

New lichen species and lichen reports from Amazon forest remnants and Cerrado vegetation in the Tocantina Region, northern Brazil

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ABSTRACT. A recent field trip to the adjacent states of Maranhão, Pará and Tocantins yielded the following undescribed lichens: *Buellia lichexanthonica*, *Chrysothrix citrinella*, *Cryptothecia isidioxantha* and *Heterocyphelium triseptatum* (which is also reported from Tanzania). In addition, 127 species are reported new to Tocantins state, 126 to Maranhão and 73 to Pará; 22 of these are first records for Brazil. viz. *Astrothelium ferrugineum*, *A. nigratum*, *A. norisianum*, *Bathelium inspersomastoideum*, *Bulbothrix sipmanii*, *Caloplaca oxfordensis*, *Collema rugosum*, *C. texanum*, *Diorygma erythrellum*, *Graphis atrocelata*, *G. deserpens*, *G. hiascens*, *G. norstictica*, *Lecanographa subcaesioides*, *Lecanora jamesii*, *Platygramme computata*, *Platythecium suberythrellum*, *Porina coralloidea*, *P. hibernica*, *Staurothele arenaria*, *Synarthothelium cerebriforme* and *Verrucaria margacea*. The new combination *Gassicurtia endococcinea* is also made; it is the first saxicolous member of this genus.

KEYWORDS. Corticolous, saxicolous, Maranhão, Pará, Tocantins, Tanzania.



Recently, we started a project to survey the lichens in the still mostly primary rain forests of the Amazon basin, first in Rondônia, which is situated at the SW end of the Amazon. The results published so far (Aptroot & Cáceres 2013, 2014a,b, 2016; Cáceres et al. 2014a,b) show that the region may contain among the highest lichen diversity in the world. It is especially surprising that the majority of the species found were still undescribed. This includes species that were abundantly found in each region visited, the prime example being *Astrothelium eustomurale* Aptroot & Cáceres, which was for many years the most common undescribed lichen in the world known. Subsequently, a collecting trip was organised to the state of Amapá, which is situated at the mouth of the Amazon River on both sides of the equator (Cáceres & Aptroot 2016). Next, we went into the heart of the Amazon near

Manaus (Cáceres & Aptroot 2017). In all instances, the vast majority of the identified species were new to the state, even in Amazonas. There is a clear overlap between the regions, but every region and even every forest also yielded undescribed species that have not been found elsewhere.

At the occasion of the 8o EGBL (Encontro do Grupo Brasileiro de Liquenólogos), we visited several localities at the eastern border of the Amazon basin, in the states of Pará, Maranhão and Tocantins, the so-called Tocantina Region. The Tocantina Region is a territorial area located near the Tocantins River and encompasses the central-southern areas of the state of Maranhão, the extreme north of Tocantins and the south and southeast of Pará (Sousa 2009). Cerrado is Brazil's second largest biome, with about 2 million km² of continuous area, and it is present in 11 Brazilian states, including the Tocantina Region. The Cerrado in Maranhão occupies approximately 30% of the total state area, and it is characterized by

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DOI: 10.1639/0007-2745-120.3.320

bushes with thick bark and twisted branches, and denser bushes associated with grasses and palm trees such as *Copernicia prunifera* Mart., known locally as carnaúba (Matos 2004). In Tocantins, almost 90% of the vegetation constitutes areas of Cerrado, and the collections in Pará were made in areas of rain forest.

Lichens were collected in October 2016 on all available substrata, but mostly from tree bark, in pristine rain forests, Cerrado forests and gardens. Crustose lichens are dominant in all habitats. For this paper, most of the crustose groups have been examined, with the exception of foliicolous lichens and most *Graphidaceae*, which will be treated in other publications. Here, we describe some new species and we also present inventory lists of the most recently visited locations.

MATERIALS AND METHODS

Identification and descriptive work was carried out in Itabaiana, Universidade Federal de Sergipe, using a Leica EZ4 stereomicroscope and a Leica DM500 compound microscope, and in Soest using an Olympus SZX7 stereomicroscope and an Olympus BX50 compound microscope with interference contrast, connected to a Nikon Coolpix digital camera. Sections have been mounted in tap water, in which also all measurements were taken. The specimens from this study are preserved in ISE and ABL. The chemistry of the type specimens was investigated by thin layer chromatography (TLC) using solvent A (Orange et al. 2001).

RESULTS

New records. A total of 127 species are reported new to Tocantins state, 126 to Maranhão (from both states almost no lichens were previously recorded), and 73 to Pará (**Table 1**). The table gives the state for which the species are newly reported, and the biome it was found in (Cerrado, rain forest or gardens). The following 22 species are first records for Brazil: *Astrothelium ferrugineum* (Müll. Arg.) Aptroot & Lücking, *A. nigratum* (Müll. Arg.) Aptroot & Lücking, *A. norisianum* Lücking, M.P.Nelsen & Aptroot, *Bathelium inspersomastoideum* Flakus & Aptroot, *Bulbothrix sipmanii* Aptroot & Aubel, *Caloplaca oxfordensis* Fink, *Collema rugosum* Kremp., *C. texanum* Tuck., *Diorygma erythrellum* (Mont. & Bosch) Kalb, Staiger & Elix, *Graphis atrocelata* (A.W.Archer) A.W.Archer, *G. deserpens* Vain., *G. hiascens* (Fée) Nyl., *G. norstictica* A.W.Archer & Lücking, *Lecanographa*

subcaesioides Egea & Torrente, *Lecanora jamesii* J.R.Laundon, *Platygramme computata* (Kremp.) A.W.Archer, *Platythecium suberythrellum* (M.Wirth & Hale) Staiger & Kalb, *Porina coralloidea* P.James, *P. hibernica* P.James & Swinscow, *Staurothele arenaria* Malme, *Synarthothelium cerebriforme* Sparrius, and *Verrucaria margacea* (Wahlenb.) Wahlenb.

