba Porto da Linha, road PR-405 km 36.2, at right side of road, in chácara (property of Donald Schause), 14.X.2020, alt. 15 m, on palm tree bark, *A. Aptroot & M.F. Souza 82161* (holo-, CGMS; iso-, ABL).

ADDITIONAL MATERIAL STUDIED. — Same details, *A. Aptroot & M.F. Souza 82090* (CGMS).

DESCRIPTION

Thallus corticolous, pale ochraceous, dull, thin, IKI negative, covering an area of up to 4 cm diam., surrounded by a c. 0.2 mm wide brown hyphal prothallus line. Algae trentepohlioid, orange, c. 10-17 µm diam. Soralia delimited, patchy, covering about half of the thallus surface. Soredia globose to short ellipsoid, IKI negative, filled with small crystals, c. 25-40 µm diam, often with thin protruding hyphae. Ascomata and pycnidia not observed.

CHEMISTRY. — Thallus C-, K-, P-, UV+ yellow, with lichexanthone; soralia UV+ white, with 2'-O-methylmicrophyllinic acid. The substance 2'-O-methylmicrophyllinic acid and lichexanthone were demonstrated by tlc.

DISCUSSION

Cryptothecia Stirt. is a genus with c. 65 accepted species (Jagadeesh Ram & Sinha 2016). The current species is characterized by the combination of two secondary substances that luoresce differently in UV light, one substance in the thallus and the other substance in the soredia. It gives a very characteristic view already in the field (under UV light). As the species is only known sterile, typical *Cryptothecia* characters such as the scattered asci; thus the species is provisionally included in the genus, because it shows many similarities with the type species.

Genus *Herpothallon* Tobler

Herpothallon purpureum Aptroot & M.F. Souza, sp. nov.
(Fig. 1G, H)

Foliicolous sterile *Herpothallon* with thallus grey mottled with purple, containing chiodectonic acid, surrounded by a dark purple prothallus line, pseudoisidia globose, 0.1-0.2 mm diam. and high, purple, in dense clusters.

MYCOBANK. — MB839447.

TABLE 1. — List of identified species newly reported here from Brazil or Paraná state. **loc 1**, Guaraqueçaba, Tagaçaba Porto da Linha, road PR–405 km 36.2, at right side of road, in chácara (property of Donald Schause); 14–16.X.2020, 25°13'19"S, 48°27'22"W, alt. 15 m; **loc 2**, Guaraqueçaba, Tagaçaba Porto da Linha, road PR–405 km 36.2, at left side of road, behind Roman–Catholic church; 16.X.2020, 25°13'07"S, 48°27'23"W, alt. 75 m; **loc 3**, Antonina, Lageado, road PR–405 km 9.2, at right side of road, in "Reserva Natural Guaricica" (property of the NGO "Sociedade de Pesquisa em Vida Selvagem e Educação Ambiental" = S.P.V.S.); 17.XII.2020, 25°18'55"S, 48°39'36"W, alt. 20 m; **loc 4**, Curitiba, bairro Uberaba, in "Parque Municipal do Centenário da Imigração Japonesa no Brasil"; 17.XII.2020, 25°30'17"S, 49°12'19"W, alt. 875 m; **loc 5**, Curitiba, city center; 18.XII.2020, 25°27'S, 49°17'W, alt. 900 m.

new to	species name	collectors	coll. no.	loc	substratum
PR	<i>Agonimia opuntiella</i> (Poelt & Buschardt) Vězda	leg. A. Aptroot & M.F. Souza	82152	1	bark
PR	<i>Agonimia tenuiloba</i> Aptroot & M. Cáceres	leg. A. Aptroot & M.F. Souza	82253	5	bark
PR	<i>Agonimia tristicula</i> (Nyl.) Zahlbr.	leg. A. Aptroot & M.F. Souza	82011	1	bark
PR	<i>Allographa chlorocarpa</i> (Fée) Lücking & Kalb	leg. A. Aptroot & M.F. Souza	82133	1	bark
PR	<i>Allographa obtectostriata</i> (Käffer & Aptroot) Lücking & Kalb	leg. A. Aptroot & M.F. Souza	82115	1	wood
first Brazil	<i>Allographa vestita</i> (Fr.) Lücking & Kalb	leg. A. Aptroot & M.F. Souza	82071	1	bark
PR	<i>Anisomeridium foliicola</i> R. Sant. & Tibell	leg. M.F. Souza & A. Aptroot	284	1	living leaves
PR	<i>Anomomorpha turbulenta</i> (Nyl.) Hue	leg. A. Aptroot & M.F. Souza	82103	1	bark
PR	<i>Aspidothelium cinerascens</i> Vain.	leg. M.F. Souza & A. Aptroot	285	1	living leaves
PR	<i>Astrothelium macrocarpum</i> (Fée) Aptroot & Lücking	leg. A. Aptroot & M.F. Souza	82096	1	bark
PR	<i>Astrothelium neoinspersum</i> Aptroot	leg. A. Aptroot & M.F. Souza	82078	1	bark
PR	<i>Astrothelium ocellatum</i> Malme	leg. A. Aptroot & M.F. Souza	82121	1	bark
PR	<i>Astrothelium scoria</i> (Fée) Aptroot & Lücking	leg. A. Aptroot & M.F. Souza	82194	1	bark
PR	<i>Astrothelium vitrisporum</i> Aptroot & M. Cáceres ined.	leg. A. Aptroot & M.F. Souza	82108	1	bark
PR	<i>Bacidina neotropica</i> Lücking	leg. M.F. Souza & A. Aptroot	303	1	living leaves
PR	<i>Buellia griseovirens</i> (Turner & Borrer ex Sm.) Almb.	leg. A. Aptroot & M.F. Souza	82254	5	bark
PR	<i>Byssolecania fumosonigricans</i> (Müll. Arg.) R. Sant.	leg. M.F. Souza & A. Aptroot	292	1	living leaves
PR	<i>Byssoloma chlorinum</i> (Vain.) Zahlbr.	leg. M.F. Souza & A. Aptroot	248	1	living leaves
PR	<i>Calicium hyperelloides</i> Nyl.	leg. A. Aptroot & M.F. Souza	82208	1	bark
PR	<i>Calopadia subcoerulescens</i> (Zahlbr.) Vězda	leg. A. Aptroot & M.F. Souza	82188	1	bark
PR	<i>Candelaria concolor</i> (Dicks.) Stein	leg. A. Aptroot & M.F. Souza	82259	4	bark of Prunus
PR	<i>Chrysothrix xanthina</i> (Vain.) Kalb	leg. A. Aptroot & M.F. Souza	82083	1	bark
PR	<i>Coccocarpia domingensis</i> Vain.	leg. M.F. Souza & A. Aptroot	280	1	living leaves
PR	<i>Coccocarpia epiphylla</i> (Fée) Müll. Arg.	leg. A. Aptroot & M.F. Souza	82100	1	bark
PR	<i>Coccocarpia palmicola</i> (Spreng.) L. Arvidss. & D.J. Galloway	leg. A. Aptroot & M.F. Souza	82061	1	bark
PR	<i>Coccocarpia prostrata</i> Lücking, Aptroot & Sipman	leg. A. Aptroot & M.F. Souza	82120	1	bark
PR	<i>Coenogonium barbatum</i> Lücking, Aptroot & Umaña	leg. M.F. Souza & A. Aptroot	272	1	living leaves
PR	<i>Coenogonium strigosum</i> Rivas Plata, Lücking & Chaves	leg. A. Aptroot & M.F. Souza	82095	1	sheltered siliceous rock
PR	<i>Coenogonium subdentatum</i> (Vězda & G. Thor) Rivas Plata, Lücking, Umaña & Chaves	leg. A. Aptroot & M.F. Souza	82107	1	bark
PR	<i>Coniocarpon cinnabarinum</i> DC.	leg. A. Aptroot & M.F. Souza	82186	1	bark