TAXONOMY

NEW COMBINATION

Table 1 includes *Buellia endococcinea*, which is a *Gassicurtia*, because of the bright red medulla with chiodectonic acid. It is the first saxicolous member of this genus, as it was resurrected in a paper on corticolous lichens (Marbach 2000), and since that time, only a handful of additional corticolous species have been newly described in the genus. Therefore, the following new combination is made:

Gassicurtia endococcinea (Vain.) Aptroot, *comb. nov.*

MYCOBANK MB 821699

BASIONYM: *Buellia endococcinea* Vain., Acta Soc. Fauna Fl. fenn. 7(1): 168 (1890).

NEW SPECIES

Buellia lichexanthonica Aptroot & M.Cáceres, *sp. nov.* **Fig. 1A**

MYCOBANK MB 821700

Saxicolous Buellia with relatively thick, ochraceous yellow thallus which reacts C-negative but UV+ orange and contains 4,5-dichlorolichexanthone and ascospores 11–13 × 6–7.5 μm, with thin walls.

TYPE: BRAZIL. MARANHÃO: Riachão, Poço Azul, alt. ca. 450 m, 7°13'28"S, 46°27'10"W, on sandstone in Cerrado, 27 October 2016, M.E.S. Cáceres & A. Aptroot ISE 40055 (holotype: ISE; isotype: ABL).

Description. Thallus ca. 0.1–0.2 mm thick, dull, cortex only indicated by absence of algae and presence of copious xanthone crystals, uneven, dissected into angular areoles of ca. 0.2–0.6 mm diam. which become almost radial towards the margins of the thallus, pale yellowish green, not surrounded by a prothallus. Ascomata sessile, round, black, dull, ca. 0.2–0.5 mm diam., up to ca. 0.2 mm high; margin ca. 0.1 mm wide, higher than the disc; disc flat. Epithemium olive green; hypothecium dark brown; excipulum black throughout. Hymenium hyaline, not interspersed, ca. 60 μm high. Ascus

Table 1. New lichen records. BR = new to Brazil; MA = new to Maranhão; PA = new to Pará; TO = new to Tocantins; C = from Cerrado; R = from rain forest; G = from gardens. Maranhão records are from Riachão, Poço Azul, except for the ones that are from gardens (marked G in Habitat column) which are from Bananal near Imperatriz; all Pará records are from 85 km NW of Dom Eliseu; most Tocantins records are from near Itaguatins.

New to	Habitat	Species
MA, TO	G, C	<i>Acanthothecis abaphoides</i> (Nyl.) Staiger & Kalb
TO	C	<i>A. corcovadensis</i> (Redinger) Staiger & Kalb
TO	C	<i>A. subabaphoides</i> Staiger & Kalb
MA	C	<i>A. tetrachora</i> (Nyl.) Staiger & Kalb
PA, TO	R, C	<i>Aggregatorygma triseptatum</i> M.Cáceres, Aptroot & Lücking
PA	R	<i>Ampliotrema amplius</i> (Nyl.) Kalb
PA	R	<i>A. lepadinoides</i> (Leight.) Kalb
MA	G	<i>Anisomeridium polypori</i> (Ellis & Everh.) M.E.Barr
PA	R	<i>A. terminatum</i> (Nyl.) R.C.Harris
TO	C	<i>Arthonia antillarum</i> (Fée) Nyl.
TO	C	<i>A. parantillarum</i> Aptroot
PA	R	<i>Aspidothelium glabrum</i> Lücking, Aptroot & Sipman
PA	R	<i>Astrochapsa platycarpella</i> (Vain.) Parmen., Lücking & Lumbsch
PA	R	<i>Astrothelium aeneoides</i> Aptroot
MA, TO	G, C	<i>A. aeneum</i> (Eschw.) Aptroot & Lücking
MA	C	<i>A. bicolor</i> (Taylor) Aptroot & Lücking
MA, PA, TO	R, C	<i>A. cinnamomeum</i> (Eschw.) Müll. Arg.
PA	R	<i>A. crassum</i> (Fée) Aptroot
MA	C	<i>A. degenerans</i> (Vain.) Aptroot & Lücking
TO	C	<i>A. eustomum</i> (Mont.) Müll. Arg.
PA	R	<i>A. ferrugineum</i> (Müll. Arg.) Aptroot & Lücking
PA	R	<i>A. flavomurisporum</i> Aptroot & M.Cáceres
MA	G	<i>A. inspersaeneum</i> E.L.Lima, Aptroot & M.Cáceres
MA, PA	C, R	<i>A. kunzei</i> (Fée) Aptroot & Lücking
TO	C	<i>A. mesoduplex</i> Aptroot & M.Cáceres
TO	C	<i>A. neoinspersum</i> Aptroot
BR, TO	C	<i>A. nigratum</i> (Müll. Arg.) Aptroot & Lücking
PA, TO	R, C	<i>A. nitidiusculum</i> (Nyl.) Aptroot & Lücking
BR, PA	R	<i>A. norisianum</i> Lücking, M.P.Nelsen & Aptroot
MA	G	<i>A. phlyctaena</i> (Fée) Aptroot & Lücking
PA, TO	R, C	<i>A. pulcherrimum</i> (Fée) Aptroot & Lücking
PA, TO	R, C	<i>A. rufescens</i> (Müll. Arg.) Aptroot & Lücking
PA	R	<i>A. subendochryseum</i> Lücking, M.P.Nelsen & Marcelli
TO	C	<i>A. subscoria</i> Flakus & Aptroot
MA	G	<i>Bacidia medialis</i> (Tuck.) Zahlbr.
MA, TO	G, C	<i>Bathelium madreporiforme</i> (Eschw.) Trevis.
BR, MA	G	<i>B. inspersomastoideum</i> Flakus & Aptroot
MA	G	<i>B. mastoideum</i> Afzel. ex Ach.
MA	C	<i>Buellia aethalea</i> (Ach.) Th. Fr.