PR	<i>Constrictolumina cinchonae</i> (Ach.) Lücking, M.P. Nelsen & Aptroot	leg. A. Aptroot & M.F. Souza	82278	4	bark of Prunus
PR	<i>Crocodia clathrata</i> (De Not.) Trevis.	leg. A. Aptroot & M.F. Souza	82159	1	bark
PR	<i>Crypthonia albida</i> (Fée) Frisch & G. Thor	leg. A. Aptroot & M.F. Souza	82220	1	bark
PR	<i>Cryptothecia effusa</i> (Müll. Arg.) R. Sant.	leg. M.F. Souza & A. Aptroot	290	1	living leaves
first Brazil	<i>Cryptothecia inexpectata</i> G. Thor	leg. M.F. Souza & A. Aptroot	255	1	living leaves
PR	<i>Dictyonema phylogenum</i> (Müll. Arg.) Zahlbr.	leg. M.F. Souza & A. Aptroot	282	1	living leaves
PR	<i>Dictyonema sericeum</i> (Sw.) Berk.	leg. A. Aptroot & M.F. Souza	82126	1	bark
PR	<i>Diploschistes hypoleucus</i> (Vain.) Zahlbr.	leg. A. Aptroot & M.F. Souza	82086	1	sheltered siliceous rock
PR	<i>Dirinaria melanocarpa</i> (Müll. Arg.) C.W. Dodge	leg. A. Aptroot & M.F. Souza	82247	5	bark
PR	<i>Dirinaria picta</i> (Sw.) Clem. & Shear	leg. A. Aptroot & M.F. Souza	82271	4	bark of Prunus
PR	<i>Echinoplaca leucotrichoides</i> (Vain.) R. Sant.	leg. M.F. Souza & A. Aptroot	273	1	living leaves
PR	<i>Echinoplaca pellicula</i> (Müll. Arg.) R. Sant.	leg. M.F. Souza & A. Aptroot	276	1	living leaves
PR	<i>Eremothecella calamicola</i> Syd.	leg. M.F. Souza & A. Aptroot	299	1	living leaves
PR	<i>Fissurina pseudostromatica</i> Lücking & Rivas Plata	leg. A. Aptroot & M.F. Souza	82238	1	bark
PR	<i>Flavoparmelia caperata</i> (L.) Hale	leg. M.F. Souza & A. Aptroot	236	2	bark
first Brazil	<i>Graphis adpressa</i> Vain.	leg. M.F. Souza & A. Aptroot	231	2	bark of Pinus
PR	<i>Graphis duplicata</i> Ach.	leg. A. Aptroot & M.F. Souza	82048	1	bark
PR	<i>Graphis tenella</i> Ach.	leg. A. Aptroot & M.F. Souza	82174	1	bark
PR	<i>Herpothallon roseocinctum</i> (Fr.) Aptroot, Lücking & G. Thor	leg. M.F. Souza & A. Aptroot	265	3	bark
PR	<i>Hyperphyscia adglutinata</i> (Flörke) H. Mayrhofer & Poelt	leg. A. Aptroot & M.F. Souza	82256	5	bark
PR	<i>Hyperphyscia mobergii</i> Kalb	leg. A. Aptroot & M.F. Souza	82276	4	bark of Prunus
PR	<i>Hyperphyscia syncolla</i> (Tuck.) Kalb	leg. A. Aptroot & M.F. Souza	82255	5	bark
PR	<i>Lecanactis epileuca</i> (Nyl.) Tehler	leg. A. Aptroot & M.F. Souza	82094	1	bark
PR	<i>Lecanora leproplaca</i> Zahlbr.	leg. A. Aptroot & M.F. Souza	82087	1	bark
PR	<i>Leptogium austroamericanum</i> (Malme) C.W. Dodge	leg. A. Aptroot & M.F. Souza	82242	1	bark
PR	<i>Leptogium corticola</i> (Taylor) Tuck.	leg. A. Aptroot & M.F. Souza	82032	1	bark
PR	<i>Leptogium isidiosellum</i> (Riddle) Sierk	leg. A. Aptroot & M.F. Souza	82028	1	bark
PR	<i>Leptogium moluccanellum</i> Marcelli & I.P.R. Cunha	leg. A. Aptroot & M.F. Souza	82001	1	sheltered siliceous rock
PR	<i>Malmidea fuscella</i> (Müll. Arg.) Kalb & Lücking	leg. M.F. Souza & A. Aptroot	217	2	bark
PR	<i>Malmidea piperis</i> (Spreng.) Kalb, Rivas Plata & Lumbsch	leg. M.F. Souza & A. Aptroot	261	3	bark
PR	<i>Malmidea polycampia</i> (Tuck.) Kalb & Lücking	leg. M.F. Souza & A. Aptroot	262	3	bark

TABLE 1. — Continuation.

new to	species name	collectors	coll. no.	loc	substratum
PR	<i>Malmidea vinosa</i> (Eschw.) Kalb, Rivas Plata & Lumbsch	leg. A. Aptroot & M.F. Souza	82239	1	bark
PR	<i>Mycoporum compositum</i> (A. Massal.) R.C. Harris	leg. A. Aptroot & M.F. Souza	82153	1	bark
PR	<i>Mycoporum sparsellum</i> Nyl.	leg. A. Aptroot & M.F. Souza	82136	1	bark
PR	<i>Myriotrema neofrondosum</i> Sipman	leg. M.F. Souza & A. Aptroot	223	2	bark
PR	<i>Ocellularia mauritiana</i> Hale	leg. A. Aptroot & M.F. Souza	82213	1	bark
PR	<i>Parmeliella conopieoides</i> P.M. Jørg	leg. A. Aptroot & M.F. Souza	82128	1	living leaves
first Brazil	<i>Parmeliella pannosa</i> (Sw.) Müll. Arg.	leg. M.F. Souza & A. Aptroot	259	3	bark
PR	<i>Parmelinella salacinifera</i> (Hale) Benatti & Marcelli	leg. A. Aptroot & M.F. Souza	82273	4	bark of Prunus
PR	<i>Parmelinopsis subfaticens</i> (Kurok.) Elix & Hale	leg. M.F. Souza & A. Aptroot	247	1	living leaves
PR	<i>Parmotrema clavuliferum</i> (Räs.) Streimann	leg. A. Aptroot & M.F. Souza	82119	1	bark
PR	<i>Parmotrema gardneri</i> (C.W. Dodge) Serus.	leg. A. Aptroot & M.F. Souza	82009	1	sheltered siliceous rock
PR	<i>Parmotrema hypomiltoides</i> (Vain.) Fleig	leg. A. Aptroot & M.F. Souza	82122	1	bark
first Brazil	<i>Parmotrema marcellianum</i> Spielmann & Bungartz	leg. A. Aptroot & M.F. Souza	82045	1	bark
PR	<i>Pertusaria dehiscens</i> Müll. Arg.	leg. M.F. Souza & A. Aptroot	214	2	bark
PR	<i>Phaeographis leiogrammodes</i> (Kremp.) Müll. Arg.	leg. A. Aptroot & M.F. Souza	82191	1	bark
PR	<i>Phaeographis medusiformis</i> (Kremp.) Müll. Arg.	leg. A. Aptroot & M.F. Souza	82193	1	bark
PR	<i>Phyllobothelium leguminosae</i> (Cavalc. & A. A. Silva) Lücking & Sérus.	leg. M.F. Souza & A. Aptroot	275	1	living leaves
PR	<i>Phylloporis phyllogena</i> (Müll. Arg.) Clem.	leg. M.F. Souza & A. Aptroot	289	1	living leaves
first Brazil	<i>Phyllopsora haemophaea</i> (Nyl.) Müll. Arg.	leg. A. Aptroot & M.F. Souza	82207	1	bark
PR	<i>Phyllopsora pyrromelaena</i> (Tuck.) Swinscow & Krog	leg. M.F. Souza & A. Aptroot	256	3	bark
PR	<i>Phyllopsora pyxinoides</i> (Nyl.) Kistenich, Timdal, Bendiksby & S.Ekman	leg. A. Aptroot & M.F. Souza	82124	1	bark
PR	<i>Phyllopsora soralifera</i> Timdal	leg. M.F. Souza & A. Aptroot	220	2	bark
PR	<i>Physcia erumpens</i> Moberg	leg. A. Aptroot & M.F. Souza	82246	5	bark
PR	<i>Physcia krogiae</i> Moberg	leg. A. Aptroot & M.F. Souza	82275	4	bark of Prunus