Table 1. Continued.

New to	Habitat	Species
MA	C	<i>B. subtabacina</i> Malme
MA	C	<i>B. xanthinula</i> (Müll. Arg.) Malme
BR, MA	G	<i>Bulbothrix pseudocoronata</i> (Gyeln.) Benatti
BR, MA	C	<i>B. sipmanii</i> Aptroot & Aubel
PA, TO	R, C	<i>Calopadia pruinosa</i> Lücking & Chaves
MA	C	<i>Caloplaca brachyloba</i> (Müll. Arg.) Zahlbr.
MA	C	<i>C. chapadensis</i> (Malme) Zahlbr.
BR, MA	C	<i>C. oxfordensis</i> Fink
TO	C	<i>Canoparmelia amazonica</i> (Nyl.) Elix & Hale
TO	C	<i>C. cinerascens</i> (Lyngé) Elix & Hale
MA	C	<i>Carbacanthographis chionophora</i> (Redinger) Staiger & Kalb
PA	R	<i>C. marcescens</i> (Fée) Staiger & Kalb
MA, TO	C	<i>C. stictica</i> Staiger & Kalb
PA, TO	R, C	<i>Chapsa leprocarpa</i> (Nyl.) Frisch
PA	R	<i>C. thalotrema</i> Lücking & N.Salazar
MA, TO	G, C	<i>Chrysothrix xanthina</i> (Vain.) Kalb
MA	C	<i>Cladonia ceratophylla</i> (Sw.) Spreng.
MA	C	<i>C. subradiata</i> (Vain.) Sandst.
MA	G	<i>Coenogonium chloroticum</i> Xavier-Leite, M.Cáceres & Aptroot
PA	R	<i>C. confervoides</i> Nyl.
MA	C	<i>C. linkii</i> Ehrenb.
MA	G	<i>C. nepalense</i> (G.Thor & Vězda) Lücking, Aptroot & Sipman
PA	R	<i>C. strigosum</i> Rivas Plata, Lücking & Chaves
PA	R	<i>C. subdentatum</i> (Vězda & G. Thor) Rivas Plata, Lücking, Umaña & Chaves
TO	C	<i>C. subdilutum</i> (Malme) Lücking, Aptroot & Sipman
TO	C	<i>Collema rugosum</i> Kremp.
MA	C	<i>C. texanum</i> Tuck.
MA	G	<i>Coniocarpon cinnabarinum</i> DC.
MA	C	<i>Cratiria obscurior</i> (Stirt.) Marbach & Kalb
MA	C	<i>C. vioxanthina</i> (Elix) Kalb & Elix
TO	C	<i>Cresponea proximata</i> (Nyl.) Egea & Torrente
PA	R	<i>Crypthonia corticorygmoides</i> Aptroot & M.Cáceres
TO	C	<i>Cryptothecia fabispora</i> M.Cáceres, E.L.Lima & Aptroot
TO	C	<i>C. lichexanthonica</i> E.L.Lima, Aptroot & M.Cáceres
PA, TO	R, C	<i>C. striata</i> G.Thor
TO	C	<i>Dictyomeridium isohypocrellinum</i> (Xavier-Leite, M.Cáceres & Aptroot) Aptroot, M.P.Nelsen & Lücking
MA, TO	C	<i>D. proponens</i> (Nyl.) Aptroot, M.P.Nelsen & Lücking
MA	C	<i>Dimelaena tenuis</i> (Müll. Arg.) H.Mayrhofer & Wippel
PA, TO	R, C	<i>Diorygma confluens</i> (Fée) Kalb, Staiger & Elix
TO	C	<i>D. erythrellum</i> (Mont. & Bosch) Kalb, Staiger & Elix
TO	C	<i>D. incantatum</i> Feuerst. & Eliasaro

Table 1. Continued.

New to	Habitat	Species
MA, TO	G, C	<i>Dirinaria aegialita</i> (Afzel. ex Ach.) B.J.Moore
MA, TO	G, C	<i>D. applanata</i> (Fée) D.D.Awasthi
MA	C	<i>D. confluens</i> (Fr.) D.D.Awasthi
TO	C	<i>D. leopoldii</i> (Stein) D.D.Awasthi
MA, TO	G, C	<i>D. picta</i> (Sw.) Clem. & Shear
MA, TO	C	<i>D. purpurascens</i> (Vain.) B.J.Moore
MA, TO	G, C	<i>Dyplolabia afzelii</i> (Ach.) A.Massal.
MA, TO	G, C	<i>D. oryzoides</i> (Leight.) Kalb & Staiger
PA	R	<i>Eschatogonia dissecta</i> Timdal & R.Sant.
PA	R	<i>E. prolifera</i> (Mont.) R.Sant.
MA, PA	C, R	<i>Fellhanera termitophila</i> Aptroot & M.Cáceres
MA, PA, TO	R, C	<i>Fissurina amazonica</i> M.Cáceres, Aptroot & Lücking
MA, PA, TO	R, C	<i>F. pseudostromatica</i> Lücking & Rivas Plata
PA	R	<i>Flegographa leprieurii</i> (Mont.) A.Massal.
TO	C	<i>Gassicurtia caririensis</i> M.M.E.Alves, Aptroot & M.Cáceres
MA	C	<i>G. coccinea</i> Fée
MA	C	<i>G. endococcinea</i> comb. nov.
MA, TO	G, C	<i>Glyphis cicatricosa</i> Ach.
MA, PA, TO	G, R, C	<i>G. scyphulifera</i> (Ach.) Staiger
MA	G	<i>Graphis adpressa</i> Vain.
PA	R	<i>G. argentata</i> Lücking & Umaña
BR, MA	G	<i>G. atrocelata</i> (A.W.Archer) A.W.Archer
MA, TO	G, C	<i>G. caesiella</i> Vain.
TO	C	<i>G. conferta</i> Zenker
MA, TO	G, C	<i>G. copelandii</i> Vain.
TO	C	<i>G. deserpens</i> Vain.
TO	C	<i>G. duplicata</i> Ach.
MA, TO	G, C	<i>G. furcata</i> Fée
MA, TO	G, C	<i>G. glaucescens</i> Fée
MA	G	<i>G. hiascens</i> (Fée) Nyl.
MA	G	<i>G. ingarum</i> (Vain.) Lücking
MA	G	<i>G. librata</i> C.Knight
MA, TO	G, C	<i>G. lineola</i> Ach.
MA	G	<i>G. nanodes</i> Vain.
BR, MA	G	<i>G. norstictica</i> A.W.Archer & Lücking
PA	R	<i>G. pernambucoradians</i> M.Cáceres & Lücking
MA	G	<i>G. prunicola</i> Vain.
MA	G	<i>G. rimulosa</i> (Mont.) Trevis
MA	G	<i>G. sayeri</i> Müll. Arg.
TO	C	<i>G. scripta</i> (L.) Ach.
TO	C	<i>G. striatula</i> (Ach.) Spreng.
MA	G	<i>G. subserpentina</i> Nyl.
PA	R	<i>G. subtectata</i> (Nyl.) Lücking
MA	G	<i>G. tenella</i> Ach.
MA	G	<i>G. urandrae</i> Vain.
MA, TO	C	<i>Hafellia curatellae</i> (Malme) Marbach
MA, PA	C, R	<i>Hemithecium oryzaeforme</i> (Fée) Staiger
TO	C	<i>H. rufopallidum</i> (Vain.) Staiger
PA	R	<i>Herpothallon albidum</i> (Fée) Aptroot, Lücking & G.Thor
PA	R	<i>H. aurantiacoflavum</i> (B. de Lesd.) Aptroot, Lücking & G.Thor

Table 1. Continued.

New to	Habitat	Species
PA	R	<i>H. roseocinctum</i> (Fr.) Aptroot, Lücking & G.Thor
PA	R	<i>H. rubromaculatum</i> G.Thor
TO	C	<i>Heterocyphelium leucampyx</i> (Tuck.) Vain.
BR, MA	C	<i>Lecanographa subcaesioides</i> Egea & Torrente
TO	C	<i>Lecanora achroa</i> Nyl.
BR, TO	C	<i>L. jamesii</i> J.R.Laundon
MA, TO	G, C	<i>L. leproplaca</i> Zahlbr.
MA	C	<i>L. lichexanthona</i> Guderley
MA	C	<i>L. subimmersa</i> (Fée) Vain
MA, TO	G, C	<i>L. tropica</i> Zahlbr.
TO	C	<i>Leptogium austroamericanum</i> (Malme) C.W.Dodge
BR, TO	C	<i>Letrouitia flavocrocea</i> (Nyl.) Hafellner & Bellem.
TO	C	<i>L. subvulpina</i> (Nyl.) Hafellner
TO	C	<i>L. vulpina</i> (Tuck.) Hafellner & Bellem.
PA	R	<i>Malmidea furfurosa</i> (Tuck. ex Nyl.) Kalb & Lücking
PA	R	<i>M. leptoloma</i> (Müll. Arg.) Kalb & Lücking
TO	C	<i>M. papillosa</i> Weerakoon & Aptroot
PA, TO	R, C	<i>M. piperina</i> (Zahlbr.) Aptroot & Breuss
TO	C	<i>M. polycampia</i> (Tuck.) Kalb & Lücking
MA, TO	G, C	<i>M. psychotrioides</i> (Kalb & Lücking) Kalb, Rivas Plata & Lumbsch
TO	C	<i>M. rhodopsis</i> (Tuck.) Kalb, Rivas Plata & Lumbsch
PA	R	<i>M. tratiana</i> Kalb & Mongkolsuk
TO	C	<i>M. vinosa</i> (Eschw.) Kalb, Rivas Plata & Lumbsch
MA	G	<i>Malmographina plicosa</i> (C.F.W.Meissn.) M.Cáceres, Rivas Plata & Lücking
MA	G	<i>Marcelaria purpurina</i> (Nyl.) Aptroot, Nelsen & Parnmen
PA	R	<i>Micarea corallothallina</i> M.Cáceres, D.A.Mota & Aptroot
TO	C	<i>Mycoporum compositum</i> (A.Massal.) R.C.Harris
MA, PA	G, R	<i>M. eschweileri</i> (Müll. Arg.) R.C.Harris
PA	R	<i>Myeloconis fecunda</i> P.M.McCarthy & Elix
PA	R	<i>Myriostigma filicinum</i> (Ellis & Everh.) Frisch & G.Thor
TO	C	<i>M. minutum</i> (Vain. ex Lücking) Aptroot, Ertz, Grube & M.Cáceres
PA	R	<i>Myriotrema neofrondosum</i> Sipman
MA	C	<i>Nigrothelium tropicum</i> (Ach.) Lücking, M.P.Nelsen & Aptroot
TO	C	<i>Opegrapha anguinella</i> (Nyl.) Ertz & Diederich
MA, TO	G, C	<i>Pallidogramme chapadana</i> (Redinger) Staiger, Kalb & Lücking
TO	C	<i>Parmotrema endosulphureum</i> (Hillmann) Hale
MA	C	<i>P. mordenii</i> (Hale) Hale
TO	C	<i>P. praesorediosum</i> (Nyl.) Hale