PR	<i>Physcia solediosa</i> (Vain.) Lynge	leg. A. Aptroot & M.F. Souza	82006	1	sheltered siliceous rock
PR	<i>Physcia tribacioides</i> Nyl.	leg. A. Aptroot & M.F. Souza	82251	5	bark
PR	<i>Placynthiella icmalea</i> (Ach.) Coppins & P. James	leg. M.F. Souza & A. Aptroot	238	2	bark
PR	<i>Porina distans</i> Vězda & Vivant	leg. A. Aptroot & M.F. Souza	82228	1	bark
PR	<i>Porina mastoidea</i> (Ach.) Müll. Arg.	leg. M.F. Souza & A. Aptroot	258	3	bark
PR	<i>Pyrenula acutalis</i> R.C. Harris	leg. A. Aptroot & M.F. Souza	82072	1	bark
PR	<i>Pyrenula aspistea</i> (Afzel. ex Ach.) Ach.	leg. M.F. Souza & A. Aptroot	241	2	bark
PR	<i>Pyrenula mamillana</i> (Ach.) Trevis.	leg. A. Aptroot & M.F. Souza	82230	1	bark
PR	<i>Pyrenula massariospora</i> (Starbäck) R.C. Harris	leg. A. Aptroot & M.F. Souza	82210	1	bark
first Brazil	<i>Pyrenula microcarpa</i> Müll. Arg.	leg. A. Aptroot & M.F. Souza	82245	5	bark
first Brazil	<i>Pyrenula neosandwicensis</i> Aptroot	leg. A. Aptroot & M.F. Souza	82176	1	bark
PR	<i>Pyrenula quassiicola</i> (Fée) Fée	leg. A. Aptroot & M.F. Souza	82132	1	bark
first Brazil	<i>Septotrapelia usnica</i> (Sipman) Kalb & Bungartz	leg. A. Aptroot & M.F. Souza	82054	1	bark
PR	<i>Sporopodium leprieurii</i> Mont.	leg. M.F. Souza & A. Aptroot	286	1	living leaves
PR	<i>Sticta xanthotropa</i> (Kremp.) D.J. Galloway	leg. A. Aptroot & M.F. Souza	82023	1	bark
PR	<i>Strigula melanobapha</i> (Kremp.) R. Sant.	leg. M.F. Souza & A. Aptroot	246	1	living leaves
PR	<i>Sulzbacheromyces caatingae</i> (Sulzbacher & Lücking) B.P. Hodk. & Lücking	leg. M.F. Souza & A. Aptroot	233	2	soil
PR	<i>Synarthonia sarcographoides</i> Aptroot, A.A. Menezes, E.L. Lima & M. Cáceres	leg. A. Aptroot & M.F. Souza	82163	1	bark
PR	<i>Syncesia rhizomorpha</i> Tehler	leg. A. Aptroot & M.F. Souza	82042	1	bark
PR	<i>Thelenella luridella</i> (Nyl.) Mayrh.	leg. A. Aptroot & M.F. Souza	82066	1	sheltered siliceous rock
PR	<i>Trapeliopsis flexuosa</i> (Fr.) P. James & Coppins	leg. A. Aptroot & M.F. Souza	82114	1	wood
PR	<i>Tricharia urceolata</i> (Müll. Arg.) R. Sant.	leg. M.F. Souza & A. Aptroot	253	1	living leaves
PR	<i>Tylophoron hibernicum</i> (D. Hawksw., Coppins & P. James) Ertz, Diederich, Bungartz & Tibell	leg. A. Aptroot & M.F. Souza	82044	1	bark
PR	<i>Usnea perhispidella</i> Steiner	leg. A. Aptroot & M.F. Souza	82171	1	bark
PR	<i>Usnea rubicunda</i> Stirt.	leg. A. Aptroot & M.F. Souza	82164	1	bark
PR	<i>Usnea subscabrosa</i> Motyka	leg. A. Aptroot & M.F. Souza	82118	1	wood