Table 1. Continued.

New to	Habitat	Species
TO	C	<i>P. subisidiosum</i> (Müll. Arg.) Hale
TO	C	<i>P. tinctorum</i> (Despr. ex Nyl.) Hale
TO	C	<i>Peltula obscurans</i> (Nyl.) Gyeln.
MA	C	<i>Pertusaria subventosa</i> Malme
MA, PA	C, R	<i>P. tropica</i> Vain.
MA, PA, TO	G, R, C	<i>Phaeographis brasiliensis</i> (A.Massal.) Kalb & Matthes-Leicht
PA	R	<i>P. crispata</i> Kalb & Matthes-Leicht
TO	C	<i>P. epruinosa</i> (Redinger) Staiger
MA, TO	G, C	<i>P. flavescens</i> Dal-Forno & Eliasaro
MA, TO	G, C	<i>P. intricans</i> (Nyl.) Staiger
MA, TO	G, C	<i>P. haematites</i> (Fée) Müll. Arg.
MA, PA, TO	G, R, C	<i>P. leiogrammodes</i> (Kremp.) Müll. Arg.
TO	C	<i>P. major</i> (Kremp.) Lücking
PA	R	<i>P. nylanderii</i> (Vain.) Zahlbr.
TO	C	<i>P. scalpturata</i> (Ach.) Staiger
TO	C	<i>P. quadrifera</i> (Nyl.) Staiger
PA	R	<i>Phyllopsora nigrocincta</i> Timdal
MA	G	<i>Physcia atrostriata</i> Moberg
MA	G	<i>P. krogiae</i> Moberg
MA	G	<i>P. solediosa</i> (Vain.) Lynge
PA	R	<i>Physcidia striata</i> Aptroot, M.Cáceres & Timdal
MA	G	<i>Platygramme computata</i> (Kremp.) A.W.Archer
PA, TO	R, C	<i>Platythecium colliculosum</i> (Mont.) Staiger
TO	C	<i>P. dimorphodes</i> (Nyl.) Staiger
TO	C	<i>P. grammitis</i> (Fée) Staiger
TO	C	<i>P. serpentinellum</i> (Nyl.) Staiger
PA	R	<i>P. sphaerosporellum</i> (Nyl.) Staiger
BR, TO	C	<i>P. suberythrellum</i> (M.Wirth & Hale) Staiger & Kalb
PA	R	<i>Polymeridium albidoreagens</i> Aptroot, A.A.Menezes & M.Cáceres
MA	C	<i>P. albidum</i> (Müll. Arg.) R.C.Harris
MA	C	<i>P. albocinereum</i> (Kremp.) R.C.Harris
TO	C	<i>P. alboflavescens</i> Aptroot
MA	C	<i>P. catapastum</i> (Nyl.) R.C.Harris
TO	C	<i>P. costaricense</i> Aptroot
MA	C	<i>P. pleiomerellum</i> (Müll. Arg.) R.C.Harris
MA	C	<i>P. subcinereum</i> (Nyl.) R.C.Harris
MA	C	<i>P. subvirescens</i> (Leight.) Aptroot
PA	R	<i>Porina americana</i> Fée
MA	C	<i>P. chlorotica</i> (Ach.) Müll. Arg.
PA, TO	R, C	<i>P. conspersa</i> Malme
BR, TO	C	<i>P. coralloidea</i> P.James
PA	R	<i>P. cryptostoma</i> Mont.
BR, TO	C	<i>P. hibernica</i> P.James & Swinscow
PA	R	<i>P. isidioambigua</i> M.Cáceres, M.W.O.Santos & Aptroot
MA	G	<i>P. leptalea</i> (Durieu & Mont.) A.L.Sm.
TO	C	<i>P. mastoidea</i> Fée
PA	R	<i>P. maxispora</i> Aptroot & M.Cáceres
PA	R	<i>P. melanops</i> Malme

Table 1. Continued.