TYPE. — **Brazil**, Paraná, Guaraqueçaba, Tagaçaba Porto da Linha, road PR-405 km 36.2, at right side of road, in chácara (property of Donald Schause), 14.X.2020, alt. 155 m, on dead palm frond, *M.F. Souza & A. Aptroot 264* (holo-, CGMS; iso-, ABL).

CHEMISTRY. — Thallus C-, UV-, P-, K+ blood red, with chiodec-tonic acid, demonstrated in tlc.

DESCRIPTION

Thallus epiphyllous and hypophyllous, grey mottled with purple, concentrically streaked with paler and darker patches, dull, floccose, easily removed from the substratum, covering an area of up to 6 cm diam., surrounded by a c. 0.5 mm wide dark purple prothallus line. Lower surface dark, purple, with

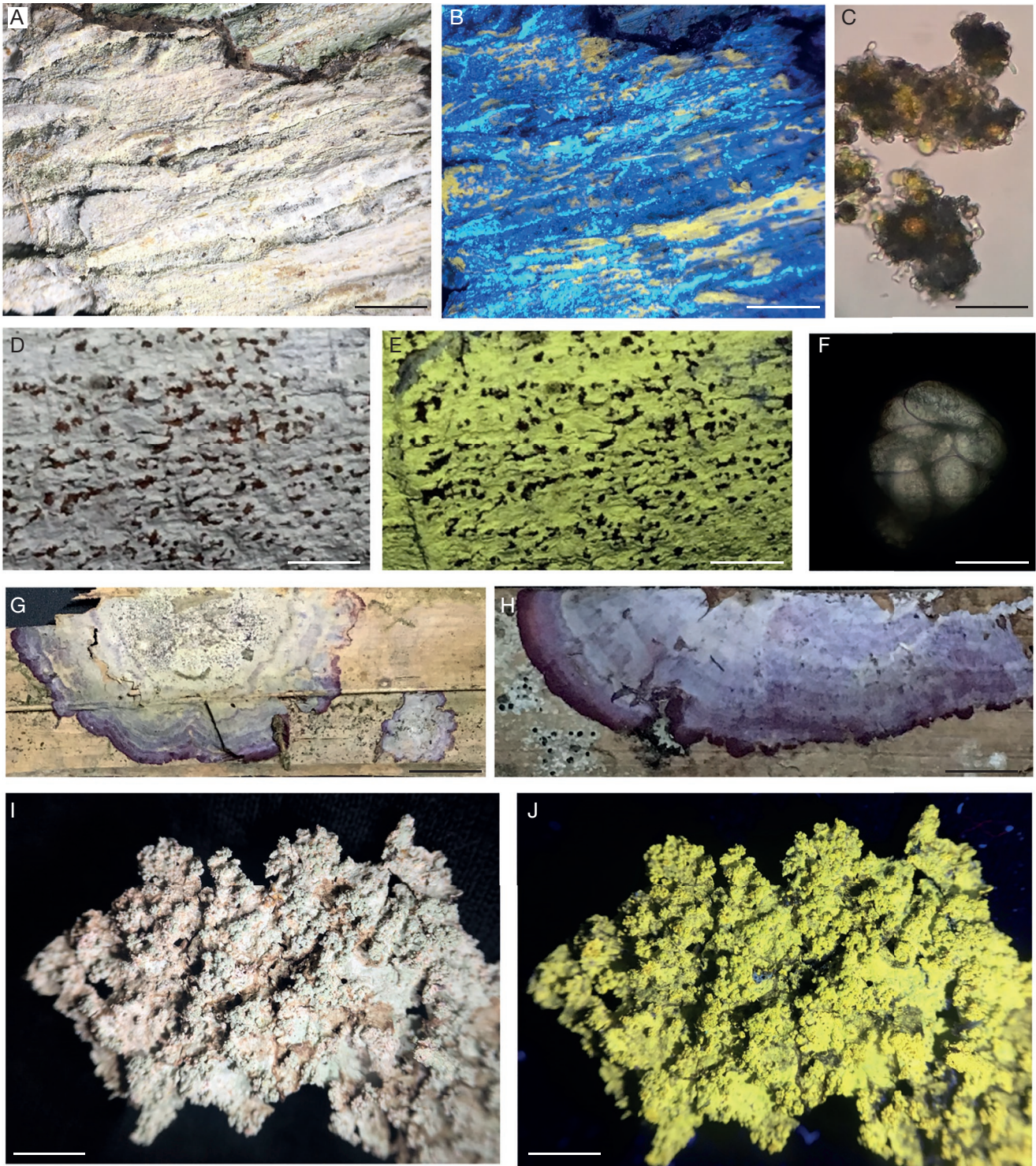


FIG. 1. — **A, B.** *Cryptothecia duplofluorescens* Aptroot & M.F. Souza, sp. nov.: **A**, thallus; **B**, thallus under UV light; **C**, soredia; **D-F.** *Myriostigma xanthominium* Aptroot & M.F. Souza, sp. nov.: **D**, thallus; **E**, thallus under UV light; **F**, ascus with ascospores; **G, H.** *Herpothallon purpureum* Aptroot & M.F. Souza, sp. nov.: **G**, hypophyllous thallus; **H** epiphyllous thallus; **I, J.** *Wirthiotrema xanthopustulatum* Aptroot & M.F. Souza, sp. nov.: **I**, thallus; **J**, thallus under UV light. All from holotypes. Scales: A, B, 4 mm; C, 30 μ m; D, E, 5 mm; F, 80 μ m; G, 7 mm, H-J, 5 mm.