New to	Habitat	Species
TO	C	<i>P. nucula</i> Ach.
BR, TO	C	<i>P. subnucula</i> Lumbsch, Lücking & Vězda
MA, TO	G, C	<i>Protoparmelia isidiata</i> Diederich, Aptroot & Sérus.
PA	R	<i>Pseudochapsa dilatata</i> (Müll. Arg.) Parnmen, Lücking & Lumbsch
MA	G	<i>Pseudopyrenula subgregaria</i> Müll. Arg.
MA, TO	G, C	<i>P. subnudata</i> Müll. Arg.
MA, PA	C, R	<i>Pyrenula aggregataspistea</i> Aptroot & M.Cáceres
MA, TO	G, C	<i>P. anomala</i> (Ach.) Vain.
TO	C	<i>P. aspistea</i> (Afzel. ex Ach.) Ach.
TO	C	<i>P. brunnea</i> Fée
TO	C	<i>P. cubana</i> (Müll. Arg.) R.C.Harris
MA	G	<i>P. globifera</i> (Eschw.) Aptroot
MA, TO	G, C	<i>P. infraleucotrypa</i> Aptroot & M.Cáceres
TO	C	<i>P. lineatostroma</i> Aptroot
TO	C	<i>P. mamillana</i> (Ach.) Trevis.
TO	C	<i>P. quassiicola</i> Fée
PA	R	<i>P. rubrostigma</i> Aptroot & M.Cáceres
MA	G	<i>Pyxine coccifera</i> (Fée) Nyl.
MA	G	<i>P. daedalea</i> Krog & R. Sant.
TO	C	<i>P. eschweileri</i> (Tuck.) Vain.
MA	C	<i>P. obscurascens</i> Malme
MA	G	<i>P. retirugella</i> Nyl.
MA	C	<i>Ramboldia haematites</i> (Fée) Kalb, Lumbsch & Elix
MA	G	<i>Ramonia kandleri</i> Kalb
MA	G	<i>R. valenzueliana</i> (Mont.) Stizenb.
MA	C	<i>Relicina abstrusa</i> (Vain.) Hale
TO	C	<i>R. subabstrusa</i> (Gyeln.) Hale
MA, TO	G, C	<i>Sarcographa cinchonarum</i> Fée
PA	R	<i>S. labyrinthica</i> (Ach.) Müll. Arg.
MA	C	<i>Staurothele arenaria</i> Malme
TO	C	<i>Stigmatochroma epimarta</i> (Nyl.) Marbach
TO	C	<i>S. gerontoides</i> (Stirt.) Marbach
MA	G	<i>S. metaleptodes</i> (Nyl.) Marbach
PA	R	<i>Sulzbacheromyces caatingae</i> (Sulzbacher & Lücking) B.P.Hodk. & Lücking
BR, PA, TO	R, C	<i>Synarthothelium cerebriforme</i> Sparrius
TO	C	<i>Thalloloma rhodastrum</i> (Redinger) Staiger
TO	C	<i>Traponora asterella</i> Aptroot
MA, TO	C	<i>Triclinum cinchonarum</i> Fée
MA, TO	G, C	<i>Trypethelium eluteriae</i> Spreng.
TO	C	<i>T. foveolatum</i> Müll. Arg.
MA, PA, TO	G, R, C	<i>T. platystomum</i> Mont.
MA, TO	G, C	<i>T. subeluteriae</i> Makhija & Patw.
BR, MA	C	<i>Verrucaria margacea</i> (Wahlenb.) Wahlenb.
MA	C	<i>Xanthoparmelia brasiliensis</i> T.H.Nash & Elix
MA	C	<i>X. subplittii</i> Hale

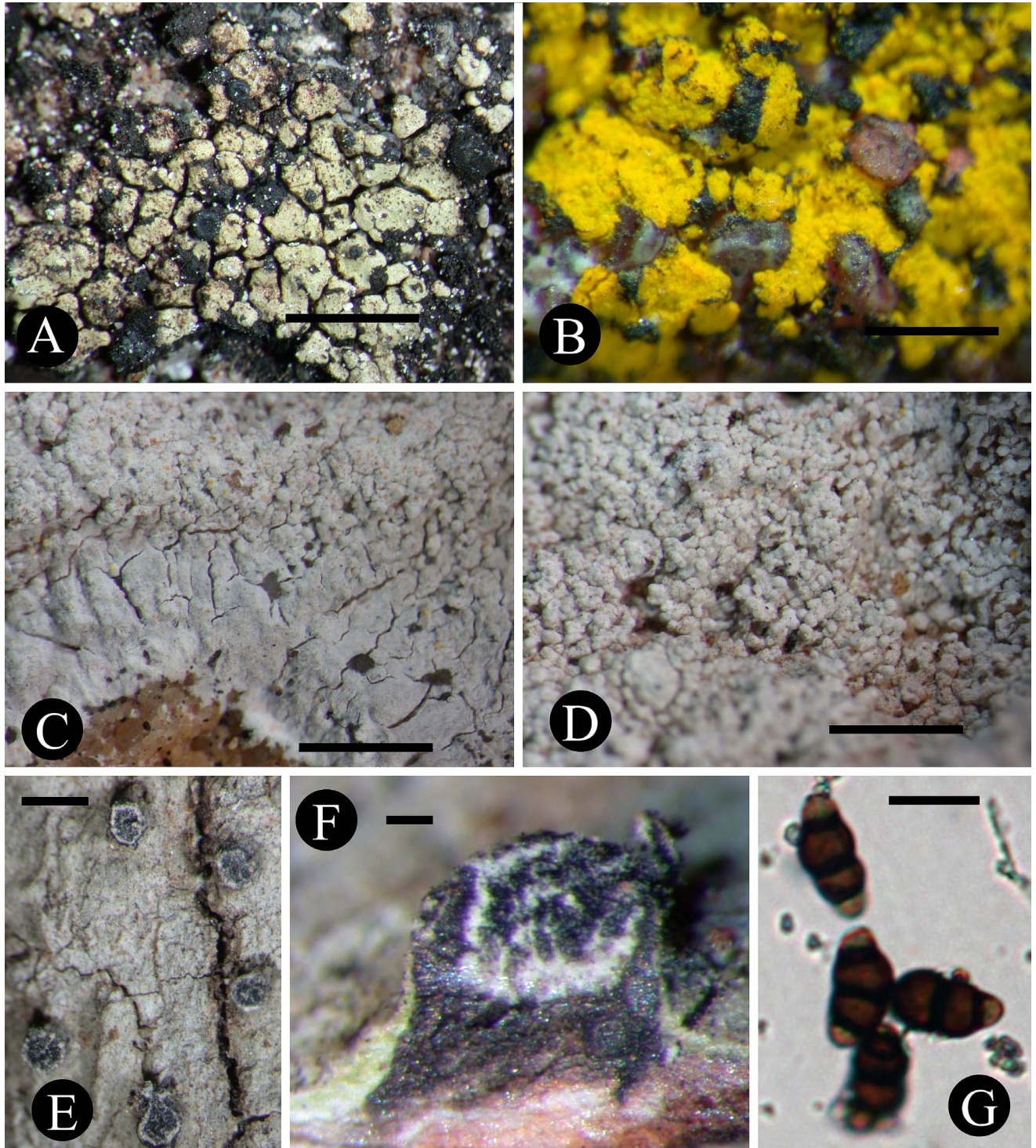


Figure 1. A. *Buellia lichexanthonica* (isotype), habitus. B. *Chrysothrix citrinella* (isotype), habitus. C–D. *Cryptothecia isidioxantha* (isotype). C. Habitus. D. Isidia. E–G. *Heterocyphelium triseptatum* (isotype). E. Habitus. F. Section through ascoma. G. Ascospores. Scale: A, C–E = 1 mm; B = 0.5 mm; F = 0.1 mm; G = 10 µm.

with 8 ascospores. Ascospores dark brown, ellipsoid, 1-septate, $11\text{--}13 \times 6\text{--}7.5$ µm, psilate, with thin wall and septum, ends broadly rounded. Pycnidia black, emergent; conidia not observed.

Chemistry. Thallus UV+ orange, C–, P–, K–. TLC: 4,5-dichlorolichexanthone.

Etymology. Named after the lichexanthone in the cortex of the thallus.

Ecology and distribution. On sandstone in Cerrado; only known from Brazil.

Discussion. The genus *Buellia* is in use for a relatively large group of only partly related lichens, after the recent merging of *Hafellia* with *Buellia*. Many species groups are insufficiently known, especially in the tropics, but the species with cortical xantheses have received much attention (e.g., Bungartz et al. 2004a; Scheidegger & Rued 1988). The new species differs from all species treated in these papers. It comes closest to some morphs attributed by Bungartz et al. (2004b) to *Buellia prospersa* (Nyl.) Riddle, which is best known as *Amandinea lecideina* (H. Mayrhofer & Poelt) Scheid. & H. Mayrhofer, and which was most recently recombined as *Amandinea pelidna* (Ach.) Fryday & L. Arcadia, notwithstanding the fact that Fryday & Arcadia (2012) state that “it is almost certainly not congeneric with *A. conioops* (Wahlenb.) M. Choisy, the type species of *Amandinea*.” However, that species has a much thinner to almost chasmolithic thallus which is never ochraceous yellow and ascospores with a usually persistent thickened median septum. The vast majority of the material assigned to any of these names has no cortical xantheses, and it remains questionable whether the specimens with xantheses, which seem restricted to the Neotropics, really are conspecific. Also, in all publications, it is stressed that this species is only known from coastal areas and the collecting locality of the new species is 600 km from the coast.

Chrysothrix citrinella Aptroot & M. Cáceres, *sp. nov.*

Fig. 1B

MYCOBANK MB 821701

Saxicolous Chrysothrix with relatively thick, bright yellow thallus consisting of partly dissected appressed microsquamules with upper surface partly dissolving into soredia of ca. 40–55 µm diam.

TYPE: BRAZIL. MARANHÃO: Riachão, Poço Azul, alt. ca. 450 m, 7°13'28"S, 46°27'10"W, on sandstone in Cerrado, 27 October 2016, M.E.S. Cáceres & A. Aptroot ISE 40069 (holotype: ISE; isotype: ABL).

Description. Thallus ca. 0.1–0.3 mm thick, dull, uneven, dissected into very unequal, mostly rounded areoles or micro squamules of ca. 0.05–0.6 mm diam. which become smaller and dissected towards the margins of the thallus, bright citrine yellow, not surrounded by a prothallus. Soredia present in a thin layer on much of the interior part of the thallus,

readily detached, ca. 40–55 µm diam. Apothecia and pycnidia not observed.

Chemistry. Thallus UV+ dark orange, C–, P+ orange, K+ orange. TLC: Calycin.

Etymology. Named after the bright citrine yellow thallus and soredia.

Ecology and distribution. On sandstone in Cerrado, locally abundant; only known from Brazil.

Discussion. This species is chemically similar to *Chrysothrix granulosa* G. Thor, *C. placodioides* G. Thor (Thor 1988) and to *C. candelaris* (L.) J.R. Laundon (Kalb 2001), but it differs by the microsquamulose, partly dissected thallus which bears regular soredia. *Chrysothrix candelaris* is sorediate but not microsquamulose; *C. granulosa* is sorediate and can be microsquamulose (or rather placodioid) but it is very thick, usually up to 1 mm thick, and can be detached more or less intact from the substrate with a knife; *C. placodioides* can be microsquamulose (or rather placodioid) but is not sorediate.