red pigment in addition to the purple colour. Algae trentepohlioid, orange, *c.* 10-15 μ m diam. Pseudoisidia present in the central part of the thallus, globose, 0.1-0.2 mm diam. and high, purple, in dense clusters. Soralia, ascomata and pycnidia not observed.

DISCUSSION

Herpothallon Tobler is a genus with *c.* 48 currently accepted species. A key to most species is given by Aptroot *et al.* (2009). This new species differs from all known species by the purple colour. The colour is more pronounced on epiphyllous

thalli which receive more light, than on hypophyllous thalli (compare Fig. 1G, H).

Genus *Myriostigma* Kremp.

Myriostigma xanthominiatum
Aptroot & M.F. Souza, sp. nov.
(Fig. 1D-F)

Corticolous *Myriostigma* with thallus whitish ochraceous, containing lichexanthone, ascigerous areas delimited, black with orange pruina, ascospores 8/ascus, ellipsoid, hyaline, muriform, *c.* 12 × 10-septate, 85-94 × 35-39 μm, central lumina much larger (*c.* 10 μm diam.) than lumina near the wall.

MYCOBANK. — MB839448.

TYPE. — **Brazil**, Paraná, Guaraqueçaba, Tagaçaba Porto da Linha, road PR-405 km 36.2, at right side of road, in chácara (property of Donald Schause), 14.X.2020, alt. 15 m, on tree bark, *A. Aptroot & M.F. Souza 82089* (holo-, CGMS; iso-, ABL).

ADDITIONAL MATERIAL STUDIED. — Same details, *M.F. Souza & A. Aptroot 291* (CGMS).

CHEMISTRY. — Thallus C-, K-, P-, UV+ yellow, with lichexanthone; ascigerous areas K+ red and UV+ red, with an unidentified anthraquinone (Rf 1 TDA, pale orange yellow in acetone solution).