Cryptothecia isidioxantha Aptroot & M. Cáceres, *sp. nov.* **Fig. 1C–D**

MYCOBANK MB 821702

Saxicolous Cryptothecia with thallus with coralloid, partly branched pseudoisidia of ca. 0.1–0.2 mm thick and ca. 0.1–0.3 mm high, with lichexanthone.

TYPE: BRAZIL. MARANHÃO: Riachão, Poço Azul, alt. ca. 450 m, 7°13'28"S, 46°27'10"W, on sandstone in Cerrado, 27 October 2016, M.E.S. Cáceres & A. Aptroot ISE 40070 (holotype: ISE; isotype: ABL).

Description. Thallus ca. 0.1–0.3 mm thick, gray towards the margin, pale ochraceous in the center, marginal zone fissured into angular areoles, in the center dissected into roundish areoles of ca. 0.1–0.5 mm diam., densely covered with coralloid, partly branched pseudoisidia of ca. 0.1–0.2 mm thick and ca. 0.1–0.3 mm high, surrounded by a ca. 0.4 mm wide white hyphale hypothallus. Ascomata and pycnidia not observed.

Chemistry. Thallus UV+ yellow, C–, P–, K–. TLC: Lichexanthone.

Etymology. Named after the isidia and the xanthone.

Ecology and distribution. On sandstone in Cerrado; only known from Brazil.

Discussion. In the genus *Cryptothecia*, currently 71 species are accepted (Jagadeesh Ram & Singha 2016), but no doubt many more species have already been collected, because many specimens are not fertile and cannot be satisfactorily identified. Also, the chemistry can be complex or confusing. This new species is not known fertile, but it is so characteristic that it is nevertheless certainly undescribed. It has the thick cretaceous thallus structure of the core group of *Cryptothecia*, and a chemistry that is known from only three *Cryptothecia* species, viz. *C. assimilis* Makhija & Patw., *C. darwiniana* Bungartz & Elix and *C. lichexanthonica* Aptroot (Jagadeesh Ram & Singha 2016; Lima et al. 2013). The new species differs from all these species by the clear isidia (technically pseudoisidia as there is no cortex) and the saxicolous habitat, on overhanging rock, a habitat to which relatively many Arthoniales are restricted, but no other known *Cryptothecia* species.

Heterocyphelium triseptatum Aptroot & M.Cáceres, *sp. nov.* **Fig. 1E–G**

MYCOBANK MB 821703

Corticolous Heterocyphelium with 3-septate, slightly curved brown ascospores 12–14 × 6–7 μm with middle cell much wider and generally larger than the two end cells, and much more pigmented.

TYPE: BRAZIL. TOCANTINS: Near Itaguatins, alt. 150 m, 5°45'22"S, 47°33'53"W, on tree bark along river in Cerrado vegetation, 23 October 2016, M.E.S. Cáceres & A. Aptroot ISE 28920 (holotype: ISE; isotype: ABL).

Description. Thallus not corticate, fissured, closely following the bark, ca. 0.1 mm thick, mineral greenish grey, without pseudocyphellae or pockets of crystals; algae trentepohlioid. Ascomata mazaedioid, sessile, simple, dispersed, 0.3–0.6 mm diam., 0.3–0.6 mm high, excipulum cupular, carbonized, black, sides fully with thallus covering. Wall more or less equally carbonized, without crystals, ca. 100 μm thick. Disc mottled black with white rim. Hamathecium not observed but ascospores in vertical columns. Ascospores dark brown, 3-septate, fusiform, with strong constrictions, slightly curved, 12–14 × 6–7 μm, middle cell is much wider and generally larger than the two end cells, and much more pigmented, septa dark. Pycnidia not observed.

Chemistry. Thallus UV–, C–, P–, K–. TLC: No substances detected.

Etymology. Named after the 3-septate ascospores.

Ecology and distribution. On tree bark in Cerrado or savannah forest along rivers; known from Brazil and Tanzania.

Discussion. The genus *Heterocyphelium* is so far only known from the type species, *H. leucampyx* (Tuck.) Vain., which is widespread throughout the tropics (Tibell 1996). It is characterized by the consistently 2-septate ascospores, which is a rare character in lichens and even in ascomycetes in general. These ascospores are also very characteristic in that the middle cell is much wider and generally larger than the two end cells, and much more pigmented; the cells are separated by dark septa and constrictions. Moreover, they are all slightly curved. Occasionally a few 3-septate ascospores are intermixed. When at the turn of the century a specimen from Tanzania was examined that had only 3-septate ascospores, it was thought to represent an aberrant morph. Now that in Tocantins state in Brazil a typical specimen of *Heterocyphelium leucampyx* s.str. with 2-septate ascospores, but also two collections with consistently 3-septate ascospores, it is recognized to be a distinct new species, the second in the genus. *Heterocyphelium leucampyx* s.str. is also known from Brazil, from the states of Bahia, Matto Grosso, Rio Grande do Sul and now Tocantins (same locality as the type of *H. triseptatum*, 28997), but not from Tanzania.

Additional specimens seen. BRAZIL. Same as type, 28923 (ISE, ABL). TANZANIA. IRINGA DISTRICT: Udzungwa Mts., Lukega Forest Reserve, on tree, alt. 675 m., 17 September 1999, V. Alstrup TZ 2165 (C, ABL).

ACKNOWLEDGMENTS

MESC thanks the CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico) for a research grant (309058/2015-5). AA thanks the Stichting Hugo de Vries-fonds for a grant to attend 80. EGBL. SCF thanks CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior) for Master's scholarship.

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manuscript received March 12, 2017; accepted July 4, 2017.