DESCRIPTION

Thallus corticolous, whitish ochraceous, dull, somewhat granular and variable in thickness up to *c.* 0.2 mm thick, covering an area of up to 10 cm diam., surrounded by a *c.* 0.2 mm wide black prothallus line. Algae trentepohlioid, orange, *c.* 10-15 μm diam. Ascigerous areas delimited, IKI negative, patchy, roundish to irregularly lirelline, black spots with orange pruina, up to 2 mm long and 0.7 mm wide, *c.* 0.2-0.3 mm high, covering about a quarter of the thallus surface. Asci globose, hyaline, containing 8 ascospores, 100-125 μm diam, wall up to 15 μm thick. Ascospores ellipsoid, hyaline, muriform, *c.* 12 × 10-septate, 85-94 × 35-39 μm, central lumina much larger (*c.* 10 μm diam.) than lumina near the wall. Pycnidia not observed.

DISCUSSION

Myriostigma Kremp. is a small tropical genus in which so far eight species have been accepted (Jagadeesh Ram & Sinha 2016, Aptroot & Cáceres 2018). This new species agrees with *Myriostigma. miniatum* (Lücking) Aptroot, Ertz, Grube & M.Cáceres in all characters except the presence of lichexanthone.

Family GRAPHIDACEAE Dumort.

Genus *Wirthiotrema* Rivas Plata, Kalb & Frisch

Wirthiotrema xanthopustulatum Aptroot & M.F. Souza,
sp. nov.
(Fig. 1I, J)

Corticolous sterile *Wirthiotrema* with thallus pale olivaceous metallic green, shiny, containing lichexanthone and protocetraric acid,

pustules delimited, soredia globose to short ellipsoid, filled with small crystals, *c.* 45-100 μm diam.

MYCOBANK. — MB839449.

TYPE. — **Brazil**, Paraná, Guaraqueçaba, Tagaçaba Porto da Linha, road PR-405 km 36.2, at right side of road, in chácara (property of Donald Schause), 14.X.2020, alt. 15 m, on tree bark, *A. Aptroot & M.F. Souza 82093* (holo-, CGMS; iso-, ABL).

CHEMISTRY. — Thallus and pustules C-, UV+ yellow, K-, P+ red, with lichexanthone and protocetraric acid, demonstrated in tlc.

DESCRIPTION

Thallus corticolous, pale olivaceous metallic green, shiny, thin, IKI negative, covering an area of up to 10 cm diam., without prothallus line, but lower surface a continuous dark brown hypothallus. Algae trentepohlioid, green, *c.* 10-14 μm diam. Pustules delimited, of thallus colour or somewhat paler, starting as semiglobose *c.* 0.2 mm diam. warts, aggregating into mostly stalked, *c.* 0.5-2.0 mm diam, *c.* 0.5-1.7 mm high clusters, covering about quarter of the thallus surface. Soredia developing on top of abraded pustules, irregularly globose to short ellipsoid, IKI negative, filled with small crystals, *c.* 45-100 μm diam. Ascomata and pycnidia not observed.

DISCUSSION

Wirthiotrema Rivas Plata, Kalb & Frisch is a genus with so far only five accepted species. The new species is very similar to *W. santessonii* (Hale) Rivas Plata & Frisch (Rivas Plata *et al.* 2010), but for the chemistry: lichexanthone and protocetraric acid instead of stictic acid.

DISCUSSION

The surprising character that most of the new species have in common is that they contain lichexanthone, a cortical substance. This substance is often said to be instrumental in keeping out UV radiation and thus protecting the algae inside lichens, enabling them to grow on places that were otherwise uninhabitable for them, like high mountains or exposed trees in tropical areas (Galloway 1993). In such places, most lichens have a cortical substance, either lichexanthone or atranorin or usnic acid. However, the lichens newly described here originated from much less exposed areas, and cortical substances are rare in the families these species belong to. Its ecological significance is therefore unknown, and it should be stressed that related or similar species (partly mentioned in the discussion of the respective species) are in existence without any cortical substance, thus demonstrating that the presence of lichexanthone is not necessary for these lichens to survive.

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